Urdu Newspapers in India

Determinant and Conveyor of Muslim Opinion

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The declining fortunes of Urdu newspapers seem to be reversing as major media houses are beginning to invest in Urdu media. Largely catering to the Muslim population in the country, its impact in terms of representing Muslim interests and shaping Muslim opinion is enormous. Domestically, almost all Urdu media outlets regularly highlight the theme of Muslim victimhood at the hands of the Indian state. Internationally, these outlets are consistently critical of Israel, the United States and the West for their propaganda vis-à-vis international Islamic terrorism and adverse foreign policy towards Muslim nations.

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The Urdu press is the third-largest language press in India, after Hindi and English, in terms of reach and influence. Urdu newspapers and periodicals are published across India in 16 states and one union territory, the most important being Telangana, Bihar, West Bengal, Delhi, Jammu and Kashmir (J&K), Karnataka, Maharashtra, Punjab and Uttar Pradesh (UP). Geographically, the most important centres for Urdu newspapers are Delhi, Lucknow and Srinagar in the north, Bhopal in central India, Mumbai and Aurangabad in the west, Hyderabad and Bengaluru in the south, and Kolkata and Patna in the east. While other vernacular newspapers, including those in Hindi, are generally confined to particular linguistic belts, Urdu dailies are published in scattered pockets throughout India.

Urdu papers continue to stay afloat and politically important in India's media landscape despite their limited reach. Urdu was among the leading languages, and attracted poets and commoners alike in many parts of India for most of its pre- and post-independence history. However, the last two decades have seen a sharp decline in its popularity. Of late, the trend seems to be changing as major media houses have started investing in Urdu newspapers and television channels.

Overview

In 1947, the Urdu press had a dominant position in the whole of northern India. But the situation changed after the country's bloody partition and Urdu newspapers saw a decline in their circulation. Urdu's political influence was soon limited to the Muslim sections as more and more people took to English, Hindi and other popular languages. But now with increased competition in the saturated media market, Urdu media is gaining importance again. The interest shown by private media groups is proof of that.

Although the number of Urdu publications is quite large, a majority of them have limited circulation, catering to a strictly local or regional readership. India's Muslim community usually gets its news initially from media outlets, followed by mosques and various Muslim organisations. From the standpoint of influencing public perceptions on a variety of issues, the role of smaller publications should not be underestimated given their close links to readers (see Table 1 (pp 104–05) for an overview of contemporary Urdu publications).

Many newspapers in India are helped by prominent national and/or regional political parties, and social organisations. Almost every Urdu-language daily in India is known to have a

Table 1: Overview of Contemporary Urdu Publications

Name of the Daily/Weekly	Ownership/Publisher	Circulation Area	Features and Known Biases
Rashtriya Sahara	Owned by Sahara India Mass Communication and published by poet Zia Qadri.	Self-reported daily circulation 3,93,000; publishes from nine cities, including Delhi	Politically, *Rashtriya Sahara* tilts to favour the Samajwadi Party (SP), as its corporate have good relations with senior party officials. Officially, however, it claims to have no political or ideological affiliation with any group or party. It claims to be the "most widely read" Urdu-language daily in India. It is critical of the United States (US) and supports dialogue between India and Pakistan. The daily is less critical of Bharatiya Janata Party (BJP) compared to other Urdu dailies. It targets educated, affluent Muslims.
Inquilab	Owned by the Dainik Jagran group and published by Jagran Prakashan Limited	Publishes from 14 cities in Maharashtra, Delhi, UP and Bihar	Published since 1938, the daily takes an independent course on national issues while giving more attention to Muslims' social and educational development. This is also one of the oldest and highest-circulated Urdu dailies. The newspaper is well-regarded among Muslims of western and northern India. It is known for its independent editorial policy and critical of the US and Western Europe. The daily favours India–Pakistan talks and is critical of the BJP government for allowing alleged "victimisation" of Muslims by Indian security agencies. It usually blames Modi government for giving "free hand" to Hindu extremist groups. The daily strongly denounces terrorism.
Munsif Daily	Owned and edited by Khan Lateef Muhammed Khan, chairman Munsif Group of Companies	Publishes from Hyderabad; according to Audit Bureau of Circulations (ABC) (2017), *Munsif Daily* is the highest-circulated Urdu-language daily in India	*Munsif Daily* is one of the most widely read and influential Urdu dailies in India. Politically, *Munsif Daily* is non-partisan, pro-Muslim but not fundamentalist. It is critical of the US and Western Europe; supports dialogue between India and Pakistan and is critical of the Modi government for alleged "victimisation" of Muslims in terror-related cases.
Siasat Daily	Owned and edited by Hyderabad's prominent social activist and journalist Zahid Ali Khan	According to ABC (2017), *Siasat Daily* is the second highest-circulated Urdu-language daily in India	*Siasat Daily* is widely respected for independence of opinion and professional sincerity. The newspaper is also involved in social and educational welfare activities. The daily is extremely critical of the US, Israel, and BJP-led government.
Etemaad	Owned by All India Majlis-e-Ittehadul Muslimeen (AIMIM), which has long been seen as a political representative of Muslims in Telangana; edited by Burhanuddin Owaisi, brother of AIMIM president and parliamentarian Asaduddin Owaisi	Publishes from Hyderabad	Extremely critical of Hindu nationalist groups.
Salar	Published by Al-Ameen Trust, part of self-help Al-Ameen movement working towards social, educational and economic upliftment of the Muslim community in Karnataka	Publishes from Bengaluru	*Salar* is moderate and independent in approach. The daily takes a middle-of-the-road position on issues of national interest. It is pro-Muslim but not radical.
Sahafat	Published and edited by Lucknow-based journalist Aman Abbas	Publishes from Lucknow, Delhi and Mumbai	Appears to be sympathetic to Iran; promotes better India–Iran ties; extremely critical of US foreign policy towards West Asia and Iran.
Akhbar-e-Mashriq	Edited by veteran journalist and former Congress party parliamentarian Mohammad Wasimul Haque	Publishes from Kolkata, Delhi, and Ranchi	The newspaper claims to be independent in views on political and social issues. It takes an Indian nationalist approach on foreign policy issues, including policy towards Pakistan; critical of US foreign policy in West Asia.
Qaumi Tanzeem	A leading Urdu daily in Bihar and Jharkhand, edited by journalist S M Ashraf Farid	Publishes from Patna and Ranchi	It is politically independent and does not favour any particular political party.
Daily Aftab	Published by Srinagar-based Aftab Charitable Trust	Publishes from Srinagar	It does not favour any political party and stands for friendly India–Pakistan ties. The daily reports extensively on domestic political issues of the state and prominently reports separatist leaders' statements.
Kashmir Uzma	Published by G K Communication Private Limited; edited by prominent journalist Fayaz Ahmed Kaloo	Publishes from Srinagar	Politically independent, seems to favour Kashmir secessionists and seeks friendly ties with Pakistan. It prominently publishes statements by separatist leaders.
Srinagar Times	Published by social activist Shadab Bashir and edited by Kashmir's prominent journalist Bashir Ahmad Bashir	Publishes from Srinagar	Independent, widely circulated newspaper in Jammu and Kashmir (J&K); follows independent editorial policy; equally critical of mainstream politicians and Kashmir separatist leaders.
Aurangabad Times	Published and edited by journalist-cum-industrialist Shoeb Khusro	Publishes from Aurangabad in Maharashtra	The newspaper has no direct affiliation to any political party. It proclaims to speak for the people and highlights regional issues. Began in 1967, it prominently covers Muslim politicians and religious leaders.
Hind Samachar	Started by Punjab Kesari group; Hindi-language daily *Punjab Kesari*'s editor-in-chief Vijay Kumar Chopra is also the editor of *Hind Samachar*	Publishes three editions from Punjab and J&K	It highlights local- and state-level issues. The newspaper has a rightist approach and generally supports BJP.
Daily Chattan	Published and edited by Kashmir's prominent journalist Tahir Mohiuddin	Publishes from Srinagar	Widely read in Kashmir, tends to support Kashmiri secessionists but not terrorism. It is critical of Indian state and very popular in north Kashmir.
Hindustan Express	Published and edited by industrialist Parwaiz Suhaib Ahmad	Publishes from Delhi	Persistent anti-BJP stance. Launched in 2006, it prominently highlights Muslim issues such as communal violence against them, Muslim personal laws and alleged victimisation of Muslims in terror cases.

Continued

Table 1: *Continued*

Name of the Daily/Weekly	Ownership/Publisher	Circulation Area	Features and Known Biases
Roznama Khabrein	Published by a young journalist Muslim Ghazi, and edited by *Rashtriya Sahara*'s former editor Qasim Syed	Has sizeable readership in Delhi and UP state	Anti-BJP daily; claims to be "independent" of any political influence; launched in January 2014; frequently criticises BJP-led government, especially on issues related to human and minority rights.
Hamara Samaj	Published and edited by Janata Dal (United) leader Khalid Anwar	Publishes from Patna and Delhi	Centrist and anti-BJP daily; extremely critical of the US and Israel's foreign policy in West Asia.
Nai Duniya	Edited and published by senior journalist and SP's former parliamentarian Shahid Siddiqui	Publishes from Delhi	Widely popular weekly among Muslim masses. It highlights issues of Muslim concern. The daily tends to sensationalise issues; portrays Muslims as oppressed; critical of right-wing BJP.
Dawat	Published by prominent Muslim group Jamaat-e-Islami Hind; edited by veteran journalist Parwaaz Rahmani	Publishes from Delhi	Publishes 10 issues a month consisting of news digests and commentaries on national and international issues. It is the mouthpiece of the Muslim organisation Jamaat-e-Islami Hind; critical of the US foreign policy and Israel; extremely critical of BJP-led government.
Aag	Founded in 2006 by Ahmed Ibrahim Alvi, well-known Shia journalist; owned by True Media Indian Communication Limited, which also runs a Hindi-language, sister daily *Nazar*	Publishes from Lucknow	Popular pro-language daily; extremely critical of the US, Israel and European countries; favours Iran's foreign policy.

Table 2: Urdu Publications with Avowed Political/Religious Links

Name of Daily/Weekly	Links with Political Parties	Links with Religious Outfits/Sects	Stance (Hard Line, Moderate)
Dawat	Welfare Party of India	Jamaat-e-Islami Hind	Hard line
Rashtriya Sahara	SP	Has close links with all Sunni Muslim groups	Moderate
Inquilab	Takes independent stance	Balanced in approach, supports Sunni and Shia Muslims equally	Moderate
Nai Duniya	Appears to switch loyalties between Congress, SP, Bahujan Samaj Party, and Rashtriya Lok Dal	Has close links with religious clerics of Deobandi school of thought	Hard line
Hind Samachar	BJP	Sufi leaders	Moderate
Etemaad	AIMIM	Observed to support all Muslim outfits across country	Hard line
Daily Milap	BJP	Observed to support Sufi saints	Moderate
Daily Pratap	BJP	Observed to support Sufi leaders	Moderate

Hard line publications are those that are strict or extreme in their ideological moorings. Moderate publications refer to those who are not quite left or right, but somewhere in the middle.

staunch ideological allegiance and a steadfast commitment to a single (in some cases, multiple) political party or religious entity (see Table 2 for a list of publications with known political and religious links, as reported in the media).

According to the Registrar of Newspapers for India (RNI), the total circulation of all types of Urdu newspapers and magazines stands at 4.13 crore copies in 2014–15 across 16 states of India (RNI 2015). The major centres of publication comprise New Delhi, Lucknow, Mumbai, Patna, Srinagar, Hyderabad and Kolkata. Estimates of the total Urdu newspaper readership in India could not be found officially.

This study uses qualitative content analysis and thematic analysis methods to trace the determinants of Muslim opinion as the unit of analysis from 15 Urdu newspapers, namely *Rashtriya Sahara*, *Inquilab*, *Hamara Samaj*, *Hindustan Express*, *Sahafat*, *Akhbar-e-Mashriq*, *Urdu Times*, *Munsif Daily*, *Siasat Daily*, *Dawat*, *Daily Aftab*, *Srinagar Times*, *Daily Chattan*, *Kashmir Uzma* and *Roznama Khabrein*. As these determinants are dynamic and keep changing according to contemporary interests, the keywords pertaining to the dominant themes were first searched manually from the selected newspapers followed by the narrowing down of the dominant themes pertaining to the study. The themes were then analysed in the context of religion, polity and society to understand how Urdu newspapers have directly/indirectly conveyed and shaped the opinion of the Muslim community. The dominant themes used for analysis were Muslim victimhood, home-grown and saffron terror, cross-border and international terrorism, American imperialism, Israel, issues of Muslim women and Ahmadiyyas, Indian foreign policy and criticism of the Hindu right-wing and Bharatiya Janata Party (BJP).

Political Economy

Singapore-based researcher Amit Jaipal Julka classifies India's Urdu newspapers into three categories: (i) traditional Muslim-owned newspapers being published from areas with major Muslim populations; (ii) newspapers with Hindu owners who migrated from the areas which are now under Pakistan; and (iii) newspapers owned by big media houses (personal interview 2016). The majority of Urdu publications are individual or family-owned. It is quite common for the owners to be directly involved in editing and managing their publications. Newsrooms are, however, manned by professional journalists or translators who translate from English to Urdu. Some Urdu newspapers and magazines are also published by public and private companies, public societies, trusts, state governments, and political parties. Some owner–editors may have political affiliations or ambitions, but it is not a general phenomenon.

The Urdu press is not generally financed or controlled by big business houses or political parties. The exceptions to this include the Urdu-language daily of the Hindi *Rashtriya Sahara* chain (the first corporate entity in Urdu news) and *Inquilab* of the Hindi *Dainik Jagran* chain. Exceptions to the political non-affiliation rule comprise *Aabshaar* (Kolkata) which followed the party line of the Communist Party of India (Marxist) but shut

shop recently, *Daily Pratap* (Delhi) which is sympathetic to the BJP, and *Hind Samachar* (Jalandhar) which is close to the political ideology of the Hindu nationalist Rashtriya Swayamsevak Sangh (RSS) and its numerous offshoots such as the BJP, Vishva Hindu Parishad, Bajrang Dal, etc.

Indian Urdu newspapers have never been in the leading, or even comfortable position, with regard to political, economic, technological and social resources. Little has been done in terms of formulating an industrial policy to build a stable, independent and critical media. Studies under various settings show that political influences can lead to media bias, and in turn help political parties reap electoral rewards (Mishra 2014). While Urdu newspapers in India are exploited by several political parties, the publications themselves have been unable to reap major financial rewards.

Further, despite the decline in Urdu speakers among non-Muslims, there has been a sharp increase in the incidence of non-Muslim publishers of Urdu newspapers over the past decade. So, contrary to the popular perception, the RNI data suggests that over the past decade, both registration of Urdu newspapers and the participation of non-Muslims in the Urdu newspaper industry, have increased (Pandey 2016).

However, the number of Urdu readers has gone down substantially (Zafar 2011). Readers seem unwilling to spend on newspapers, unless such enticements as signing up for a contest which promises a fully paid trip to perform hajj (Islamic pilgrimage) in Saudi Arabia or some breaking news or beneficial article or advertisement are carried in the daily. However, most Urdu dailies seem to find it hard to keep up with regular subscriptions. Given this, bringing out a good newspaper, expanding circulation and publishing critical content become difficult to sustain for most publications.

Most national and regional dailies (whether English, Bengali, or Gujarati among others) carry columns and op-eds by eminent, respectable and scholarly individuals. Such contributors also receive suitable compensation for their pieces. However, this is not the case with Urdu newspapers. Furthermore, most Urdu papers refrain from employing dedicated correspondents and columnists for the lack of financial resources. This results in a heavy dependence on non-Urdu language news agencies, features services and freelance journalists for news stories and special columns.

New trends are surfacing as publishers recognise the need to provide varied news (such as on social and economic issues) and cater to the changing tastes of the new generation. Most Urdu newspapers are now available in soft copies; the rest are quickly moving in that direction. At least 40 dailies are available on the internet and five Urdu dailies are distributed in West Asian countries, where many Urdu-speaking expatriates from India, Pakistan and Bangladesh are employed. *Siasat Daily* and *Munsif Daily* are also distributed in the United States (US), Canada, and Europe, all of which have significant numbers of Urdu speakers from South Asia.

Although Urdu newspapers largely cover Muslim issues, Hindu political organisations such as the RSS and its allied parties closely scrutinise Urdu press. A while ago, the right-wing think tank, India Policy Foundation—an organisation headed by Rakesh Sinha, considered to be a close ally of the RSS—started a fortnightly review of Urdu newspapers under the title "Review of Urdu Press." In this, all the esteemed Urdu newspapers of the country have been included. In fact, Prime Minister Narendra Modi is said to have taken the help of Urdu newspapers to build a secular image of himself by covering up the taint of communalism and the Gujarat massacre of 2002 (Rizvi 2014).

Urdu journalism needs to find new standards of reporting. The same news story in an Urdu and Hindi publication can give the reader completely contradictory impressions. If a reader were to read Urdu newspapers, they would believe that Muslims are perennial victims and were they to read Hindi newspapers, the impression they would get is that Muslims are responsible for all issues. It is widely considered that the Urdu media best reflects the sentiments of Indian Muslims. Hence, journalists associated with Hindi and English media translate reports from the field of Urdu journalism on Muslim issues.

Representing Muslim Interests

India's Urdu press has a rich political tradition dating to the days of India's independence movement, when the regional language press played a central role in stimulating the movement throughout the country. In line with this traditional focus on political developments, the Urdu press continues to give wide coverage to political events, especially issues affecting minority interests that Urdu speakers may view as being downplayed, ignored, or misrepresented by larger media outlets. In addition to the coverage of local news, Urdu newspapers cover all major international events, especially those relating to the Muslim world. International events with implications for India are given space in accordance with their overall importance. While Urdu dailies do not carry as many commentaries on world affairs as their English-language counterparts, they do comment on all major international issues and on important foreign policies of the US, Russia, Europe and other major players in world politics, especially those of interest and concern to the Muslim world and South Asia.

Aside from the fact that Urdu has a rich common heritage for Hindus and Muslims alike (even today, there are many Hindus who still read and write in Urdu), in India Urdu is largely identified with Muslims. Both historical and political factors have abetted this communalisation of the language. Given this, Urdu language publications largely cater to Muslim interests. Although these newspapers also give factual coverage to other communities, the coverage is negligible but never negative. The Urdu press is largely run by Muslims and reflects their sentiments. Regardless of whether an Urdu publication is owned by a non-Muslim individual/family, such as *Hind Samachar, Daily Milap,* and *Daily Pratap* among others, or run by a non-Muslim corporate management like *Rashtriya Sahara,* or even headed by a non-Muslim editor, the editorial and composing sections are administered largely or totally by Muslim staff. As a result, the majority of Urdu publications are highly community-sensitive, taking special care to cover issues and events of interest and concern to Muslims. Consequently, in situations of critical significance to the community, one can observe Urdu newspapers

from the four corners of the country speaking in onevoice. *Hind Samachar* and *Daily Pratap* are exceptions to this trend as they are run by non-Muslims and affiliated with the BJP.

Most of the Urdu newspapers represent Sunni Muslims and thereby promote Sunni world views and religious epithets. All the Sunni clerics get wider coverage in comparison to Shia clerics. Exceptions to this include *Sahafat*, *Inquilab* and *Aag*. If we look at the links between religious authorities and Urdu media, then it can be safely said that the latter is largely influenced by the Muslim clergy. They do not utter a single word against Muslim ulemas/imams/religious authorities. They always keep a close watch on Muslim political threats and opportunities, and try to guide Muslim community by arousing religious sentiments or by urging them to unite. A commentary on an English language news portal, *FirstPost* (Suroor 2014), observed that Urdu newspapers "reveal a disturbingly sectarian world view."

The Urdu-language media in India also tries to glorify Muslim leaders and Muslim political parties like the All India Majlis-e-Ittehadul Muslimeen (AIMIM) in Hyderabad, All India United Democratic Front in Assam, Indian Union Muslim League in Kerala, and Peace Party of India and Rashtriya Ulama Council in UP. During elections, these newspapers were seen arousing religious fervour among Muslim voters (Jain 2014; *Urdu Times* 2014a). However, after the 2014 general elections and 2017 UP assembly election, the same newspapers were seen criticising Muslim political parties for dividing Muslim voters and political leaders.

Key Themes of Coverage

A sustained study of the Urdu media in India suggests that their reportage and commentary often reflect and reinforce some common themes, which are distinctly different from the ones observed in the national English- and Hindi-language media. The study undertaken by the authors reveals that the sampled newspapers take a strong stance on the following issues regularly.

Muslim victimhood in India: Urdu publications often underscore what they perceive to be the "institutionalised victimisation" of Indian Muslims by the Indian state machinery and agencies. The theme of victimhood is perhaps best reflected in news reportage and comments on incidents of stated counterterrorism operations that involve the killings and arrests of Muslim youth. Most Urdu newspapers view such operations with deep reservations and often openly regard them as "fake" (*Inquilab* 2015c). The controversial killing of any Muslim in the country always evokes sharp reactions across various Urdu media outlets, demanding the investigation of all suspicious killings and arrests of Muslim youth under terrorism charges. Thus, Urdu media have and continue to indict incumbent governments for indifference to the human rights violations against Muslims.

Expressing concern over the release of Muslim youngsters by courts who find them innocent in terror cases, an editorial in *Hamara Samaj* (2015d) questioned:

> If the cycle of being proved innocent through release after the arrests continues, how will the actual culprits be arrested? How will the actual culprits be identified? After all, who is behind these terrorist acts? There is definitely someone who has carried out this destructive act in which innocent Muslim youngsters were taken into custody and their precious lives rendered useless.

An editorial, titled "Encounter Ya Qatl" (encounter or murder), published in *Siasat Daily* (2015h), asserts "If Muslim youngsters continue to be victims of the deep conspiracies of the police and anti-Muslim elements, every human heart will only be seen mourning the insensitivity of this society."

Noting the prevalence of Islamophobia in India, an *Akhbar-e-Mashriq* (2015c) editorial stresses on the point that

> National security can certainly not be compromised. However, mere speculation and suspicion cannot be categorised as proof and evidence. If the government has any concrete evidence in this regard, it should come up with it.

Many publications affirm that there are systematic attempts by the Indian government and the political class to keep Muslims backward and to deny the community justice (*Urdu Times* 2015b). Widely read Urdu-language daily *Rashtriya Sahara* (2015g) alleged that "it is a bitter truth that Muslims are often discriminated against in government and non-government sectors." According to *Siasat Daily* (2015m), "Muslims are being subjected to discriminatory treatment on religious grounds in every field." Some experts, however, have criticised the Urdu media's "inability" to "look beyond the gambit of Muslims" and for allegedly exaggerating the "sense of discrimination" among Muslims (Sinha 2013; *Times of India* 2015).

Recently, Urdu-language newspapers gave wide coverage to the "Not In My Name" protests held across some cities in the country on 28 June 2017 against the recent attacks by cow vigilantes. In fact, they dedicated several pages to the protests, and carried editorials and commentaries for several days. Demanding investigation of "all" killings and attacks, the Urdu media criticised the BJP-led union government and UP state government for indifference, and urged organised efforts by Muslims "within the constitutional framework" to counter the "anti-Muslim" conspiracy (*Urdu Times* 2017; *Rashtriya Sahara* 2017; Shamsi 2017; *Sahafat* 2017).

Home-grown and saffron terror: Urdu-language newspapers' analysis of terrorism in India is more nuanced than English- and Hindi-language newspapers. We present here the broad positions on home-grown, cross-border, international and saffron terror.

Unlike English- and Hindi-language press, Urdu newspapers mostly tend to view the Indian security agencies' claims about Indian-origin Islamic terrorists and radical groups with deep distrust. They voice strong suspicions over and disapproval of Indian counterterror activities, involving the killings and arrests of Muslim youth, and perceive them as attempts to suppress the community as a whole (*Hamara Samaj* 2015d; *Hindustan Express* 2015a; *Siasat Daily* 2015a, 2015h). Urdu media allude to a "political cause" behind the killings of Muslim youth in "fake encounters" and their indiscriminate arrests under "false charges of terrorism" by the police "across the country" (*Daily Chattan* 2017; *Kashmir Uzma* 2016).

In contrast to the portrayal of the Indian Mujahideen as a major Indian terrorist group by English and Hindi media, Urdu newspapers often question the very existence of the said group. They project Indian Mujahideen as a "fictitious entity" and a "brainchild" of the Indian intelligence agencies aimed at maligning Muslims (Rizvi 2013; *Sahafat* 2013; Shamsi 2013; *Urdu Times* 2014c). However, not all Urdu newspapers completely deny the possibility of Indian Muslim youth's involvement in terrorism. Some cite Muslim youth's purported disappointment with the government and communal tensions with Hindu hard line elements, as probable reasons for Muslims to turn towards terrorism (*Akhbar-e-Mashriq* 2014d; *Hindustan Express* 2015b; *Siasat Daily* (2013, 2015m).

The Students' Islamic Movement of India (SIMI) is an Islamist student organisation that was banned by the Government of India in 2001 (Srivastava 2014). Many English- and Hindi-language media have reported on its alleged role in terrorism in India (Ghatwai 2014). In contrast, many Urdu publications voiced their opposition to the ban arguing that SIMI members arrested on terrorism charges have been acquitted (*Akhbar-e-Mashriq* 2014a; *Inquilab* 2014; *Rashtriya Sahara* 2014a; *Urdu Times* 2014d).

On the other hand, Urdu newspapers are extremely critical of purported Hindu extremism and periodically highlight the alleged role of Hindu radicals in terrorist attacks at Muslim sites. They allege a systematic attempt to shield the Hindu terror accused from justice (*Dawat* 2015b; *Hamara Samaj* 2014a; *Sahafat* 2015b; Shahab 2014; *Urdu Times* 2014b).

Cross-border and international terrorism: Most Urdu newspapers, like their English and Hindi counterparts, articulate strong concerns over terrorism originating in Pakistan and see the "encouragement of terrorism" by Islamabad as the "biggest hurdle" in normalisation of bilateral ties (*Akhbar-e-Mashriq* 2015b; *Hamara Samaj* 2015a; *Rashtriya Sahara* 2015a; *Siasat Daily* 2015e, 2015i). However, they still mostly advocate cooperation to resolve differences, as opposed to a more hawkish line espoused by some English and Hindi media (*Daily Aftab* 2015a, 2015b; *Siasat Daily* 2014b; *Akhbar-e-Mashriq* 2015f). Urdu newspapers usually welcome and favour the continuation of talks between India and Pakistan (*Siasat Daily* 2014a, 2015d; *Rashtriya Sahara* 2015b, 2015c).

The Urdu media sees Muslims as the biggest victims of international Islamic terrorism and strongly opposes associating the Muslim community with terrorism. In many cases, they see the linking of the Muslim community with terrorism as a ploy to defame Islam (*Akhbar-e-Mashriq* 2015a; *Munsif Daily* 2014).

Most Urdu newspapers are critical of the Islamic State of Iraq and the Levant (ISIL) and have repeatedly called for its elimination through international action (*Hamara Samaj* 2015e; *Inquilab* 2015b; *Rashtriya Sahara* 2014b). However, as mentioned above, many also see the role of the US and the West as having abetted the group's emergence (*Siasat Daily* 2015j; *Hamara Samaj* 2014b). Select outlets have been observed to carry reports and articles projecting ISIL in somewhat positive light. For example, *Akhbar-e-Mashriq* (2014b), a prominent Urdu daily from West Bengal, prominently flagged an account that ISIL extremists were the "real protectors" of Indian nurses, whom they had held captive and released subsequently in Iraq. The newspaper, however, did not report accounts of two other Indian workers who accused ISIL terrorists of "brutality" and being "barbarians" (Suroor 2014).

Much reportage and comment have not been observed in the Urdu media about Al-Qaeda in the Indian Subcontinent (AQIS). An *Urdu Times* (2014c) commentary on 11 September, discussing the announcement of AQIS, actually appeared to question and mock the media concern over the development.

Critique of US imperialism: Urdu publications, in stark contrast to the rest of the Indian media, are the sharpest critics of the US' foreign policy and of the Israeli state, particularly with reference to West Asia. They frequently project a deep distrust and suspicion of the US and the West, and espouse the belief that the US, United Kingdom (UK) and some of their European allies have anti-Islamic and anti-Muslim designs (*Rashtriya Sahara* 2015f; *Akhbar-e-Mashriq* 2015d). Some outlets even claim that the twin towers attack on 11 September 2001 was "plotted" by the US and that the following "hype" was used as a pretext to "meddle" in the affairs of Muslim nations (Shamsi 2014). For instance, a *Siasat Daily* (2015c) editorial suggested that

> As a result of these attacks, the United States had found a justification for launching a one-sided attack on Afghanistan and wreaking destruction there... There are already many doubts and suspicions regarding the authenticity of these attacks. Rather, it would not be wrong to say that the majority [of people] in the world are aware of the truth behind these attacks and believe that the United States and Israel alone had a role in the attacks, and that these attacks have been used as a justification to target the Islamic world.

Most commentaries in Urdu newspapers also blame the US and the West for international Islamic terrorism, particularly the emergence of the IS (Islamic State), Islamic State in Iraq and Syria (ISIS) and ISIL (*Siasat Daily* 2015j; *Dawat* 2014; *Hamara Samaj* 2014b; *Urdu Times* 2014c). Raising questions over the spread of international terrorism, a *Munsif Daily* editorial (2014) stridently announced

> Wow, what a script! But why (is it that) this intelligent and thinking world does not see who the biggest terrorist of the world is. Who is the one that attacked Iraq and killed more than a million people after leveling false allegations of the country possessing weapons of mass destructions (WMDS)? Who is the one that wreaked havoc in Latin American countries and killed 2.5 million people in a quarter of a century? Who is the one that rained so many chemical weapons on Vietnam that the country became barren? Who is the one that dropped nuclear bombs on Hiroshima and Nagasaki? Who is the one that wants to influence the entire world through its terror and dominance by setting up its military bases in every corner of the world? Who is the one that spreads unrest in West Asia, becomes a reason for the emergence of ISIL, and uses every act of it to defame Islam?

While flagging the "war mongering" nature of the US, Urdu-language newspapers were observed to forward a critique of Western imperialism. According to an *Urdu Times* editorial on 14 May 2013, "From the US to Europe, everyone is united over the fact that the West, western culture, and western imperialism have only one objective in the world; starting a new crusade against Islam."

Critique of Israel: Except for a few Urdu-language publications run by non-Muslims, most Urdu outlets publish editorials and commentaries that oppose the US and UK's actions in Afghanistan and Iraq, and what they view as the US's "blind support" to Israel's "tyrannical policy" towards Palestinians (*Hindustan Express* 2011; *Inquilab* 2017). As an extension of their criticism of the US, the Urdu press was observed to harshly criticise Israel (*Dawat* 2015a; *Siasat Daily* 2015f, 2015l; *Hamara Samaj* 2015c). An editorial published in *Urdu Times* on 5 March 2015a, read thus "There is no change in our well-thought-out view that the salvation of the world lies in the destruction of Israel."

In July 2017, India's English and Hindi media praised Prime Minister Modi's 4–6 July visit to Israel but the Urdu media cautioned that closer ties with Israel could harm India's relations with the Arab world. Prominent Urdu-language dailies *Inquilab* (2017) and *Akhbar-e-Mashriq* (2017) faulted Modi's decision to not visit the Palestine.

At the same time, Urdu editorials and commentaries tend to support Iraqi resistance against foreign forces, oppose imperial campaigns against Iran, express solidarity with the Palestinian struggle, sympathise with HAMAS, and take every opportunity to condemn Israel and its supporters, especially the US (*Akhbar-e-Mashriq* 2015e, 2014c; Shamsi 2015). Select media outlets, however, were seen welcoming the US–Iran nuclear agreement in 2015 as a "diplomatic victory" for Iran and affirming that the deal would end the era's "biggest dispute" (*Siasat Daily* 2015k; *Dawat* 2015c; *Rashtriya Sahara* 2015d). An editorial in *Siasat Daily* (2015g) claimed that

> Through the agreement, the global powers have recognised Iran's right to (carry on) its nuclear program. From this aspect, it can certainly be called Iran's diplomatic achievement.

On India foreign policy: The Urdu press generally advocates strong caution in India's dealing with the US. Some outlets insinuate that the US has its own "hidden interests" behind the increasing friendship with India, warn against Washington's "use and throw" policy, and caution against rushing into signing pacts with the imperial nation (*Akhbar-e-Mashriq* 2015e; *Hamara Samaj* 2015b). During the former US President Barack Obama's visit in January 2015, the Urdu dailies focused more on portraying his remarks on the rising religious intolerance in India as a "blow" for Prime Minister Modi than on the substantive outcomes from the former's visit (*Inquilab* 2015a; *Sahafat* 2015a; *Srinagar Times* 2015). On other occasions, they have opposed expanding relations with the US at the cost of India's ties with Russia and China (*Akhbar-e-Mashriq* 2015e; *Hamara Samaj* 2015b; *Siasat Daily* 2015b; *Rashtriya Sahara* 2015h). While they do not tend to specifically oppose improved relations with the US, they have taken a cautious approach, warning New Delhi that becoming too close to Washington could jeopardise India's own national interests.

All complaints and criticisms against the US and its allies aside, India's Urdu press does not encourage readers to resort to jihad or other violent means of expressing anger over events seen as being painful to Muslims at home or abroad. Well-aware of the fact that foreign policy is a federal government prerogative, Urdu papers generally go along with New Delhi on foreign policy issues. However, since they cater to a readership that is part of the global Muslim community, they favour cordial relations between India and Muslim countries, and often take positions that seek to accommodate the Muslim world's concerns and New Delhi's larger foreign policy framework.

Muslim women and Ahmadiyyas: There is no denying that Urdu newspapers could not come out of Islam and the Islamic world. Urdu dailies, almost on a daily basis, publish articles about Islam, the Islamic way of life, and Quranic interpretations. In fact, on Fridays, most Urdu newspapers publish a dedicated page for religious narratives (*Inquilab* 2018; *Rashtriya Sahara* 2018).

The Urdu-language media has played an ugly role in the Ahmadiyya movement. While they do not run stories on the Muslim minority community frequently, whenever they do they always portray them in a negative light. In fact, most dailies do not recognise Ahmadiyya Muslims as Muslims at all. They do not use the word Muslims for Ahmadiyyas and instead use the pejorative word *Qadiani* or *Qadiyani*. This term originated from Qadian, a small town in Punjab and the birthplace of Mirza Ghulam Ahmad, the founder of the Ahmadiyya movement. In 2013, Urdu-language dailies prominently covered the Gujarat state assembly opposition leader Shankersinh Vaghela's statement claiming that the RSS is using "Qadianis" to defame Muslims. They went on to urge the state government to take this allegation seriously and carry out a high-level investigation (*Munsif Daily* 2013). Further, Urdu-language dailies were openly critical of the Modi government's decision in 2016 to recognise Ahmadiyya Muslims as a Muslim sect. Maharashtra's prominent Urdu-language daily, the *Urdu Times* (2016a) declared that

> since the Qadiyanis believe in Ghulam Ahmad Qadiyani as their last prophet, they cannot be counted among the Islamic sects. This is the unanimous decision of the Islamic world.

The liberal space in Urdu media is slowly and gradually shrinking. A review of Urdu language dailies on triple talaq, polygamy and halala prove this point. Urdu dailies are directly or indirectly influenced by Muslim clerics. As a result, most of the dailies do not give even an iota of space to contrary opinions when it comes to Muslim personal laws. They do not publish anything critical on the violation of Muslim women's rights. Since the emergence of the triple talaq debate, most Urdu-language dailies carried all the statements of Islamic clerics criticising the government's affidavit banning triple talaq and the Allahabad High Court's remark on the same (*Urdu Times* 2016b; *Roznama Khabrein* 2016). The Allahabad High Court had said that the practice of "triple talaq" within the Muslim community is unconstitutional and violates the rights of Muslim women, and asserted that "no personal law board is above the Constitution" (*India Today* 2016). A commentary in the daily *Dawat* titled "this beef politics" claimed that the Indian government has "distracted" the people from its failures by triggering a debate on triple talaq (*Dawat* 2017).

Criticism of Modi and BJP: Urdu newspapers have been observed to be generally critical of the ruling BJP government led by Prime Minister Modi. In particular, they have sharply criticised the right-wing Hindu groups' initiatives, such as "ghar wapsi," and blamed the government for giving a "free rein" to such groups and creating an "anti-Muslim atmosphere" (Anjum 2015; *Siasat Daily* 2015n; *Hindustan Express* 2015c). Many outlets have also accused the Modi government of either trying to protect Hindu terror accused or turning a "blind eye" towards them (Shahab 2014; *Urdu Times* 2014b; *Rashtriya Sahara* 2015e*; Sahafat* 2015b).

Conclusions

India has the second-largest Muslim population in the world and is projected to have the largest by 2050. Further, a vast section of the Muslim population in India follows Urdu-language newspapers. Thus, the Urdu media is a key opinion shaper and sentiment barometer for a large segment of the community. There is no denying the fact that the Indian Urdu press, by and large, is a Muslim press (*Farouqui* 2009). The Urdu press gives wide coverage to political events, especially issues affecting minority interests that Urdu speakers may view as being downplayed, ignored, or misrepresented by larger media outlets. In that, they do tend to take a conservative position vis-à-vis Muslim minorities (such as the Ahmadiyyas), Muslim women and questions pertaining to their rights. This is a result of the close links between the Urdu press and Muslim clergy.

Contrary to the popular misperception that the Urdu media is a monolithic entity, it offers diverse coverage to a range of issues as well as differing opinions and arguments (Mushtaq 2008). It has also been established that India's Urdu papers are consistently critical of the US and Western policies, which in their judgment negatively impact Islam and the Muslim world. Urdu publications strongly support cordial relations between India and its neighbouring countries—including Pakistan—and encourage close political and economic cooperation within South Asia. They back India's adherence to the "non-aligned" path, leading the developing world at the international level in resisting what they view as the "hegemony" of the global North.

Unlike English and Hindi media, Urdu newspapers mostly view intelligence agencies' claims about Indian-origin terrorist groups with deep distrust. However, most Urdu newspapers, like their English and Hindi counterparts, articulate strong concerns over terrorism originating from Pakistan. Urdu dailies do not carry as many commentaries on world affairs as their English language counterparts, they do comment on all major international issues and on important foreign policies of the Muslim world and South Asia.

Urdu publications are also deeply critical of the Hindu right-wing, the Modi-led BJP, and the phenomenon of saffron terror. Further, the Urdu press mostly operates within the frames of nationalism and national interest.

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CONTENTS

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Environmental Sustainability And Electronic Media : Prospects And Perspectives

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Television is an amazing medium for advancing awareness, improving situations, proficiency, social awareness and political cognizance. The proposed inquiry is aimed at understanding the role electronic media can play in environmental sustainability objectives. This paper explores how India's english-medium electronic media speaks about climate and sustainable development issues. The study further adds to the existing knowledge on the dynamics of media and environment from the stakeholder perspective. The paper attempts to answer the critical questions regarding communication related challenges in dissemination of information regarding environmental issues to the masses. The present examination is constrained to five english news channels of India. These are DD News, CNN-News 18, NDTV 24x7, Times Now and India Today.

KEYWORDS

Environmental awareness, Climate change, Environmental sustainability, Electronic media

1. INTRODUCTION

Genuine natural stories are characteristically condemning of corporate needs and administrative subservience to those needs. In this manner, the proprietors or controllers of the systems and huge enterprises that run media are threatening to these issues. With respect to the TV systems-sections on untamed life, especially in intriguing areas, remain a staple of the nightly news, with documentaries showing the state of affairs touching all-time lows, gradually leaving the field to autonomous makers. The neighbourhood media has time and again showed hesitance to follow town projects and organizations, the toxic issues have constrained a more noteworthy examination. For relentless, top to bottom revealing an examination of ecological issues, one must look to network based media. Given the prevailing press 'emergency' approach, little regard is paid to 'counteractive action'- inventive advancements being spearheaded for cleaner autos or valuable ways to use sewage muck; the need for enterprises to lessen contaminations at their source; why and how people ought to reuse. In any case, the real media rushes to take a gander at impacts, while overlooking the reasons for ecological issues. Subsequently, the government approaches stay stalemated and under obligation to industry and secluded people battling proceedings with daunting struggles to keep their districts from turning into another unacceptable place. However, the eventual fate of financial aspects and legislative issues, human and social liberties, are inseparably connected to the ecological emergency and mankind's readiness to roll out amends and significant way of life improvements.

In the current scenario, it becomes imperative for media experts to revisit the expressions of Murrow (1958), which he delivered in discourse before the broadcaster's association which hold true even in the present day. Murrow emphasized that the people make their history for the coming generation to see. The recorded legacy the broadcasters are leaving and that too if left would provide the historians the evidence of decadence, escapism and insulation from the realities of the lived world. The ecological area has grasped online life swiftly and with complete faith. This medium provides a platform to help ecological battles and to bring individuals locally and transnationally on major ecological issues, like environmental change. It addition-

ally furnishes normal individuals with the capacity to track the nature of the air and water around them and after that offer this information to others. Current social condition is a common asset, one that has progressively been debilitated by the quick development of extractive exercises to stay aware of requests driven by consumerism and molded by industry. As a rule, innovation has enabled the people to change a portion of their practices and direct 'greener' business, however, people are still not staying aware of the pace of the ecological changes happening in light of the abuse of natural assets. The communication about the earth, climate change and sustainable development has remained a challenge for mainstream media houses. Many media houses even lack a beat on the environment because it is difficult for them to question the business establishments and factory outlets, which most often pollute the environment. This, in turn, affects the sustainable development processes.

In assessing the variables affecting social development procedures, media scope and political choices, many confining researchers have taken after the clue from humanist William Gamson embracing a 'social constructivist' approach. As indicated by this paradigm of research, locals use as assets the edges accessible in media scope, keeping in mind the end goal to make sense of political issues. However, they also coordinate these informational bundles with their own particular mental boundaries of reference fashioned by a method for individual experience and discussions with others. Media casings may help in establishing the terms of discussion amongst political performers and people in general, yet once in a while, if at any point, do they only decide popular supposition. Rather, as a major aspect of a 'casing challenge', one interpretative bundle may pick up impact since it resounds with pop culture or a progression of occasions; fits with media schedules or rehearses and additionally is vigorously supported by intense political on-screen characters (Gamson and Modigliani, 1989; Gamson, 1992; Price *et al.,* 2005; Nisbet, 2009a).

The surrounding of a natural issue can likewise impact more extensive open consideration while additionally molding the "extent of interest" in a political discussion (characterized as the sorts and quantities of gatherings who are engaged with approach making). Indeed, over the historical backdrop of numerous arrangement discussed control has switched on the capacity to not just control with regard to an issue inside strategy settings or in the media, yet in addition to all the while outline the idea of the issue and what ought to be done (Hansen, 2011; Nisbet and Huge, 2006, 2007). Surrounding environmental change as far as general wellbeing stresses environmental change's capability to increment the frequency of irresistible maladies, asthma, hypersensitivities, warm stroke and other notable medical issues, particularly among the most powerless populaces : the elderly and kids. Simultaneously, the general wellbeing outline rolls out atmosphere improvement by significant to new gatherings of people by associating the issue to medical issues that are now natural and seen as vital. The edge likewise moves the geographic area of effects, supplanting visuals of remote arctic areas, creatures and people groups with all the more socially proximate neighbours and places crosswise over nearby networks and urban communities. Scope at nearby TV news outlets and specific urban media is additionally created (Nisbet 2009a; Weathers *et al.,* 2013).

Endeavours to ensure and shield individuals and networks are likewise effectively limited. State and Civil Governments have more noteworthy control, duty and specialist over environmental change adjustment associated approach activities. In these cases, due to the restriction of the issue and the non-political nature of the investment, obstructions identified with polarization might be all the more effectively survive and an assorted variety of associations can take a shot at the issue without being named as advocates, activists or hippies. Moreover, once network individuals from varying political foundations combine to accomplish an extensively moving objective, for example ensuring individuals and a neighbourhood lifestyle, at that point the systems of trust and coordinated effort shaped can be utilized to push this different portion toward participation in quest for na-

tional approach objectives (Nisbet *et al.,* 2012; Weathers *et al.,* 2013). Internet based life has become substantiated by an important device for giving platform and means to the general population to take an interest in impacting or denying verifiable ecological choices made by governments and companies, which influence the common people. It has devised a path for individuals to align with nearby natural difficulties and participate in the bigger scale accounts which would influence the world populace as a worldwide network.

1.1 Major challenges

1. Ecological detecting systems will develop in the coming years, however the multiplication of new stages that don't address each other is troublesome. A test client must face in the coming years will attempt to fabricate solid correspondence channels to make the most available information scene conceivable.

2. The simplicity with which individuals can quickly bolster natural battles by tapping on connections or catches can be ground-breaking for data sharing, yet in addition, can possibly prompt a diffused ecological development in which most supporters just take an interest through demonstrations of clicktivism that don't really mean natural change.

3. When gathering data from individuals, particularly about close to home natural wellbeing, it is essential to ensure that the media stages assembling the information have worked in criticism circles so individuals get something as a byproduct of contributing information. Natural correspondences researchers can conveniently expand on and consolidate moral establishments inquire about by analyzing various particular inquiries. To begin with, how do these natural good outline interface with or potentially are enacted by various confined messages? For instance, does surrounding environmental change as a general medical issue have a more extensive interest since it focuses on hurt/care to people instead of the earth? So also, in the discussion over sustenance biotechnology, how do diverse edges of reference advanced by naturalists enact moral instincts (and restriction to the innovation) among nonconformists by actuating moral instincts identified with the immaculateness/sacredness of nature or by initiating moral instincts identified with the decency of nourishment strategy managed by huge partnerships instead of customers or little ranchers?

India makes up 2.4% of the world's territory while supporting 16% of the total populace. Alongside, whatever is left of the world, India too is bothered with environmental change. The intensifying outcome is an extremely unsustainable utilization of regular assets for a few ages. As of now, India is encountering fast and across the board natural corruption at disturbing rates. Enormous weight is set upon the nation's property and regular assets to help the huge overpopulation. Because of ecological debasement, the nation is confronting lost nearly $9-$10 billion consistently. For example $15 billion were gone through on managing surges in Kashmir in 2014. Around the same time, $11 billion were spent on the pay of the harms caused by twister Hudhud. Because of the environmental change, from 2020 to the finish of this century, the horticulture efficiency will be truly influenced. The Agriculture Ministry has given this data in its report introduced as of late to a Parliamentary Board of trustees. It has been said in the report that there can be a lack in the yield of the numerous products because of environmental change, yet the yield of soybean, bengal gram, groundnut, coconut (on the western drift) and potato (in punjab, haryana and western uttar pradesh) may enhance also. In any case, the service likewise trusts that if the example of cultivating is changed remembering environmental change, after 2021, an expansion of 10% to 40% in the yield of the considerable number of products is conceivable. All things considered, in the present date, while a few states in the north east and northern India are inundated in surges, then again there is choking out the warmth in the western part.

Ecological supportability has turned out to be one of the significant difficulties as India floods along its anticipated development direction and the nation needs to strike an adjust where the advantages of urbanization are augmented without trading off the natural benchmarks, a report by the administration has said. As indicated by the India Habitat III-National Report discharged by the Ministry of Housing and Urban Poverty Alleviation, a key ecological worry that India faces is to address natural difficulties activated by extraordinary climate conditions, requiring generous changes in accordance with urban arranging, arrive utilize administration and framework methodologies and standards (The Hindu, 2016).

In spite of the fact that there is no denying that in India, the earth versus improvement banter has been the best issue over the past two decades. Contamination is a major issue confronting the nation and there are likewise difficulties of advancement alongside it. It is unquestionably the need of great importance to always advance on the way of improvement, yet it is likewise fundamental that successful control is put on the contamination that represents a danger to mankind. In the Kyoto convention, this guideline was acknowledged that the greater the part of a nation in the carbon emanation in the air, more noteworthy is its obligation to spare the world. In any case, this guideline is again on the discourse table in the down to earth frame. On the Environment Day consistently, pioneers express worry about the compounding soundness of water, air,wood, land and sky, however, it isn't sufficient. The Indian Government wants to buildup the nation's foundation and come back to higher monetary development rates give off an impression of being foundering due to some extent to disagreements regarding the condition and land proprietorship arrangements. In such matters, media has a major part to play in making individuals understand condition and maintainability issues while taking up activities to ensure awareness about the Earth issues. This investigation is concerned about an examination of the honest and conceivable part of the electronic media in ensuring natural mindfulness.

1.2 Natural sustainability and media

The electronic media has a noteworthy part to play in encouraging the general population comprehension of natural issues. As indicated by Canadian Environmental Grantmakers' Network (2006), settling the present testing neighbourhood and worldwide natural issues while moving society towards manageability can't be just with specialists it no doubt will require the help and dynamic cooperation of an educated populace, open to fulfill their obligation in different roles, such as shoppers, voters, bosses and business and network pioneers.

Consequently, mass communications have turned into a crucial accomplice in worldwide biodiversity protection and administration through their different parts of not just expanding mindfulness on the issues and difficulties towards natural manageability, yet in addition in accomplishing definitive objectives of changing human recognition, demeanors and conduct towards ecological assets (Ogunjinm *et al.,* 2013). However, in India, not very many examinations have efficiently explored the volume, quality, extension and view of the scope of ecological manageability issues. One such investigation by Kapoor (2011) inspected the part of broad communications in the advancement of natural issues in the city Allahabad. It reasoned that there is a pressing requirement for compelling mass correspondence systems to make natural mindfulness (Kapoor, 2011). Indeed, the TV news channels have a two-dimensional part in regards to issues of natural manageability. From one perspective, they help to clarify the ecological approaches, controls and plans to general society and on the other, they mirror the worries of the general population in regards to various natural issues and in this way weight the leaders to unravel a particular natural issue (Prakash, 2013).

1.3 Extension and significance of the study

It has for quite some time been recognized that the media assume an imperative part in the public

eye by giving data, that is basic to the manner in which individuals understand and comprehend the world in which they live (UNESCO, 2011). So media can assist the general population with knowing issues identified with ecological maintainability and its effects. This examination will check the validity of english dialect news directs in making familiarity with environmental sustainability. It will research how India's english dialect electronic media speak to ecologically feasible advancement exercises. It will likewise break down what TV news channel is more dynamic ecological correspondent than their partner.

1.4 Statement of the problem

TV is a powerful medium for advancing environmental awareness in the socio-political sphere. It is additionally the fundamental data hotspot for people in general. It needs to set the plan on natural issues and offer needs to the ecological issues. An audit of records identified with ecological assessment and yearly natural reports has uncovered that mindfulness creation on these issues isn't extensively perceived in electronic media.

Moreover, it is the analyst's solid conviction that arrangement producers and implementers ought to get of how natural mindfulness exercises have been performed since they were propelled and what their triumphs and disappointments are. Else, it is difficult to guarantee advance towards moderating the causes and results of ecological issues on improvement exercises. Given the logical foundation expounded over the issue that should be examined is the genuine and potential part of the TV news diverts as far as the degree to which it is focused on bringing issues to light on ecological issues. There is a need to survey the part of the electronic media in adding to maintainable advancement objective. The objectives of the study are :

1. Study the role of electronic media in making familiarity with environmental sustainability issues.

2. Scrutinize the time allocated by the TV news channels in the dissemination of environmental sustainability issues.

3. Analyze the TV news content on environment sustainability issues.

Research questions are as follows :

1. What role does the TV news directs play in making natural mindfulness?

2. Which media source winds up powerful on ecological maintainability announcing?

3. Is the environment sustainability scope of TV programmes effortlessly comprehended? Is it intriguing and pertinent to the groups of onlookers it serves?

2. METHODOLOGY

This study adopted the following method for information gathering and investigation : The five english dialect news channels - DD News, CNN-News 18, India Today, Times Now and NDTV 24x7 were resolved in view of their viewership, lifespan and notoriety. The prime time programming fills in as the business benchmark for news channels. In this way, prime time band from 8 to 11 pm was chosen for the investigation. Several projects were recorded and a few were explored straightforwardly from YouTube channels of said news channels. This was improved the situation multi-month (November 2016). The 2016 United Nations Climate Change Conference was additionally held in Marrakesh, Morocco from 7 to 18 November 2016. From that point, the news stories were recorded under different predefined classes, for example governmental issues, business, sports, condition, wrongdoing and such like. At that point, ecological supportability related stories were independently audited and arranged.

2.1 Examination of news coverage

The November 2016's pattern in environmental news scope recommends that accident and natural disaster were the most secured issues. Times Now, India Today and CNN News 18 were for the most part dynamic in its more extensive scope. While weather and environment and wild-

the issues had a normal scope by all the four channels with CNN News 18 having an edge on others. The issue on agriculture had an insignificant scope. NDTV 24x7 had the most elevated scope. To the extent add upto prime time dedicated for ecological issues are concerned, the scope on condition was most extreme on NDTV 24x7, trailed by CNN News 18, India Today and Times Now.

3. RESULT

The following findings were established from the current studies : Environment sustainability issues comprise just about 0.35% of news on popular english news channels. Trends in the coverage of environmental sustainability issues by five prominent news channels suggest that in November 2016 the media rarely focused on environmental sustainability issues. 68% of the stories on environmental sustainability issues aired in the last segment as AV (Anchor Visual) format.

4. CONCLUSION

The investigation uncovered that no appropriate accentuation was given to natural supportability issues and the greater part of the earth maintainability issues was excessively short. It was discovered that there was an overall absence of the fundamental aptitude and preparing on the scope of the ideas of ecological supportability itself, which group significant difficulties for covering and writing about natural maintainability issues. The poor accentuation of ecological maintainability issues in the article arrangement may have at last brought about poor and conflicting scope in the TV. Notwithstanding that, ecological mindfulness hindrances ought to be distinguished first. There is a requirement for far reaching exploration to research the best orders of media application to ecological issues based on the nation's current substances. The electronic media ought to likewise look for components of getting its columnists prepared in the nuts and bolts of natural maintainability issues.

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India's Big Data Landscape: Challenges and Opportunities

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Abstract

Objective: This study aims at mapping the big data landscape in India and scrutinizing the challenges and opportunities in it. The blueprint of size, rate of growth of this sector and infrastructural challenges will enhance the knowledge on Indian Big Data Landscape. **Methods:** This study has been carried out using issue analysis method using different points of view on India's big data Landscape. This method is suitable for the analysis of ongoing processes. As India's Big data landscape is still growing and is facing infrastructural and policy level challenges, issue analysis method is perfect for analyzing the state of the art, challenges and opportunities. **Findings:** The study finds that India's big data landscape is facing severe security challenges. Information security in Indian cyberspace is critically low and needs to address urgently. The Information Security Policy of India has serious limitations and it needs to be improved. Users and Usage aspect of big data is also not clear at policy level. This study suggests for change in policy at five levels: 1. Data Management level, 2. Users' right level, 3. Responsibility level, 4. Infrastructural level and 5. Contradiction level. By adopting these policies only Indian Big data landscape can bring new opportunities and the cyber security will be safeguarded. **Applications/Improvements:** This study has scope of advancements at micro-level, on how to safeguard cyber security using state of the art technologies in third world countries, where technology comes first and regulation come next, may be an interesting field of study.

Keywords: Big Data, Cyber Security, Data Protection, Policy, Issue Analysis

1. Introduction

We have entered in the Big Data era. It is currently in a rapid development phase and continuously making technological breakthroughs. Theoretically and practically, Big Data refers to a collection of data sets, or chunks of information, too large and complex to be processed using traditional software tools[1]. According to the definition given by a research firm[2] "Big Data" are information assets that are of massive volume, have a high growth rate, are diversified, and require new processing modes to have more powerful decision making capabilities, more insight and discovery capabilities, and capabilities for optimized processes. "Big Data" has 4V features. The first is the large data volume (Volume); the second is a variety of data types (Variety); the third is low density value (Value); and the fourth is fast processing velocity[3].

As far as India is concerned, the number of netizens in India has reached 300 million mark[4], who are constantly producing and consuming a vast amount of data. The magnifying effect, transmission speed, and mobilizing power of the Internet are growing. In this information age, IT tools that we can use are omnipresent, and various kinds of information related to us can be found everywhere, too. Identities in cyberspace have become increasingly virtual, and privacy is increasingly important. One recent study

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shows that, once a person's age, sex, and postal code are known, 87 percent of the person's identity can be determined from open-source database[5].

With rapid changes in the information technology revolution in the present-day world, the Internet has become blended with different aspects of economic and social development and information technology has entered a new stage of Big Data, smart city, mobile Internet and cloud computing. There is no doubt that India with over 300 million Internet users is already a major cyber power, but it is also a major victim of information theft and cyber-attack and comes under tremendous cyber security pressure. This data explosion and continuous flow of information has also confirmed the scope of the erosion of civil liberties and right to privacy[6].

This new phase of information technology makes the issue of cyber security more and more prominent and leads to the continuous extension of the connotation of cyber security. In the past, people usually referred to the security of cyber infrastructure as cyber security and referred to the security of data and content as information security. Since 2011, however, countries like the United States, England, France, Germany, Russia, Australia, Canada, South Korea and New Zealand have all formulated their own cyberspace strategy or cyber security strategy to secure and maintain their strategic advantages in national security in the new stage of information technology. Cyberspace covers cyber infrastructure, data and content, and control domains. In other words, it covers the transmission level, cognitive level and decision making level and its scope will be extended from the present Internet to various types of networks, various types of data links and various types of equipment that they can link up with and control. The meaning of cyber security covers not just traditional cyber infrastructure security but also security at the information level, that is, the security of data and content as well as security at the level of execution of decisions, or the synthesis of non-traditional security involving information technology. The challenges from "big data" involve every level, from information storage, processing, transmission, right to distribution and application.

2. Prominent Players in Indian Big Data Industry

Bangalore is the hub of "big data" analytics in India, though other cities are emerging. Hyderabad has seen the highest growth for big data analytic companies – from 8% in 2012 to 11% in 2013[7].

According to the National Association for Software and Services Companies (NASSCOM), India's top body representing the information technology industry, the global analytics services outsourcing sector is expected to reach $ 71 billion by 2016, from $ 42 billion in 2012. A NASSCOM report said the analytics market in India is slated to more than double to $2.3 billion by 2018 from about $1 billion in 2013. Most of the growth is coming in areas such as retail, banking, and financial services[8]. According to some estimates, over 100 Indian analytics-focused software companies have developed and launched products catering to niche business needs. There has been a four-fold increase in Indian analytic start-ups in the past four years. The Indian provider landscape reportedly consists of a mix of established players which have a strong reference customer base and brand name, as well as a large number of emerging providers[9].

India reportedly hopes to play a major role in big data analytics. The NASSCOM-Crisil report said that the Indian big data industry is expected to grow from $200 million in revenue in 2012 to $ 1 billion in 2015. "Big Data will help the BPO [Business Process Outsourcing] industry move forward as it will help in 'evidence-based' decision-making for clients, which in turn has a high impact on business operations," NASSCOM said. Pointing to India's strong existing IT base, the Indian BPO industry reportedly continues to maintain over 37% of total global sourcing BPO revenues, although over the last five years rising Indian wage costs have given a competitive advantage to the Philippines, Brazil, West Asia, Poland, and Romania. Apart from that, the Indian IT landscape is divided between pure-play analytics vendors, Knowledge Process Outsourcing (KPO) a services provider, and BPO service providers who also reportedly provide big data analytics services as a part of their offerings. In addition, global companies also source analytics services from their Indian affiliates.

3. Top Players in India's Big Data Analytics Sector

Indian analytics industry landscape consists of nearly 600 firms, out of which 500 are start-ups and over 200 are product firms. In the absence of any standard rating, the firms mentioned in this paper were selected as they consistently garnered media attention and were lauded as top developers.

"Big Data Edge" developed by IT major Infosys enables real-time discovery of data. It analyzes both structured and unstructured data including information contained in emails, document files, blogs, social media, call center voice records, videos. It also converts voice calls into text to find necessary information. It uses facial recognition to extract information from videos. It has a repository of more than 250 pre-built algorithms and over 50 reporting options for display of data[10].

"TCS ACE Solution set," developed by IT major TCS Analytics, ITACE – a comprehensive set of analytic solutions covering project management, service management and financial analysis. TCS had collaborated with Twitter to launch an app IELECT to observe and analyze social media conversations during 2014 Indian parliamentary elections[11].

Genpact's website claims the company has been named "analytic leader worldwide" in the International Data Corporation market space in 2012. Its expertise includes credit risk analytics, fraud analytics, and operations risk management. Most of its clients are from the banking and financial services sector. It has also launched cloud-based order management platform[12].

Wipro generally referred to as "Indian outsourcing giant" offers services in business analytics, business intelligence, and information management. According to media reports, Wipro, the third largest information technology services company, has signed an agreement to acquire a minority stake in Opera Solutions, a US-based data analytics firm[13].

Pin storm, a top digital marketing agency, collected and analyzed tens of thousands of political statements from over 100 online platforms daily for nearly six months before the April-May 2014 Indian parliamentary elections to help political parties find supporters and tweak their political message[14].

4. Prominent Indian Startups in Big Data Analytics

Companies that are into Big Data Analytics are quite in demand in India. The following companies and products have featured in various industry surveys as prominent start-ups in the big data analytics sector of India. Create[15] collects and analyzes financial data for any irregularities. Veda Discovery by Veda Semantics[16] allows collection and analyses of social media conversations in real time.

OneView by Simplify360[17] offers real time monitoring of conversations across a range of social media platforms and offers sentiment analysis, audience intelligence, and trends monitoring.

Trisul[18] by Unleash Networks applies large scale real-time analytics on big data streams to monitor the network for a variety of purposes such as network security, traffic monitoring, and network forensics.

MECBOT by Farmcept[19] stands for Management and Enhancement of Content and is responsible for storing and analyzing all the data.

NanoBi[20] has for the first time brought into the Indian market the concept of an analytics app store.

Persistent Systems analyzed more than 15 million user responses – almost one million per week for an Indian TV show in 2012. These messages were gathered from Face book, Twitter, web, phone calls, and SMS, both in English and Hindi. Later in 2013, it analyzed 750K+ tweets over a 90-day period to analyze sentiment around a Hindi film. Not much is available on the tools it uses for data analytics[21].

Crayon Data has built a Big Data platform called White Box that can take data – be it internal or external social data – from any platform in any format and ingest it into the platform[22].

Gramener[23] has created a technology platform which reads heterogeneous data sources in practically all data formats—both structured and unstructured. During the 2014 elections, it analyzed over 10 million pages of election results in real time, which was used by prominent English language news channel CNN-IBN.

"pi" is the data analytics platform which allows users to convert raw data into meaningful information in the form of interactive charts, tables, and various other formats[24].

5. Indian Big Data Industry Faces Security Challenges

The Indian Government in 2011 introduced certain rules under the Information Technology Act outline the compliances required when collecting, storing or otherwise dealing with SPDI (sensitive personal data or information). The 2011 rules require organizations and corporations to lay out clear privacy and data protection policies in an attempt to increase the transparency to the consumer about how their information will be used[25].

Apart from that, the Indian Government is one of the largest stakeholders in data collection. The Indian Parliament on 11 March 2016 has also passed the Aadhaar Bill that aims to ensure targeted services to intended beneficiaries by assigning them unique identity numbers. These numbers will be given to each person who has stayed in India for 182 days in the year preceding the date of application. The Unique Identification Number (UIN) or "Aadhaar" in India allows government to access an individual's personal information. This is the perfect example of big data in India. This program will collect over 1.3 billion names, addresses, birth dates, gender details, and photographs. It will retain over two billion iris scans and 20 billion fingerprints in its database. These cards will provide demographics information for 1.3 billion people. Such data can be very useful for planning social programs in developing countries. Unfortunately, India doesn't have any strong strategy to protect this large amount of data.

However, according to experts, the IT Act does not impose liability on the Indian Government for any breach of privacy or loss of sensitive data collected by it. Two legal experts[26] stressed this point in an article on a technical website geospatialworld.net. They asserted that since the UIN is a government undertaking and since there are no laws delimiting the activity being undertaken by the government, the UIN project gives the government "complete freedom with respect to privacy laws." A report in prominent business daily *The Economic Times* said the government was planning to set up a data protection authority to probe any "data security breach[27]. After that, no progress was made in this regard.

6. Major Security Challenges

Big Data concerns the country's security interests. The severity and urgency of the issue of information security in cyberspace has greatly exceeded that of conventional security issues. In the highly uncertain cyberspace, the types of risks have increased, and they are difficult to prevent in this "complex circumstances[28]. Looking around the world, from the anti-terrorist campaign since 9/11 and color revolutions in East Europe to the Jasmine Revolution in the Middle East and North Africa, sovereign countries are now always in this plight of "looking for a needle in a haystack" when faced with unconventional security threats, with the needle that a government is looking for always submerged in the gigantic ocean of data. Even the cloud also comes with explicit security challenges because of control issue of datasets in cloud environment[29].

The collection of big data inevitably increases the risk of leakage of user privacy[30]. Big Data concerns the protection of state secrets. The arrange and Snowden incidents that caught the whole world's attention have vividly made clear to all the harsh challenges presented by Big Data. "Wiki Leaks" has exposed several times the United States' military, diplomatic, and other secrets on such a huge scale and with such a wide impact that stunned the whole world.

The "Prism gate" opened by Snowden refracted into the entire world the mystical rays of cyberspace that exist between state and individuals, control and counter-control, and infiltration and counter-infiltration. According to the data released by Snowden in March, 6.3 billion pieces of intelligence information about Indians was accessed. According to another revelation by Snowden, the Indian embassy was one of the 38 embassies in America bugged by the US National Security Agency. Criminals and terrorist groups have also realized the potential for utilizing mass data for crimes and strikes. During the 2008 Mumbai attacks, terrorists actively mined open source and social media data during attacks.

7. Major Challenges Confronting Cyber Security in New Stage of Information Technology

Big data and cloud computing are new focal points for cyber security. Big data have attracted more and more attention with the development of mobile Internet and other services. According to statistics published by BBC, global daily Internet traffic was 2.7 EB in 2013, with new data generated globally increasing by 40 percent annually and doubling every two years. The tapping of big data may be put to use in the economic, political, national defense and cultural sectors. Big Data are the characteristics of the new stage of information technology as well as the new focal points for the defense of cyber security. India does not pay sufficient attention to the storage, protection and utilization of big data, with the result that information is lost or incomplete. At the same time, problems of the damage, alteration and leak-

age of information have brought hazards to country's information security and protection of public privacy. Meanwhile, the in-depth application of broadband and information technology has pushed forward the development of cloud computing. Personal cloud storage, cloud manufacturing in enterprises and cloud administration have seen rapid development in recent years. Now, most of the world's data centers are going to be based on cloud computing technology. Even, India's cloud computing market has grown even faster. Many companies in India are employing Microsoft's cloud computing service. However, all those data centers are situated abroad[31]. According to "India Cloud Computing Market Forecast & Opportunities, 2020," the market for cloud computing services in India is projected to grow at the compound annual growth rate of over 22 per cent during 2015-2020[32]. Every country need to understand that distributed, virtual and service-oriented technologies in cloud computing capability are the technical foundation of cloud computing, but attacks on and breakdowns of cloud computing platforms would cause massive server paralysis.

In addition to that the security of the Internet-of-things cannot be overlooked. The Internet-of-things has numerous nodes, which are not easy to manage. Data stored at the nodes may be altered or forged, and this is a major hazard of the security of the Internet-of-things. For example, the Internet-of-things has now been put to use on medical devices, and the hacking of devices like pacemakers would directly affect the safety of people's life. Hackers may also launch attacks using smart TVs, refrigerators and wireless loudspeakers. In the world's first attack against the Internet-of-things, over 100,000 Internet-connected "intelligent" home appliances were connected into a vicious network under the control of hackers, which sent out about 750,000 phishing emails to unguarded victims within two weeks.

The security of industrial control systems also needs to be strengthened. For example, hacker attacks on the smart meter systems to change the meter data have sounded the alarm for us[33]. Some countries deliberately prepared for cyber wars to sabotage the information systems of other countries and destroy their energy, transport and other infrastructure facilities. A famous case in point was the "Stuxnet" virus which attacked and paralyzed Iran's nuclear facilities in 2010[34–36]. These serve as a warning to us.

8. India Needs Information Security Policy for Fair use of Big Data

Compared with conventional public policies, the information security policy is even more complex, comprehensive, and multifaceted. The more open and pervasive the Internet, the more external the nature of the information security policy will be. The greater the interconnectedness and interactivity of the Internet, the more parties of interests will be concerned with the information security policy. Therefore, many more aspects and issues need to be considered in formulating the information security policy. In a vibrant democracy like India, policy makers need to consider the following four aspects:

9. Strategic and Legal Aspect

The cyberspace is a natural extension of human society. Western powers including US, EU and England have laid down strategies, laws, and regulations to regulate the cyberspace. Looking at their approaches it is not difficult to see that technological development changes rapidly, making it necessary for management to advance with the times. The policy's scope of consideration and content of management must effectively accommodate advancement and innovation in Internet-based living and intelligence-based production. However, basic legal relationships and legal concepts will not undergo a fundamental change because of the virtual nature of the Internet and the concentration of data. In other words, India should handle well the relationship between "change" and "no change." What should "change" is the form and way of management; what should "not change" are security responsibilities, data ownership rights, jurisdiction rights, security management requirements, etc. These legal relationships will not change because of the virtual nature of the Internet.

10. Industrial and Market Aspect

Generally speaking, India's information industry still needs to become more open, on the condition that security must indeed be guaranteed. That is the dialectical relationship between development and security. Development is the goal, while security is the prerequisite. That should be the basic objective of the information security policy. Therefore, the management policy related

to the opening of the market and the development of industries should provide system arrangements and technological guarantees in such areas as enterprises' security obligations, industrial social responsibilities, government procurement policies, and law-based security oversight.

11. Technology and Risks Aspect

Information technology is a typical dual-use technology. Technological advances in such areas as cloud computing, Internet of Things, and mass storage are all "double-edged swords" with dual-use features. Only by managing the risks effectively can we draw on advantages and avoid the pitfalls. There have been quite a lot of discussions in many countries and societies over whether technologies and products should be indigenous or imported. The issue should be viewed dialectically. Controllability is the key. Credibility exists only with controllability. That should be the goal of the information security policy from the technology perspective.

Thus, under the circumstances of "the West being stronger and developing nations weaker" in terms of overall technological standards, India may place "controllability" above "indigenousness" as appropriate. The most urgent task at the moment is to strengthen country's abilities in analyzing and discovering IT loopholes and hidden dangers and in evaluating the risks of technological products and system applications. India should adopt such methods as "examination before application, relaxation on the condition of controllability, oversight and control in application, and security evaluation" toward new technologies and new applications and provide the support of technological standards and the guarantee of state policy for the security of the supply chain.

12. Users and Usage Aspect

As is known to all, Google made its name by determining the connection path between a webpage and another webpage, while Facebook comprises interrelated persons and organized "social graphs." Such an ability to connect a circle with another circle is immensely powerful. As a user, the only power is the power of choosing whether to connect or not to connect. Once connected, you are no longer the same self but are turned into a statistical self in the cyber database. Various kinds of relevant data will be used for commercial purposes or other causes, legal or illegal, which you will not be able to intervene physically, thus a user will immediately change from being a strong person with the right to choose into a weak one with no power to turn around a desperate situation. That raises a requirement for the Information Security Policy.

In this policy, the users must have the right to choose as well as the right to know. Enterprises that provide the technologies, products, and services should have the responsibility and obligation to voluntarily and promptly inform and remind their users.

In a country like India, where exponential growth in creation of big data is being seen, Big Data Security Policy should pay attention to five major issues.

13. Issue of Data Management

In the era of big data, the methods for storing and using data have undergone new changes, with some being inter-regional and even cross-border. The issue of data management is extremely prominent and also especially important. With respect to that, in formulating the policy India should handle well three "rights and interests":

First, India must face hegemony squarely, meaning it must be soberly aware that in such areas as Internet control power, key technologies, and high-end equipment, country is still under Western control. That is the objective circumstance and the overall backdrop.

Second, India must make clear its sovereign rights. Data, being an important strategic resource -- whether individual-owned or state-owned, must be considered within the scope of its sovereign rights. Third, it is crucial to have control rights. Possession of sovereign rights does not necessarily mean the ability to oversee and control. For example, data stored overseas and cross-border cloud computing might not be within the scope of one's sovereign rights. How should transfer of power be carried out? The country must treat different data differently and adopt solid, reliable means to effectively manage those data that truly need to be protected. If India is unable to manage data effectively, it is definitely risking a catastrophic loss of control over big data.

14. Issue of Users' Rights

This issue involves the people's welfare in cyberspace and users' data ownership, i.e., the issue of whether

users have control over their own data. It involves protection of individuals' privacy, assurance of Internet credibility, and guarantee of everybody's ownership rights over their personal data. It is not difficult to imagine that if one's information is mixed together with the information of numerous other people in a massive database that is controlled by a commercial entity and that includes such contents as users' intentions, behaviors, and interests, what changes could happen to individuals' rights? Therefore, India needs the corresponding policy and measures that are compatible with society's capabilities and methods of analyzing and handling big data.

15. Issue of Dividing Responsibilities

This issue concerns the spreading of security risks. Information security risks exist throughout the entire lifespan of data, and the security responsibilities corresponding to each link – from technological concepts and products' development to usage by subscribers and management of services -- must be shared. Big data's security issue involves governments, relevant enterprises, network operators, service providers, data producers and users, etc., making it necessary for the policy to lay down clearly the respective security responsibilities.

16. Issue of Infrastructure

Big data's development is inseparable from such key infrastructures as the telecommunications network, Internet data centers, and even industrial control systems, and its security and reliability is dependent on these infrastructures. Due to globalization of the supply chain and privatization of industries, the security between networks and key infrastructures has become increasingly complicated. A country's big data may be stored in other countries' networks, and a country's infrastructure may serve multiple countries concurrently. The high degree of global interdependence challenges the existing concept of sovereignty. Therefore, security monitoring and supervision systems for key infrastructures are extremely important. In India, it is necessary to establish as soon as possible substantive state security inspections on supply chains and regular security monitoring and supervision of basic networks.

17. Issue of Managing Contradictions

This issue concerns the contest of interests over Big Data on the Internet. As Big Data rises in value as a resource, the competition and confrontation over big data will grow in intensity. The methods of producing, processing, and using Big Data will immensely change the way contradictions of various kinds manifest themselves and the severity of damage incurred. This issue includes such contents as IPR (Intellectual Property Rights) protection, handling of Internet crimes, crackdown on online sabotage activities -- especially online terrorism, and countering the threat of cyber warfare.

18. Basic Approaches for Safeguarding Cyber Security on the Technical Level

The capacity for independent technology innovation should be increased. Today, virtually all the operating systems used on personal computers and cell phones in India are of foreign origin and the core chips are imported. This is a major hazard. As far as cyber security is concerned, it is very difficult to realize safe and controllable management without mastery of technology.

Snowden's disclosure of alleged massive US attacks against Chinese servers is a case in point. The core technologies of foreign countries cannot be bought and cannot be exchanged on the market. However, Indian market plays a very important role in the cultivation of technology and products through independent innovation. This demands that in the cultivation of network core technologies, India should also give play to the decisive role of the market in the distribution of resources and give better play to the role of the government.

The building of the contingent of cyber experts should be accelerated. India must build a strong contingent of talents who are strong in politics, proficient in vocational skills and good in work style in order to build their country into a cyber-power and safeguard cyber security. India needs to cultivate and bring up scientists of world standards, network technology personnel, outstanding engineers and

high-level innovation teams. India should play an active part in international Internet governance. In order to build itself into a cyber-power, India needs to have a say in international Internet that is commensurate with our position as a cyber-power. Indian Government's 'Make-in-India' campaign can play a vital role in this direction.

19. Opportunities

India is on the path of becoming a major global trading power. Building a trading power requires a higher reliance on modern science and technology to remold a new advantage in foreign trade competition and boosting the quality and results of the development of foreign trade. The big data applications in e-commerce are becoming increasingly widespread, providing a rare opportunity for India's foreign trade development. Fully utilizing modern information technologies such as big data is an important measure for India to cultivate a new advantage in foreign trade competition. The business and government sectors should enhance their cooperation and make the most of the role of big data as a "new engine" for the development of foreign trade.

20. Big Data Brings New Opportunities for Development of Foreign Trade

The trading platforms rely on big data service functions; [they] consolidate foreign trade information flows, capital flows, and material flows; reduce trading costs; and boost trading efficiency.

With the help of big data analysis, third party foreign trade service businesses attract small- and mid-size business groups to conduct trading, settlement, and financing on their platforms, and the data and information on the platform trading of small- and mid-size businesses provide third party foreign trade service businesses with opportunities to expand their service functions and innovate their data service products. There is positive interaction between big data and platform data. Third party foreign trade service businesses utilize big data to expand their platform service functions, gradually extending high value-added services such as online reports, credit financing, cross-border settlement, and global business consulting, for a clear rise in the level of specialization and informatisation in foreign trade business.

There are three main types of third party foreign trade businesses, cross-border ecommerce businesses, foreign trade consolidated service businesses, and supply chain management businesses. With market competition heating up, a number of countries are actively assisting the big data service providers in their country's trade fields. In order to adapt to this new situation, Indian businesses should also actively promote internationalization strategies and extend their areas of work into the fields of investment and services. This will certainly promote the tight joining of big data services with the real economy.

21. Conclusion

A smart phone today has more computing power than all of NASA when it put a man on the moon in 1969. There are five billion cell phone users and 4000 tweets generated per second. There are more than 900 million facebook users either sharing data or looking at other people's data. This unstructured data is no longer controlled by organizations; it is in people's hands. The issue is how to mine, store, transfer, refine, synthesize, and build secure systems that use this data.

Big data presents a beautiful yet terrifying picture of the future for mankind. The beautiful aspect is that it gives us a wider perspective and newer discoveries, which in turn will change our life, work, and mindset. The terrifying aspect is that it creates even more risks and greater challenges; besides security of the data itself, privacy of individuals is more of a concern. Therefore, among the numerous issues surrounding big data, security risks have been the focus of attention.

As far as India is concerned, many big domestic internet companies like Baidu, Renren, Qq, Alibaba have come up in China, while in India there are no such indigenous companies to challenge Face book, Google and Yahoo. A small number of Indian companies that do exist also depend on American servers or technology for at least some of their work. Intelligence agencies are directly obtaining information from American servers. As such, how can a common online user take precautions? The talk comes back to the government, which has not taken any stand on the privacy of citizens in its cyber policy. The contracts for many sensitive services -- like 'Adhaar,' in which private data of most of the Indians has been stored -- are with foreign companies. Merely being called the superpower of IT is not enough. The path of cyber security is in going domestic.

The proclamation of the government that it is conscious of its responsibility to prevent unauthorized use of information and protect our privacy, civil rights does not instill confidence. Even India's National Cyber Security coordinator has also described India's current privacy protection attempts as "piecemeal" and "lacks overall strategy. Shouldn't India be worried to know how the private data of its institutions, business and citizens is being processed? Or is it being handed over to other countries or parties? How long will such data be preserved and what type of conclusions is being drawn from it? The truth is that even after creating numerous cyber-security agencies, departments, organizations, laws and policies that have trendy names, the government appears to be powerless while facing cyber-attacks. There have been cyber-attacks on the Prime Minister's Office as well as on the defense and foreign ministries, Indian embassies, missile systems, the National Informatics Center and even on the computers of the Central Bureau of Investigations. Along with the surveillance, there can also be business objectives behind these attacks. In July 2010, due to in the irregularities in the power system of Insat-4B, one of its solar panels stopped functioning and 12 of its 24 transponders went out of use. Later on, it was discovered that someone had infected it with the Stuxnet virus so that TV channels beamed to INSAT are sent Chinese satellites!

There is also an absence of a legal framework on issues associated with data manipulation along with the growing fields of data visualization, predictive and link analyses, and collection strategies. The ubiquity of large data requires the right combination of people, tools and technology to leverage its unlimited potential. In these circumstances India also needs Information Security Policy for fair use of Big Data.

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Media Freedom and Autonomy in India: A Critical Analysis

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Abstract : Through this article, the authors critically examine the media freedom and autonomy in India. The paper seeks to scrutinize the recent trends in media ownership in India and their impact on media pluralism and journalistic autonomy. This study has been carried out using issue analysis method using different points of view on Indian media's autonomy and freedom.

Keywords **- Media Autonomy, Media Ownership, Media Pluralism, Journalistic Autonomy, Media Freedom**

I. INTRODUCTION

India has a vibrant and growing media industry, catering to its 1.35 billion-strong population (Worldometers 2018). The media are a reflection of the country - vast and diverse . There are 892 private television channels, including 403 devoted to news and current affairs, and 114,820 registered publications, including 14,984 newspapers (indiantelevision.com, 2016; Sarma, 2017). English-language news channels and publications are considered by the elite as the national media, but outlets in Hindi and many vernacular languages are also popular and have a significant impact. Digital news platforms are also making an impact. There are hundreds of private TV news channels, but privately-owned radio stations are still not allowed to broadcast their own hard news.

The media are mostly self-regulated. A constitutional body regulates the print media but does not have punitive powers, while an association of broadcasters supervises the electronic media. Cross-media ownership remains a matter of concern, as does the practice of "paid news", where politicians or businesses pay media outlets for favorable coverage.

International media watchdogs describe the Indian media partially free. While journalists in big cities have a large degree of freedom, concerns remain in Kashmir, where the government often clamps down on the media. Conditions are also difficult for journalists working in states with a considerable presence of Maoist rebels. Activists trying to uncover corruption have faced threats and attacks. There have been many cases of censorship in the past several years, many of which received prominent media attention.

II. MEDIA FREEDOM

Washington-based pro-democracy watchdog Freedom House called India's press and internet "partly free," despite saying that India was politically "free" overall. Freedom House cited state and national government officials' use of "security laws, criminal defamation legislation, hate-speech laws, and contempt-of-court charges" to rein in traditional and social media (Freedom House, 2015).

The government banned a 2015 BBC documentary about the 2012 gang-rape of a Delhi student. The cable news channel NDTV broadcast a blank screen for an hour as a "silent protest" against the government. Internet providers can face criminal charges for failing to remove content at the government's request. India reportedly asked Facebook to remove the most content of any country in 2014. The Indian government also occasionally suspends internet, SMS, and phone traffic in areas of unrest, such as the Kashmir Valley. Paris-based Reporters without Borders (RWB) rated India 140th out of 180 countries for freedom of the press in 2014. RWB said India was the deadliest country for media personnel in 2013, with eight journalists killed. Freedom House also cited media corruption as a concern, including "paid news," where media outlets ask politicians for payments in exchange for favorable coverage.

Paris-based Reporters Without Borders ranked India at 136 out of 180 countries in its World Press Freedom Index for 2015. This was a slight improvement from its position of 140 in 2014 and 2013. India's consistently low ranking since 2002 is due to rising "impunity" for violence against journalists and growing internet censorship, the media watchdog said.

"Almost no region is spared but Kashmir and Chhattisgarh continue to be the only two where violence and censorship are endemic. Those responsible for threats and physical violence against journalists, who are often abandoned by the judicial system and forced to censor themselves, include police and security forces as well as criminal groups, demonstrators and political party supporters" (The Economic Times, 2014). In its annual report released in late December 2015, RWB described India as Asia's "deadliest country" for journalists, ahead of Pakistan and Afghanistan.

Nine journalists were killed in the country in 2015, two of them linked to illegal mining."Indian journalists daring to cover organized crime and its links with politicians have been exposed to a surge in violence, especially violence of criminal origin, since the start of 2015... The inadequacy of the Indian authorities' response is reinforcing the climate of impunity for violence against journalists", it said (Hindustan Times, 2015). The group has called for a national plan for the protection of journalists and said a "response that matches the scale of the threats to journalists is now essential".

III. MEDIA REGULATION

Riding the digital wave, the Indian Media & Entertainment sector is expected to reach Rs 2 trillion by 2020 (Laghate, 2018). The Indian media has expanded into a very fast growing industry since media deregulation in the 1990's. Until then, the government had a monopoly over electronic media. The Indian government largely allows the media to regulate themselves, barring ad hoc attempts at media control and restrictions on content. Print media has a nominal regulatory body but it does not have enforcement authority. A broadcasters' association supervises the electronic media.

Media licensing, however, does give the government some leverage over media. Indian TV channels require a security clearance from the Indian government's Ministry of Home Affairs in order to receive a ten-year broadcasting license from the Information and Broadcasting Ministry. Some press criticized Modi's appointment of an Information and Broadcasting Ministry official to head the government's nominally independent state TV news channel as a declaration of the government's control over news (Marvel 2015).

Although there are no signs of imminent government media regulation, in 2014 the government's telecommunications regulator Telecom Regulatory Authority of India (TRAI) gave recommendations to reduce media corruption and consolidation. TRAI recommended banning media ownership by politicians, political parties, local governments, and religious groups.

IV. ATTACKS ON JOURNALISTS

Several incidents of attacks on journalists in 2015 alarmed the media and sparked concern from watchdogs. At least nine journalists were killed in 2015 in connection with their work while many were physically attacked, according to the RWB statistics seen in December 2015.

In one of the most high-profile cases, a journalist died in June 2015 after being set on fire allegedly by the police in Uttar Pradesh for writing against a state minister on Facebook. The journalist, Jagendra Singh, had accused the minister of corruption and rape. The same month, Sandeep Kothari was abducted, killed and his body burnt in Maharashtra state allegedly by those involved in illegal mining. In July 2015, the owner and editor of a local weekly in Mumbai died of multiple stab wounds in Mumbai. Media reports said Raghavendra Dube often helped the local police with information on bars which were operating illegally. In October 2015, a journalist working with Hindi newspaper Dainik Jagran, Mithilesh Pandey, was shot dead inside his home in the eastern state of Bihar. His family said he had been receiving threats. Meanwhile, television journalist Hemant Yadav was killed in Uttar Pradesh state in the same month. Separately, a journalist died of a heart attack while covering a massive medical school admissions examination scandal in Madhya Pradesh state but many have raised questions over his death. There have been dozens of mysterious deaths linked to the scandal. Meanwhile, there have been attacks on newspaper offices too.

In November 2015, some offices of prominent regional daily Lokmat were pelted with stones in Maharashtra state over a cartoon published by the paper . The daily had used the image of a piggy bank to depict the funding of the self-styled Islamic State militant group. Muslim groups said the cartoon was blasphemous as the Prophet's signature was used along with the image of a pig. The newspaper apologized for publishing the cartoon which some outlets interpreted as a surrender of freedom of expression (The Quint, 2015).

Newslaundry website, which keeps an eye on the media, said Lokmat giving up "so easily on their freedom of expression" would "embolden people who think it's alright to physically intimidate if they don't like something" (Saikia, 2015). Another news website Scroll lamented: "Violence is the weapon of choice of all self-styled defenders of faiths and ideas in India" (Mody, 2015).

In February 2016, lawyers allegedly attacked journalists in the premises of a court in Delhi. The assault took place ahead of a hearing in the case of a student leader arrested on sedition charges amid police presence, triggering an outcry in the media. Federal Minister Arun Jaitley termed the attack on journalists "highly improper and condemnable" "Media has an unhindered right to report; Attack on media persons is highly improper and condemnable," he said (The Times of India, 2016). Lamenting the dangers to the lives of journalists, respected English-language daily The Hindu has said this is a "reminder of the perils that confront investigative journalists, especially those who take on the rich and the powerful" (The Hindu, 2015).

V. CRACKDOWNS IN PARTICULAR AREAS

In Kashmir, security forces often clash with separatists and street protesters, and also crack down on the media. The authorities impose curfews and often block the internet and mobile phone networks in response to unrest or ahead of high-profile visits. This was seen ahead of Prime Minister Narendra Modi's visit to the state a few times in the past several years. Internet services were also suspended briefly in Kashmir during the Id festival in 2016 (NDTV, 2016). The suspension badly affected the work of journalists and media, particularly online editions of newspapers.

The government's decision to suspend communications also came amid tensions over the ban on the sale of beef introduced by many states in 2015-16. This is a sensitive issue in India as Hindus, which comprise 80 per cent of the population, consider the cow sacred. Meanwhile, in Maoist-affected Chhattisgarh state, journalists face pressure from the police and powerful local officials. They also get caught in the clashes between Maoist rebels and the security forces in the state. In February 2016, a female journalist's house in Chhattisgarh was attacked with stones. The group behind the incident accused Malini Subramaniam, a contributor for Scroll.in website, of supporting Maoist rebels. Subramaniam has written about alleged human rights violations by

security forces in the state. She was eventually forced to leave Jagdalpur after being reportedly threatened by local police and anti-Maoist groups. Reporters in the northeastern states of Assam and Manipur face pressure from both the government and militant groups.

In July 2015, media reports said the National Crime Records Bureau, will for the first time, start gathering data from across the country on attacks on RTI activists, journalists, social activists and whistleblowers. States were also sent new templates to compile data taken from police stations. However, some media outlets questioned the efficiency of this system since the new database will record only cases of grievous hurt of varying degrees and any deaths of journalists or activists will be noted as part of general figures on crime.

VI. CONTROLLING ONLINE CONTENT

With India's internet users standing at 456 million as of December 2017, the government has also been increasing restrictions on online content (FirstPost, 2018). Social media platforms are frequently asked to remove offensive content. The Indian government placed the maximum requests to Facebook to take down content during the first half of 2015. It asked for the removal of over 15,000 pieces of information over fears that this material could cause unrest.

"We restricted access in India to content reported primarily by law enforcement agencies and the India Computer Emergency Response Team within the Ministry of Communications and Information Technology because it was anti-religious and hate speech that could cause unrest and disharmony within India," Facebook said (Business Today, 2015).

In its Government Requests Report, the social networking platform said the number of pieces of content restricted by India stood at 15,155 in January-June 2015. The number is a sharp rise from 5,832 in July-December 2014 and 4,960 requests in January-June 2014. There are also concerns over the Indian government's mass internet surveillance system Network Traffic Analysis (Netra), which will monitor words such as "attack", "bomb", "blast" or "kill" in tweets, status updates, emails or blogs. Media reports in 2014 said the system is likely to be launched soon (Paganini, 2014).

VII. MAJOR CENSORSHIP INCIDENTS

Some incidents of state censorship in particular received widespread attention in 2015. In March, a BBC documentary "India's Daughter" made by Leslee Udwin on the gang-rape and death of a student in 2012 was not allowed to be shown in India. Leading English-language TV channel NDTV, which was to broadcast the program, registered its protest against the gag order in a unique way. It ran a blank dark screen with the film's title and a lamp for an hour on the day and time the documentary was to be aired. In the documentary, one of the rapists who was interviewed in jail defends his actions and is seen not to show any remorse for his crime. The government and a section of the media criticized the film, saying it contained objectionable content and was derogatory to women. The police feared it would disrupt law and order.

In April 2015, the Indian government banned Al-Jazeera TV channel for five days for showing what it said was a wrong map of Kashmir, which is at the center of a long-standing dispute with neighbour Pakistan (Panda, 2015). The government also objected to content aired by three popular news channels over the hanging of 1993 Mumbai blasts convict Yakub Memon. It said ABP News, NDTV 24×7 and AajTak had shown "disrespect" to the judiciary and the president through airing interviews with persons who sought mercy for the convict.

Also in June 2017, the government banned access to 857 pornographic websites, which was later to be partially lifted following widespread criticism of the decision (The Financial Express, 2017). Rejecting charges of being a Taliban-style government, Telecom Minister Ravi Shankar Prasad said all sites which do not promote child porn would be allowed to function. However, the review put the liability on internet service providers to unlock only those sites which did not contain child pornography.

On 16 November , which is celebrated as National Press Day, three English-language dailies in the northeastern state of Nagaland published blank editorials to protest against what they said was an attempt by the authorities to stifle their freedom of expression (Pandey, 2015).. Eastern Mirror, Nagaland Page and The Morung Express were objecting to a letter sent by the Assam Rifles paramilitary force, asking the media not to publish statements made by militant groups including the banned National Socialist Council of Nagaland (Khaplang). The letter said that media houses were "supporting the unlawful association intentionally or unintentionally" by publishing their statements. The state's governor, P. B. Acharya, also said banned groups should not get "publicity" in the media. Bano Haralu, a reputed journalist from the region, termed the letter by the Assam Rifles a "diktat by a paramilitary force to a democratically elected government" and said it "cannot be brushed aside." She also asked if the Assam Rifles would "dare" to "extend the same order to 'national' media houses?"

As significant sections of the public and the media debate what they see as rising intolerance in the country, journalists have not remained unaffected. In October 2015, the editor of a government magazine in Haryana state's Education Department was removed for publishing an article on the benefits of beef. It said beef is rich is iron. The sale of beef is banned in the state, cow slaughter can attract a jail term and the state government defended its action. Meanwhile, there have also been threats to journalists by right-wing groups for writing allegedly "anti-Hindu" articles.

VIII. SELF CENSOR-SHIP

Self-imposed censorship in the media has been noticed since around the time of the general election in 2014 and with a change in the ownership of some media outlets. In its "Freedom of the Press 2015" report, media watchdog Freedom House noted that "politicized interference in editorial content and staffing decisions remained a concern in 2014, and it appeared to increase in the

months surrounding the May national elections". Analysts also observed that the mainstream media, in general, shifted towards the right amid strong possibility of the victory of the Bharatiya Janata Party (BJP) in the polls and continued on this path after the election, it said. They also said that senior officials and ministers were asked to keep the media at bay and communicate only through official channels.

Media watchdogs noted "interference" in editorial decisions after the takeover of the Network 18 media group by the country's largest company, Reliance Industries Limited, in May 2014. There was also alleged pressure for "favorable coverage" during the poll campaign, they said. Opposition candidates alleged that RIL owner Mukesh Ambani was funding the election campaign of the BJP's prime ministerial candidate Narendra Modi. Noted journalists Rajdeep Sardesai and his wife Sagarika Ghose resigned from CNN-IBN, a part of the Network 18 Group, after the change in ownership.

In November 2015, sections of the media strongly criticized journalists jostling for space to take selfies with Prime Minister Narendra Modi at a gathering organized by the BJP to mark the Diwali festival. The incident was dubbed as an example of "selfie journalism" and media outlets said journalists had done themselves a "disservice" by forgetting the principle of objectivity.

"Journalists are supposed to ask questions, seek clarifications and maintain a safe distance from the people being interviewed. By ignoring even the basics, the selfie brigade has caused immense harm to the cause of independent media... Selfie journalism has ensured that they will talk and we will listen", the Business Standard newspaper said (Mishra, 2015).

Hindustan Times said: "From the Twitter outburst by members of the fraternity and general public alike, journalists did themselves a disservice. They forgot important lessons every cub reporter is taught at his or her editor's knee - neutrality and objectivity towards the one they report on. They turned into fanboys and fangirls, who could only think the likes and shares this picture can get on Facebook and Twitter, not to forget Instagram" (Sharma, 2015).

Self-censorship is also being seen in some areas over action being taken against the media by the government. In December 2015, some national media outlets reported that local journalists in the flood-hit southern city of Chennai were afraid of writing against alleged inadequate relief measures carried out by the government due to defamation fears. Prominent daily Hindustan Times said there are 200 criminal defamation cases against journalists and media organizations in Chennai, filed by the state government, for publishing stories on various issues which it views as critical of the authorities. Local editors said they do not get government advertisements if they question or analyse its policies.

The paper quoted local reporters as saying: "We cannot write against the government. You should do this job because you are from outside" (Mondal, 2015). Tamil Nadu officials denied imposing restrictions on the press, Hindustan Times reported. There was also criticism in the national media and on online platforms for photos of the then Tamil Nadu Chief Minister J. Jayalalithaa being pasted on relief material packets allegedly by workers of the ruling party AIADMK.

Media website Newslaundry termed these actions as "intimidation". "The kind of intolerance towards dissent that Jayalalithaa has gotten away with, a Modi would have been hauled over coals and skewered. The AIADMK's defamation spree is nothing short of intimidation and an attempt to quell free speech and press freedom", it wrote (Singh, 2015)

Media watchdogs feel that many existing laws can be used to curb media freedom. These include the law on sedition (Article 124A of the Indian Penal Code which prohibits any expression that can cause "hatred or contempt, or excites or attempts to excite disaffection" towards the government) as well as the 1923 Official Secrets Act which gives the authorities the power to censor articles related to security matters and take action against members of the press.

CONCLUSION:

Media owners, agenda of various groups, government advertisers, market size, media audience, etc. influence the construction of media contents and seriously challenge the so called "Free Media" in India. In Asian countries media autonomy is a controversial issue, on one side right to information and freedom of expression is provided on other side media regulations and Press laws are ready to curb the media freedom. In China the party and government are attempting to act as a media watchdog in a fast changing world of media communication. Pakistani military uses a range of legal and constitutional powers to curb press freedom. The spiritualistic image making of political leaders are also very common practice over Indian media (Mishra, 2008).

India's media are considered partially free by international watchdogs. There is a large degree of freedom in big cities but concerns persist over the situation in Kashmir and states with a significant presence of Maoist rebels, such as Chhattisgarh. Journalists, social activists and anti-corruption investigators face dangers in their work. There have also been many cases of censorship.

However, the government has also taken one more step in the direction of granting autonomy to All India Radio and Doordarshan by promulgating an ordinance to effect some changes in the Prasar Bharati Act. The most important change brought about by the ordinance was the scrapping of the provision to have a 22-member parliamentary committee to oversee the Prasar Bharati Board. This proposal had invited much criticism because such supervision would go against the idea of an autonomous media set-up.

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Co-maximal signed graphs of commutative rings

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Co-maximal signed graphs of commutative rings

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Abstract: Let $\Gamma(R)$ be a graph with element of R (finite commutative ring with unity) as vertices, where two vertices a and b are adjacent if and only if $Ra + Rb = R$. In this paper, we characterize the rings for which a co-maximal meet signed graph $\Gamma_\Sigma(R)$, a co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$, a co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$, their negation signed graphs $\eta(\Gamma_\Sigma(R))$, $\eta(\Gamma_\Sigma^\vee(R))$, $\eta(\Gamma_\Sigma^\oplus(R))$ respectively and their line signed graphs are balanced, clusterable, and sign-compatible.

Key words: Finite commutative ring, maximal ideal, co-maximal graph, balanced signed graph, co-maximal meet signed graph, co-maximal join signed graph, co-maximal ring sum signed graph

1. Introduction

Istvan Beck [5] introduced the concept of associating a graph with commutative rings. Since then, many researchers have worked in this field. Ashrafi et al.[2] defined the *unit graph* of a commutative ring (R) as the simple graph with vertex set R and two distinct vertices x and y are adjacent if their sum $x + y \in U(R)$, where $U(R)$ is the set of units of R. This graph is denoted by $G(R)$. This kind of work can also be seen in [17]. Let R be a commuatative ring with a nonzero unity and let $Z(R)$ be the set of all zero divisors in R. We recall from [7] that the total graph of R is the simple graph with vertex set R and two distinct vertices x and y are adjacent if their sum $x + y \in Z(R)$. This graph is denoted by $T(\Gamma(R))$. In 1995, Sharma and Bhatwadekar [15] introduced a graph $\Gamma(R)$ on a commutative ring R, whose vertices are elements of R and two distinct vertices a and b are adjacent if and only if $Ra + Rb = R$. Further properties of these graphs were established by Maimani et al. [13], and they named this graph the *co-maximal graph* of R, denoted by $\Gamma(R)$. Observe that $G(R)$ is an induced subgraph of the co-maximal graph. Note that if R is a finite ring, then $G(R)$ is the complement graph of $T(\Gamma(R))$ and hence the complement graph of $T(\Gamma(R))$ is an induced subgraph of the co-maximal graph.

Further, in [13], the authors worked on properties of subgraphs $\Gamma_1(R)$, $\Gamma_2(R)$, and $\Gamma_2(R) \setminus J(R)$, where $\Gamma_1(R)$ is the subgraph of $\Gamma(R)$ generated by the units of R, $\Gamma_2(R)$ is the subgraph of $\Gamma(R)$ generated by nonunit elements, and $\Gamma_2(R) \setminus J(R)$ is the subgraph of $\Gamma(R)$ induced on the set of nonunits of R that are not in $J(R)$, where $J(R)$ is the Jacobson radical of R, and also $J(R)$ is the largest 2-sided ideal of R such that $1 - a$ is a unit for all $a \in J(R)$. Let $\Gamma_1(R)$ be the subgraph of $\Gamma(R)$, generated by the units of R, and $\Gamma_2(R)$

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be the subgraph of $\Gamma(R)$, generated by nonunit elements of the ring R. The co-maximal graph $\Gamma(Z_6)$ is shown in Figure 1.

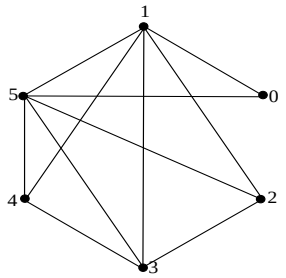

Figure 1. $\Gamma(Z_6)$

For preliminary notations and terminologies in abstract algebra we refer to standard textbooks [8, 9], and for graph theory we refer to [11, 21]. Unless mentioned otherwise, all rings considered in this paper are finite and commutative with unity $1 \neq 0$.

A subring A of a ring R is called a (two-sided) *ideal* of R if for every $r \in R$ and every $a \in A$ both ra and ar are in A. A proper ideal A of R is *maximal ideal* of R if there are no other ideals contained between A and R. An element $a \in R$ is *unit* of the ring R if a^{-1} exists, where $a^{-1} \in R$ is multiplicative inverse of a. A commutative ring is *quasi-local* if it has only finitely many maximal ideals.

In this paper, we denote $\Gamma_2(R) \setminus J(R)$ by $\Gamma_2^{'}(R)$ and $Max(R) = \{M_1, M_2, \ldots, M_n\}$ denotes the set of maximal ideals of R, where M_i is a maximal ideal of R. For a ring R, $U(R)$ denotes the set of units of R.

There are many exciting results proved on subgraphs of co-maximal graphs of rings in [3, 13–15, 19, 22], such as girth, diameter, and some structural properties of $\Gamma_2^{'}(R)$. Some elementary ones are listed below.

Theorem 1 *[13, 19] The following hold for co-maximal graph $\Gamma(R)$ of a commutative ring R:*

(a) Let $\Gamma_1(R)$ be a subgraph of $\Gamma(R)$ whose vertices are the units of R; then $\Gamma_1(R)$ is a complete graph.

(b) Let $\Gamma_2(R)$ be a subgraph of $\Gamma(R)$ whose vertices are the nonunit elements of R; then $a \in J(R)$ if and only if $deg_{\Gamma_2(R)} a = 0$.

(c) $\Gamma_2(R)$ is totally disconnected if and only if R is a local ring.

We extend the theory of the co-maximal graph in the realm of signed graphs. For preliminary notations and terminology for signed graphs, we refer to Zaslavsky [23–25]. A *signed graph* is an ordered pair $\Sigma = (\Sigma^u, \sigma)$, where $\Sigma^u = (V, E)$ is a graph, called the *underlying graph* of Σ and $\sigma : E \to \{+, -\}$ is a function from the edge set E of Σ^u into the set $\{+, -\}$ called the *signature* of Σ. Let $E^+(\Sigma) = \{e \in E(\Sigma^u) : \sigma(e) = +\}$ and $E^-(\Sigma) = \{e \in E(\Sigma^u) : \sigma(e) = -\}$. The elements of $E^+(\Sigma)$ and $E^-(\Sigma)$ are called *positive* and *negative* edges of Σ, respectively. A signed graph is said to be *homogeneous* if all its edges have the same sign and *heterogeneous* otherwise. The *negation* $\eta(\Sigma)$ of a signed graph Σ is a signed graph obtained from Σ by negating the sign of every edge of Σ.

One of the fundamental concepts in the theory of signed graphs is that of balance, clusterability, and $\mathcal{C}$-sign-compatibility. Harary [12] introduced the concept of balanced signed graphs for the analysis of social

networks, in which a positive edge stands for a positive relation and a negative edge represents a negative relation. A signed graph is *balanced* if every cycle has an even number of negative edges, and a signed graph that is not balanced is called an unbalanced signed graph.

The following is the well-known result given by Harary in 1956.

Theorem 2 *[12] A signed graph Σ is balanced if and only if its vertex set $V(\Sigma)$ can be partitioned into two subsets V_1 and V_2 (one of them possibly empty) such that every negative edge of Σ joins a vertex of V_1 with one of V_2 while no positive edge does so.*

Now by a *positive section* (*negative section*) [10] in a signed graph Σ, we mean a maximal edge induced weakly connected subsigned graph consisting of only positive (negative) edges of Σ that turn out to be simply a path (semipath) if Σ is a cycle (semicycle). For a signed graph Σ, Behzad and Chartrand [6] defined its *line signed graph* $L(\Sigma)$ as the signed graph in which the edges of Σ are represented as vertices. Two of these vertices are defined to be adjacent whenever the corresponding edge in Σ has a vertex in common; any such edge ef is negative whenever both e and f are negative edges in Σ and positive otherwise.

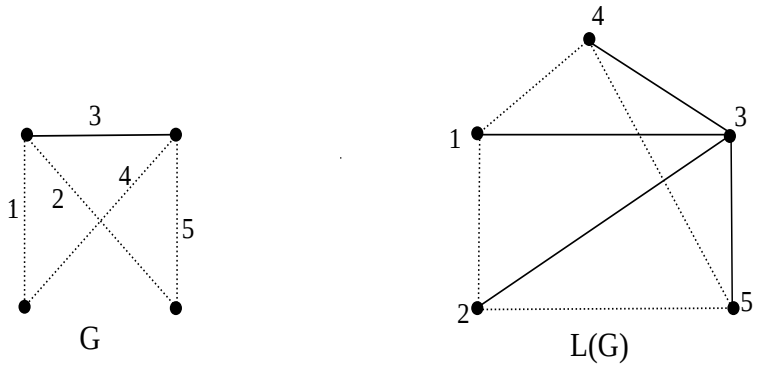

Figure 2. A signed graph G and its line signed graph $L(G)$.

We have the following result that gives the characterization of signed graphs for which their line signed graphs are balanced:

Theorem 3 *[1] For a signed graph Σ, $L(\Sigma)$ is balanced if and only if the following conditions hold:*

(i) for some cycle Z in Σ,

(a) if Z is all-negative, then Z has even length;

(b) if Z is heterogeneous, then Z has an even number of negative sections with even length;

(ii) for $v \in V(\Sigma)$, if $d(v) > 2$, then there is at most one negative edge incident at v in Σ.

A signed graph Σ is said to be *clusterable* if its vertex set can be partitioned into pairwise disjoint subsets called clusters, such that every negative edge joins vertices in different clusters and every positive edge join vertices in the same cluster. Davis in 1967 gave the characterization of clusterable signed graphs as precisely those in which no cycle has exactly one negative edge.

Theorem 4 *[7] A signed graph Σ is clusterable if and only if Σ contains no cycle with exactly one negative edge.*

A *marking* of a given signed graph Σ is a function $\mu : V(\Sigma) \to \{+, -\}$. A signed graph Σ is said to be *sign-compatible* if there exists a marking μ of its vertices such that the end vertices of every negative edge receive a '$-$' sign in μ, and no positive edge in Σ has both of its ends assigned a '$-$' sign in μ. Further, we establish the characterization of sign-compatible signed graphs.

Theorem 5 *[20] A signed graph Σ is sign-compatible if and only if its vertices can be partitioned into two subsets V_1 and V_2 (one of them possibly empty) such that the all-negative subsigned graph of Σ is precisely the subsigned graph induced by exactly one of the subsets V_1 or V_2.*

Theorem 6 *[20] A signed graph Σ is sign-compatible if and only if Σ does not contain a subsigned graph isomorphic to either of the two signed graphs, Σ_1 formed by taking the path $P_4 = (x, u, v, y)$ with both the edges xu and vy negative and the edge uv positive and Σ_2 formed by taking Σ_1 and identifying the vertices x and y.*

In a signed graph $\Sigma = (\Sigma^u, \sigma), \sigma$ induces a unique marking μ_σ defined by

$$\mu_\sigma(v) = \Pi_{e_j \in E_v} \sigma(e_j), v \in V(\Sigma),$$

which is called the *canonical marking* (or $\mathcal{C}$-marking in short) of Σ, where E_v is a set of edges e_j incident at v in Σ. A canonically marked signed graph Σ is said to be *canonically sign-compatible* (or *$\mathcal{C}$-sign-compatible* in short), if the end vertices of every negative edge receive '$-$' signs and no positive edge has both of its ends assigned '$-$' under μ_σ.

Theorem 7 *[16] A signed graph Σ is $\mathcal{C}$-sign-compatible if and only if the following conditions hold in Σ:*

(a) for every vertex $v \in V(\Sigma)$ either $d^-(v) = 0$ or $d^-(v) \equiv 1 \pmod 2$ and

(b) for every positive edge $e_k = v_i v_j$ in Σ, $d^-(v_i) = 0$ or $d^-(v_j) = 0$

2. Co-maximal meet signed graph

A co-maximal meet signed graph is defined as follows:

Definition 8 *A co-maximal meet signed graph is an ordered pair $\Gamma_\Sigma(R) = (\Gamma(R), \sigma)$, where $\Gamma(R)$ is the co-maximal graph of a commutative ring R and for an edge ab of $\Gamma_\Sigma(R)$, σ is defined as*

$$\sigma(ab) = \begin{cases} + & \text{if } a \in U(R) \text{ and } b \in U(R), \\ - & \text{otherwise.} \end{cases}$$

The co-maximal meet signed graphs $\Gamma_\Sigma(Z_2 * Z_3)$ and $\Gamma_\Sigma(Z_2(x)/\langle x^2 \rangle)$ are shown in Figure 3, in which solid line segments are positive edges and dotted line segments are negative edges.

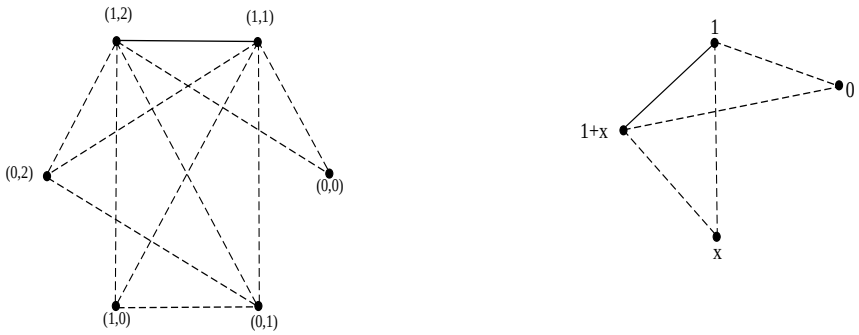

Figure 3. Showing the co-maximal meet signed graphs of $\Gamma_\Sigma(Z_2 * Z_3)$ and $\Gamma_\Sigma(Z_2(x)/\langle x^2\rangle)$.

2.1. Properties of co-maximal meet signed graph

In this section, we describe properties such as balance, clusterability, sign-compatibility, and $\mathcal{C}$-sign-compatibility of co-maximal meet signed graphs. Some of these results were presented at the "International Conference on Current Trends in Graph Theory and Computation(CTGTC-2016)" and were highly appreciated [18].

Theorem 9 *A co-maximal meet signed graph $\Gamma_\Sigma(R)$ is balanced if and only if R is a local ring.*

Proof Let R be a commutative ring with unity(say u). First, we assume that $\Gamma_\Sigma(R)$ is balanced. This implies there does not exist any negative cycle.

If R is not a local ring, then by Theorem 1, $\Gamma_2(R) \setminus J(R)$ is not totally disconnected. There are nonunits $a, b \in R$ such that $Ra + Rb = R$. Since in $\Gamma_\Sigma(R)$ there is a positive edge between two vertices if and only if both the vertices are units of R, then ab is a negative edge and a and b are connected to $u(u \in U(R))$ by a negative edge; therefore $auba$ is a negative cycle, a contradiction.

Now if R is a local ring, then it has only one maximal ideal and $\Gamma_2(R) \setminus J(R)$ is a totally disconnected graph. Therefore, in $\Gamma_\Sigma(R)$ there does not exist any edge between two nonunits. If there is some cycle present in $\Gamma_\Sigma(R)$, then it is of the form $u_l v_m u_n u_l$ (where u_i's are units and v_i's are nonunits), which always contains an even number of negative edges. Therefore, $\Gamma_\Sigma(R)$ is balanced. □

Theorem 10 *A co-maximal meet signed graph $\Gamma_\Sigma(R)$ is always clusterable.*

Proof From the construction of the co-maximal meet signed graph we know that there must be a positive edge between all pairs of units. Simultaneously there must be a negative edge between all pairs of vertices comprising one unit and one nonunit. Additionally there might be a negative edge between some two nonunits also. Now we can partition its vertices into pairwise disjoint subsets $V_1, V_2, V_3 \ldots$ such that all units can be put in one set, say V_1, and all nonunits in different sets $V_2, V_3, V_4 \ldots$. Hence $\Gamma_\Sigma(R)$ is clusterable. □

Theorem 11 *A co-maximal meet signed graph $\Gamma_\Sigma(R)$ is sign-compatible if and only if $|U(R)| = 1$.*

Proof Necessity: Let the co-maximal meet signed graph $\Gamma_\Sigma(R)$ be sign-compatible. Let $|U(R)| \geq 2$, $u_1, u_2, 0 \in R$, where u_1, u_2 are units of the ring R and 0 is zero of ring R. From the definition of the co-maximal meet signed graph, we know that $u_1 0$ and $u_2 0$ are negative edges and so we assign negative signs to all three vertices u_1, u_2, and 0. Since $u_1 u_2$ is a positive edge, at least one of the vertices u_1 or u_2 must have a positive sign, which is a contradiction.

Sufficiency is trivial. □

Corollary 12 *If R is a local ring, then $\Gamma_\Sigma(R)$ is sign-compatible if and only if R is isomorphic to Z_2.*

Theorem 13 *If $|U(R)| \geq 2$, then $\Gamma_\Sigma(R)$ is not $\mathcal{C}$-sign-compatible.*

Proof Due to condition (b) of Theorem 7. □

Theorem 14 *If R is a local ring, then $\Gamma_\Sigma(R)$ is $\mathcal{C}$-sign-compatible if and only if R is isomorphic to Z_2.*

2.2. Negation of the co-maximal meet signed graph

In this section, we describe properties such as balance, clusterability, sign-compatibility, and $\mathcal{C}$-sign-compatibility of the negation of the co-maximal meet signed graph.

Theorem 15 *Negation of the co-maximal meet signed graph $\eta(\Gamma_\Sigma(R))$ is balanced if and only if the cardinality of the set of units of ring R is one.*

Proof Necessity: Let us assume that $\eta(\Gamma_\Sigma(R))$ is balanced. In $\eta(\Gamma_\Sigma(R))$ the signs of the edges of $\Gamma_\Sigma(R)$ are changed, that is, some two units are connected with a negative edge, between some two nonunits there is a positive edge, and also there is a positive edge between some two units and nonunits.

If $|U(R)| \geq 2$, then there are two unit elements u_1 and u_2 (say). There exists nonunit $0 \in R$ such that $Ru_1 + R0 = Ru_2 + R0 = Ru_1 + Ru_2 = R$. Thus we have a cycle $u_1 0 u_2 u_1$ with one negative edge between u_1 and u_2, which is a contradiction.

Sufficiency: Now $|U(R)| = 1$ implies that the graph is all-positive. Hence $\eta(\Gamma_\Sigma(R))$ is balanced. □

Theorem 16 *Negation of the co-maximal meet signed graph $\eta(\Gamma_\Sigma(R))$ is clusterable if and only if the cardinality of the set of units of ring R is one.*

Proof Let us assume that $|U(R)| = 1$. Then the negation of the co-maximal meet signed graph $\eta(\Gamma_\Sigma(R))$ is all-positive; therefore trivially is clusterable.

Now suppose $|U(R)| \geq 2$; then there exists at least one negative edge in $\eta(\Gamma_\Sigma(R))$ between the two units u_1, u_2 (say), and also every unit is joined by a positive edge to a nonunit. Let $e_1 \in R$ be some nonunit element. Therefore, there exist positive edges $u_1 e_1$, $u_2 e_1$. Now u_1, u_2 with some nonunit element will form a cycle with exactly one negative edge, contradicting the Davis criterion of clusterability. Hence if $|U(R)| \geq 2$, then $\eta(\Gamma_\Sigma(R))$ is not clusterable. □

Example 17 *If R is isomorphic to either Z_2 or Z_2^r, then negation of the co-maximal meet signed graph $\eta(\Gamma_\Sigma(R))$ is balanced as well as clusterable.*

Theorem 18 *The negation of the co-maximal meet signed graph $\eta(\Gamma_\Sigma(R))$ is always sign-compatible.*

Proof The proof is trivial by giving a negative sign to all units and a positive sign to all nonunits. □

Theorem 19 *The negation of the co-maximal meet signed graph $\eta(\Gamma_\Sigma(R))$ is $\mathcal{C}$-sign-compatible if and only if $|U(R)| = 1$ or even.*

Proof If $|U(R)| = 1$, then the negation of the co-maximal meet signed graph is an all-positive signed graph; therefore $\mathcal{C}$-sign-compatible. If $|U(R)|$ is even, then due to Theorem 7 the signed graph is $\mathcal{C}$-sign-compatible. Next suppose $\eta(\Gamma_\Sigma(R))$ is $\mathcal{C}$-sign-compatible, but on the contrary let $|U(R)|$ be odd. Then $d^-(u_i) \equiv 0 \pmod 2$, where $u_i \in U(R)$, a contradiction due to Theorem 7. □

Example 20 *$\Gamma_\Sigma(R)$ is $\mathcal{C}$-sign-compatible if R is isomorphic to one of the following rings, $Z_n, Z_n * Z_m, Z_2[x]/\langle x^n\rangle (n = 2, 3, \dots)$ or $F = \{0, 1, 2, \dots, p-1\}$ (p is a prime), $F[x]/\langle x^n\rangle (n = 2, 3, \dots)$.*

2.3. Line signed graph of co-maximal meet signed graph

Theorem 21 *The line signed graph of the co-maximal meet signed graph $L(\Gamma_\Sigma(R))$ is balanced if and only if $R \cong Z_2$.*

Proof Necessity: Let the line signed graph $L(\Gamma_\Sigma(R))$ be balanced and the cardinality of ring R be greater than two. Then it has either $|U(R)| \geq 2$ or $|R/U(R)| \geq 2$. Now from the construction of $\Gamma_\Sigma(R)$, if $|U(R)| \geq 2$, then there exists $0 \in R$, where 0 is zero of the ring R, such that $d(0) \geq 2$, precisely $d^-(0) \geq 2$. This is a contradiction due to Theorem 3. On the other hand, if $|R/U(R)| \geq 2$, then there exists $u_i \in R$, where u_i is a unit of ring R such that $d(u_i) \geq 2$, precisely $d^-(u_i) \geq 2$, again a contradiction due to Theorem 3.

Sufficiency: If $|R| \leq 2$, then the proof is trivial since $R \cong Z_2$. □

Theorem 22 *A line signed graph of the negation of the co-maximal meet signed graph $L(\eta(\Gamma_\Sigma(R)))$ is balanced if and only if $|U(R)| \leq 2$.*

Proof Necessity: Let $L(\eta(\Gamma_\Sigma(R)))$ be balanced. On the contrary let $|U(R)| \geq 3$; then from the construction of $\eta(\Gamma_\Sigma(R))$ there exists $u_i \in R$, where u_i is a unit of ring R such that $d^-(u_i) \geq 2$, a contradiction to Theorem 3. Hence $L(\eta(\Gamma_\Sigma(R)))$ is not balanced for $|U(R)| \geq 3$.

Sufficiency: Let $|U(R)| \leq 2$ then the negation of the co-maximal meet signed graph contains at most one negative edge. Hence, its line signed graph is all-positive. This implies that $L(\eta(\Gamma_\Sigma(R)))$ is balanced. □

Corollary 23 *If R is a field, then the line signed graph of the negation of the co-maximal meet signed graph $L(\eta(\Gamma_\Sigma(R)))$ is balanced if R is isomorphic to either Z_2 or Z_3.*

Example 24 *If R is isomorphic to Z_2^r or all polynomial rings over Z_2, then the line signed graph of the negation of the co-maximal meet signed graph $L(\eta(\Gamma_\Sigma(R)))$ is balanced.*

Theorem 25 *The line signed graph of co-maximal meet signed graph $L(\Gamma_\Sigma(R))$ is clusterable if and only if $|U(R)| = 1$.*

Proof Necessity: Let $L(\Gamma_\Sigma(R))$ be clusterable. On the contrary let $|U(R)| \geq 2$. Then there exists a cycle in $\Gamma_\Sigma(R)$ of the form $u_1u_20u_1$, where $u_1, u_2 \in R$ are units of the ring and $0 \in R$ is zero of the ring. Now from the construction of the co-maximal meet signed graph, u_10, u_20 are negative edges whereas u_1u_2 is a positive edge. Clearly, in $L(\Gamma_\Sigma(R))$ there exists at least one cycle with exactly one negative edge, due to the presence of the above-mentioned cycle in $\Gamma_\Sigma(R)$, a contradiction to the Davis criterion stated in Theorem4. Hence, if $|U(R)| \geq 2$, then $L(\Gamma_\Sigma(R))$ is not clusterable.

Sufficiency: If $|U(R)| = 1$, then $\Gamma_\Sigma(R)$ is homogeneous with all-negative edges. Hence, $L(\Gamma_\Sigma(R))$ is also homogeneous with all-negative edges and therefore trivially clusterable. □

Theorem 26 *The line signed graph of the negation of the co-maximal meet signed graph $L(\eta(\Gamma_\Sigma(R)))$ is clusterable if and only if $|U(R)| \leq 2$.*

Proof For the necessity part, suppose that $L(\eta(\Gamma_\Sigma(R)))$ is clusterable. On the contrary let $|U(R)| \geq 3$; then from the construction of $\eta(\Gamma_\Sigma(R))$ we have $u_i \in R$, where u_i is a unit of the ring R such that $d^-(u_i) \geq 2$ and $d^+(u_i) \geq 1$. Let e_1, e_2 be two negative edges incident at u_i and let a_1 be a positive edge incident at u_i. Clearly, in $L(\eta(\Gamma_\Sigma(R)))$ there exists at least one triangle with exactly one negative edge, due to the presence of vertex u_i in $\eta(\Gamma_\Sigma(R))$. This is a contradiction to the Davis criterion of clusterability stated in Theorem 4.

Sufficiency is trivial since for $|U(R)| \leq 2$, $L(\eta(\Gamma_\Sigma(R)))$ is all-positive and hence clusterable. □

3. Co-maximal join signed graph

The definition of a co-maximal join signed graph is as follows:

Definition 27 *A co-maximal join signed graph is an ordered pair $\Gamma_\Sigma^\vee(R) = (\Gamma(R), \sigma)$, where $\Gamma(R)$ is the co-maximal graph of a commutative ring R and for an edge ab of $\Gamma_\Sigma^\vee(R)$, σ is defined as*

$$\sigma(ab) = \begin{cases} + & \text{if } a \in U(R) \text{ or } b \in U(R), \\ - & \text{otherwise.} \end{cases}$$

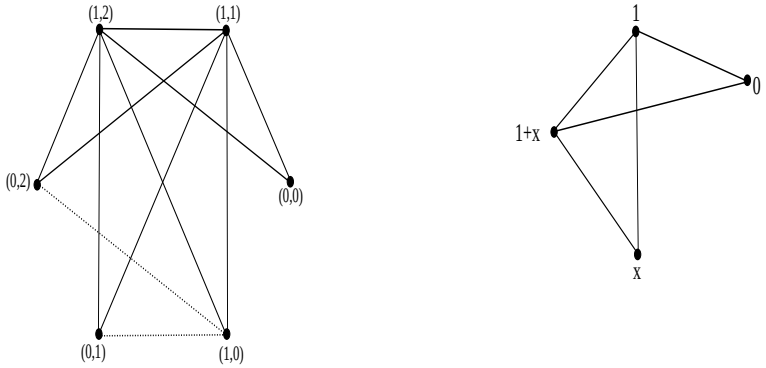

Figure 4. Showing the co-maximal join signed graphs of $\Gamma_\Sigma^\vee(Z_2 * Z_3)$ and $\Gamma_\Sigma^\vee(Z_2(x)/\langle x^2 \rangle)$.

3.1. Properties of co-maximal join signed graph

Theorem 28 *A co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is balanced if and only if R is a local ring.*

Proof First, suppose $\Gamma_\Sigma^\vee(R)$ is balanced. On the contrary let R be not a local ring. Then we have nonunits $a_1, a_2 \in R$ (say) such that $Ra_1 + Ra_2 = R$. Let u be some unit in R. Then there exists a cycle ua_1a_2u with exactly one negative edge, which is a contradiction. Now suppose R is a local ring, which implies that there does not exist some edge between nonunits. Thus $\Gamma_\Sigma^\vee(R)$ is an all-positive graph, implying that $\Gamma_\Sigma^\vee(R)$ is balanced. □

Example 29 *If R is isomorphic to either Z_{p^n} or F_q, where F_q is a field of cardinality q, then the co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is balanced.*

Theorem 30 *A co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is clusterable if and only if R is a local ring.*

Proof First, suppose $\Gamma_\Sigma^\vee(R)$ is clusterable. On the contrary let R be not a local ring. Then we have nonunits $a_1, a_2 \in R$ (say) such that $Ra_1 + Ra_2 = R$. For some unit u in R, there exists a cycle ua_1a_2u with exactly one negative edge, which is a contradiction. If R is a local ring, there does not exist some edge between nonunits. $\Gamma_\Sigma^\vee(R)$ is an all-positive graph, so that we can put all vertices in one cluster. This implies that $\Gamma_\Sigma^\vee(R)$ is clusterable. □

Theorem 31 *If R is a local ring, then the co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is $\mathcal{C}$-sign-compatible.*

Proof The proof is trivial. □

Corollary 32 *If R is a field, then the co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is $\mathcal{C}$-sign-compatible.*

Example 33 *If $R \cong Z_2 \times Z_2$, then the co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is $\mathcal{C}$-sign-compatible.*

Theorem 34 *A co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is always sign-compatible.*

Proof The proof is trivial if we give marking to the vertices according to the rule given below: If R is a local ring, then $\Gamma_\Sigma^\vee(R)$ is all-positive, and we can assign positive signs to every vertex. However, if R is not a local ring, then we can assign positive signs to all units and negative signs to all nonunits. □

3.2. Negation of co-maximal join signed graph $\eta(\Gamma_\Sigma^\vee(R))$

In this section, we describe properties such as balance, clusterability, sign-compatibility, and $\mathcal{C}$-sign-compatibility of the negation of the co-maximal join signed graph.

Theorem 35 *Negation of the co-maximal join signed graph $\eta(\Gamma_\Sigma^\vee(R))$ is balanced if and only if $|U(R)| = 1$.*

Proof Necessity: First, suppose the negation of the co-maximal join signed graph $\eta(\Gamma_\Sigma^\vee(R))$ is balanced. On the contrary let $|U(R)| \geq 2$. Let $u_1, u_2 \in R$ be units of the ring and $0 \in R$ be zero of the ring. Since $Ru_1 + R0 = Ru_2 + R0 = Ru_1 + Ru_2 = R$, therefore there exist edges between $0, u_1$, and u_2, and all are negative. This implies that there exists at least one negative cycle of length three $0u_1u_20$, which is a contradiction.

For sufficiency, let $|U(R)| = 1$. Now we will show that negation of the co-maximal join signed graph $\eta(\Gamma_\Sigma^\vee(R))$ is balanced. If R is a local ring, then there is no cycle by construction, but if R is not a local ring, then there must exist at least one cycle. All cycles are of the form ua_la_mu, where u is a unit of R and a_i's are nonunits of ring R containing an even number of negative edges. Hence $\eta(\Gamma_\Sigma^\vee(R))$ is balanced. □

Corollary 36 *For a local ring, $\eta(\Gamma_\Sigma^\vee(R))$ is balanced if and only if $R \cong Z_2$.*

Theorem 37 *Negation of the co-maximal join signed graph $\eta(\Gamma_\Sigma^\vee(R))$ is always clusterable.*

Proof The proof is trivial. □

Theorem 38 *Negation of the co-maximal join signed graph* $\eta(\Gamma_{\Sigma}^{\vee}(R))$ *is sign-compatible if and only if* R *is a local ring.*

Proof Necessity: Let the negation of the co-maximal join signed graph $\eta(\Gamma_{\Sigma}^{\vee}(R))$ be sign-compatible. On the contrary let R be not a local ring. Then we have at least two nonunits $a_1, a_2 \in R$(say) such that $Ra_1 + Ra_2 = R = Ru + Ra_1 = Ru + Ra_2$, where $u \in R$ is a unit of R. ua_1, ua_2 being negative edges, we assign negative marks to all three vertices u, a_1, and a_2. However, a_1a_2 is a positive edge and for a graph to be sign-compatible at least one of a_1 or a_2 must be assigned a positive mark, which is a contradiction.

Sufficiency is trivial, if we assign markings to the vertices according to the rule given below: If R is a local ring, then the negation of the co-maximal join signed graph $\eta(\Gamma_{\Sigma}^{\vee}(R))$ is all-negative and hence sign-compatible. □

Theorem 39 *Negation of co-maximal join signed graph* $\eta(\Gamma_{\Sigma}^{\vee}(R))$ *is* $\mathcal{C}$*-sign-compatible if and only if* R *is a local ring such that* $|U(R)|$ *is odd and* $|R|$ *is even.*

Proof Necessity: Let $\eta(\Gamma_{\Sigma}^{\vee}(R))$ be $\mathcal{C}$-sign-compatible. Then suppose that R is not a local ring. We then have an edge(positive) ab(say) between two nonunit elements $a, b \in R$. Moreover, a and b are connected to $u \in R$, where u is a unit of the ring by negative edges. This is contrary to our assumption, due to Theorem 7. Next, let R be a local ring with $|U(R)|$ being even. Now, since all nonunit elements of the ring are joined to all unit elements of the ring by a negative edge, this implies that $d^-(a_i) = |U(R)|$, where $a_i \in R$ is some nonunit element of R. This is a contradiction to condition (a) of Theorem 7.

Sufficiency: Let R be a local ring where $|U(R)|$ is odd and $|R|$ is even. Therefore, graph $\eta(\Gamma_{\Sigma}^{\vee}(R))$ is all-negative. Since the unit elements of the ring are connected to all elements of the ring, $d^-(u_i) = |R| - 1$ (odd) and all nonunit elements of the ring are joined to all the unit elements of the ring by a negative edge. This implies that $d^-(a_i) = |U(R)|$ (odd). Therefore, according to Theorem 7 we can say that $\eta(\Gamma_{\Sigma}^{\vee}(R))$ is $\mathcal{C}$-sign-compatible. □

Example 40 *If* R *is isomorphic to the rings,* Z_{p^n}, F*, where* F *is a field, then the negation of the co-maximal join signed graph* $\eta(\Gamma_{\Sigma}^{\vee}(R))$ *is sign-compatible.*

Example 41 *If* R *is isomorphic to* Z_2^r *or* Z_2*, then the negation of the co-maximal join signed graph* $\eta(\Gamma_{\Sigma}^{\vee}(R))$ *is* $\mathcal{C}$*-sign-compatible.*

Example 42 *If* R *is isomorphic to one of the following rings,* $Z_n(n \neq 2)$, Z_{p^n}*, where* p *is prime,* $Z_m * Z_n(m, n \neq 2), Z_2[x]/\langle x^2\rangle, Z_3[x]$*, then* $\eta(\Gamma_{\Sigma}^{\vee}(R))$ *is not* $\mathcal{C}$*-sign-compatible.*

3.3. Line signed graph of co-maximal join signed graph

Theorem 43 *If* R *is a local ring, then the line signed graph of the co-maximal join signed graph* $L(\Gamma_{\Sigma}^{\vee}(R))$ *is balanced.*

Proof If R is a local ring, then the co-maximal join signed graph $\Gamma_{\Sigma}^{\vee}(R)$ is all-positive and hence its line signed graph is also all-positive. This implies that the line signed graph of the co-maximal join signed graph $L(\Gamma_{\Sigma}^{\vee}(R))$ is balanced. □

Example 44 *If R is isomorphic to the rings, $Z_2 * Z_2, Z_{p^n}, F$, where F is a field, then the line signed graph of the co-maximal join signed graph $L(\Gamma_{\Sigma}^{\vee}(R))$ is balanced.*

Example 45 *If R is isomorphic to $\frac{Z_2[x]}{\langle x^3 \rangle}, Z_n * Z_m (n, m \neq 2)$, $Z_n (n \neq 2, 3, 4$ and prime$)$, then the line signed graph of the co-maximal join signed graph $L(\Gamma_{\Sigma}^{\vee}(R))$ is not balanced.*

Theorem 46 *The line signed graph of the negation of the co-maximal join signed graph $L(\eta(\Gamma_{\Sigma}^{\vee}(R)))$ is balanced if and only if $R \cong Z_2$.*

Proof Necessity: If $L(\eta(\Gamma_{\Sigma}^{\vee}(R)))$ is balanced, then our claim is that $R \cong Z_2$.

To achieve our claim, we examine the structure of $\eta(\Gamma_{\Sigma}^{\vee}(R))$, which depends upon the following two cases:

(1) when R is isomorphic to a nonlocal ring.

(2) when R is isomorphic to a local ring.

Case 1: If R is isomorphic to a nonlocal ring, then there will be at least two maximal ideals, say M_1, M_2 of R. Let $a_1 \in M_1$ and $a_2 \in M_2$, where a_1, a_2 are nonunit elements of the ring R and $u \in R$ is a unit element of the ring. Then, from the construction of $\eta(\Gamma_{\Sigma}^{\vee}(R))$ $a_1 a_2$ is a positive edge whereas ua_1 and ua_2 are negative edges. This implies that $d^-(u) \geq 2$, which is contrary to our assumption due to Theorem 3.

Case 2: If R is isomorphic to a local ring. Claim: $R \cong Z_2$; we shall prove the claim by the contradiction. If $|R| \geq 3$, then there are two possibilities:

(a) $|U(R)| \geq 2$.

If $|U(R)| \geq 2$, then $d^-(0) \geq 2$, where $0 \in R$ is zero of the ring. This is a contradiction due to Theorem 3

(b) $|U(R)| = 1$. If $|U(R)| = 1$, then from the construction of $\eta(\Gamma_{\Sigma}^{\vee}(R))$ $d^-(u) \geq 2$, where $u \in R$ is a unit of the ring. This is again a contradiction due to Theorem 3

Sufficiency is trivial. □

Theorem 47 *If R is a local ring, then the line signed graph of the co-maximal join signed graph $L(\Gamma_{\Sigma}^{\vee}(R))$ is clusterable.*

Proof The proof is trivial. □

Example 48 *If R is isomorphic to $Z_2 * Z_2$, then $L(\Gamma_{\Sigma}^{\vee}(R))$ is clusterable.*

Example 49 *If R is isomorphic to $Z_m * Z_n (n, m \neq 2)$, then $L(\Gamma_{\Sigma}^{\vee}(R))$ is not clusterable.*

Theorem 50 *The line signed graph of the negation of the co-maximal join signed graph* $L(\eta(\Gamma_\Sigma^\vee(R)))$ *is clusterable if and only if* R *is a local ring.*

Proof Necessity: Let $L(\eta(\Gamma_\Sigma^\vee(R)))$ be clusterable. On the contrary let R be not a local ring. Then in $\eta(\Gamma_\Sigma^\vee(R))$, one can easily determine a cycle of length three, viz., ua_1a_2u with one positive and two negative edges. Therefore, in $L(\eta(\Gamma_\Sigma^\vee(R)))$ there will be a cycle with exactly one negative edge, which is contrary to the Davis criterion of clusterability [Theorem 4].

Sufficiency is trivial, if R is a local ring, then $\eta(\Gamma_\Sigma^\vee(R))$ is an all-negative graph. Hence, $L(\eta(\Gamma_\Sigma^\vee(R)))$ will also be an all-negative graph and therefore clusterable. □

4. Co-maximal ring sum signed graph

Definition 51 *A co-maximal ring sum signed graph is an ordered pair* $\Gamma_\Sigma^\oplus(R) = (\Gamma(R), \sigma)$, *where* $\Gamma(R)$ *is the co-maximal graph of a commutative ring* R *and for an edge* (ab) *of* $\Gamma_\Sigma(R)^\oplus$, σ *is defined as*

$$\sigma(ab) = \begin{cases} + & \text{either } a \in U(R) \text{ or } b \in U(R), \\ - & \text{otherwise.} \end{cases}$$

The co-maximal ring sum signed graphs $\Gamma_\Sigma^\oplus(Z_2 * Z_3)$ and $\Gamma_\Sigma^\oplus(Z_2(x)/\langle x^2\rangle)$ are shown in Figure 3, in which solid line segments are positive edges and dotted line segments are negative edges.

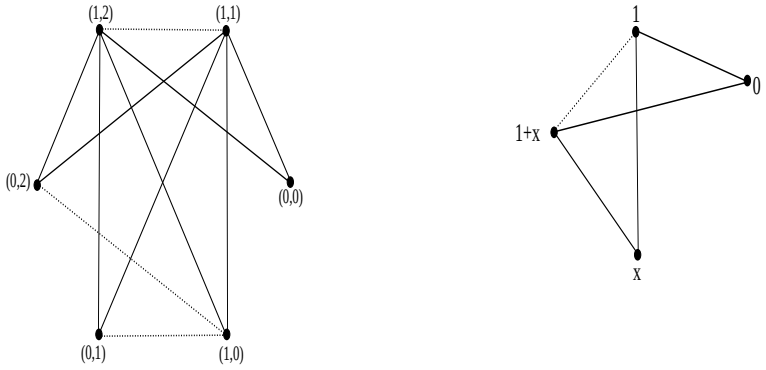

Figure 5. Showing the co-maximal ring sum signed graphs of $\Gamma(Z_2 * Z_3)$ and $\Gamma(Z_2(x)/\langle x^2\rangle)$.

4.1. Properties of co-maximal ring sum signed graphs

Theorem 52 *The co-maximal ring sum signed graph* $\Gamma_\Sigma^\oplus(R)$ *is balanced if and only if* R *is isomorphic to* Z_2.

Proof Necessity: Let the co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ be balanced. If we suppose that R is not a local ring, then there will be at least two maximal ideals, say m_1, m_2. Let $a_1 \in m_1, a_2 \in m_2$ be nonunit elements of the ring R and $u \in R$ be a unit of the ring. From the definition of a co-maximal ring sum signed graph, one can easily determine the presence of a cycle ua_1a_2u with exactly one negative edge a_1a_2, which is a contradiction to our assumption that $\Gamma_\Sigma^\oplus(R)$ is balanced. Next, if $|U(R)| \geq 2$ and R is a local ring, then there exists a cycle $u_1 0 u_2 u_1$, where $u_1, u_2 \in R$ are units of R and $0 \in R$ is zero of ring R. From the definition of

a co-maximal ring sum signed graph, $u_1 0$ and $u_2 0$ are positive edges and $u_1 u_2$ is a negative edge. Therefore, cycle $u_1 0 u_2 u_1$ has exactly one negative edge, which is a contradiction.

Sufficiency: If R is isomorphic to Z_2, then the co-maximal ring sum signed graph is all-positive and hence $\Gamma_\Sigma^\oplus(R)$ is balanced. □

Theorem 53 *Co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ is clusterable if and only if R is isomorphic to Z_2.*

Proof Necessity: Let the co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ be clusterable. From the proof of Theorem 52, one can easily determine that if R is not a local ring or R is a local ring with $|U(R)| \geq 2$, then there exists a cycle with exactly one negative edge, which is a contradiction to the Davis criterion of clusterability [Theorem 4].

Sufficiency: If R is isomorphic to Z_2, then the co-maximal ring sum signed graph is all-positive and hence $\Gamma_\Sigma^\oplus(R)$ is clusterable. □

Theorem 54 *Co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ is sign-compatible if and only if $|U(R)| = 1$ or R is a local ring.*

Proof Necessity: Let the co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ be sign-compatible. Let $|U(R)| \geq 2$, R be not a local ring, and $u_1, u_2, a_1, a_2 \in R$, where u_1, u_2 are units of R and a_1, a_2 are nonunits of R. Also $Ru_1 + Ru_2 = Ru_1 + Ra_1 = Ru_2 + Ra_2 = Ra_1 + Ra_2 = R$ implies that $a_1 a_2$, $u_1 u_2$ are negative edges. For $\Gamma_\Sigma^\oplus(R)$ to be sign-compatible end vertices $a_1, a_2; u_1, u_2$ must be assigned negative marking. However, $u_1 a_1$, $u_2 a_2$ are positive edges and therefore at least one of u_1 or a_1 and u_2 or a_2 must have positive marking, which is a contradiction.

Sufficiency is trivial. If R is a local ring, then on marking all units '$-$' and all nonunits '$+$', $\Gamma_\Sigma^\oplus(R)$ becomes sign-compatible. However, if R is not a local ring and $|U(R)| = 1$, then marking all nonunits '$-$' and all units '$+$', we get sign-compatible graph $\Gamma_\Sigma^\oplus(R)$. □

Example 55 *If R is isomorphic to either Z_2^r, then the co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ is sign-compatible.*

Theorem 56 *If R is a local ring, then the co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ is $\mathcal{C}$-sign-compatible if and only if $|U(R)| = 1$ or $|U(R)|$ is even.*

Proof Necessity: Let $\Gamma_\Sigma^\oplus(R)$ be $\mathcal{C}$-sign-compatible. If $|U(R)| \neq 1$ is odd, then $d^-(v) \neq 0$ and $d^-(v) \equiv 0 \pmod 2$, and, according to Theorem 7, $\Gamma_\Sigma^\oplus(R)$ is not $\mathcal{C}$-sign-compatible.

Sufficiency: If $|U(R)| = 1$ or $|U(R)|$ is even and R is a local ring, then either $d^-(v) = 0$ or $d^-(v) \equiv 1 \pmod 2$ and $d^-(v_i) = 0$, where $v_i \in R$ is a nonunit of ring R. Hence, as per Theorem 7, $\Gamma_\Sigma^\oplus(R)$ is $\mathcal{C}$-sign-compatible. □

Example 57 *$\Gamma_\Sigma^\oplus(R)$ is $\mathcal{C}$-sign-compatible if R is isomorphic to one of the following rings, $F = \{0, 1\}$ and $F[x]/\langle x^n \rangle (n = 2, 3, \dots)$, $F_1 = \{0, 1, \dots, p-1\}$ (p is prime) and $F_1[x]/\langle x^n \rangle (n = 2, 3, \dots)$.*

Corollary 58 *If $R \cong F_{p^n}$, where F_{p^n} is a field of cardinality p^n, then the co-maximal ring sum signed graph $\Gamma_{\Sigma}^{\oplus}(R)$ is $\mathcal{C}$-sign-compatible if and only if $p \neq 2$ and $n \geq 1$.*

Example 59 *If R is isomorphic to Z_{p^n}, where p is prime, then the co-maximal ring sum signed graph $\Gamma_{\Sigma}^{\oplus}(R)$ is $\mathcal{C}$-sign-compatible.*

Theorem 60 *In the co-maximal ring sum signed graph $\Gamma_{\Sigma}^{\oplus}(R)$ if $|U(R)| \geq 2$ and R is not a local ring, then the graph is not $\mathcal{C}$-sign-compatible.*

Proof Proof is trivial, from construction of $\Gamma_{\Sigma}^{\oplus}(R)$ and Theorem 7. □

Example 61 *If R is isomorphic to Z_{p^r}, then the co-maximal ring sum signed graph $\Gamma_{\Sigma}^{\oplus}(R)$ graph is $\mathcal{C}$-sign-compatible.*

4.2. Negation of co-maximal ring sum signed graph

Theorem 62 *Negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ is always balanced.*

Proof Proof is trivial from the construction of $\eta(\Gamma_{\Sigma}^{\oplus}(R))$. We can see that if there are some cycles, then they must contain an even number of negative edges. Hence $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ is balanced. □

Theorem 63 *Negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ is always clusterable.*

Proof Negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ is clusterable, if all the units are put in set V_1 and all the nonunits in V_2. □

Theorem 64 *Negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ is sign-compatible if and only if $R \cong Z_2$.*

Proof Necessity: Let the negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ be sign-compatible. Suppose that $|U(R)| \geq 2$. If $u_1, u_2 \in R$ are units of the ring R and $0 \in R$ is zero of ring R such that $u_1 0, u_2 0$ edges are negative, the end vertices u_1, u_2 and 0 will be marked '$-$'. However, $u_1 u_2$ edge is positive and for a signed graph to be sign-compatible at least one of the vertices u_1 and u_2 must be assigned marking '$+$', which is a contradiction. Again let R be not a local ring and $|U(R)| = 1$. Assume that $a_1, a_2 \in R$ are nonunits of the ring R and $u \in R$ is a unit of ring R such that $a_1 u, a_2 u$ edges are negative. Assigning the mark '$-$' to the vertices a_1, a_2 and u, $a_1 a_2$ being positive edges at least one of the vertices a_1 and a_2 should be marked by '$+$', which is a contradiction.

Sufficiency is trivial; all the vertices are marked '$-$'. □

Theorem 65 *Negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ is $\mathcal{C}$-sign-compatible if and only if $R \cong Z_2$.*

Proof Necessity: Let the negation of the co-maximal ring sum signed graph $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ be $\mathcal{C}$-sign-compatible. Suppose $|U(R)| \geq 2$. Then $u_1 u_2$ being a positive edge, the condition for $\eta(\Gamma_{\Sigma}^{\oplus}(R))$ to be $\mathcal{C}$-sign-compatible

is that at least one of the units u_1 or u_2 must have a marking of '+' but $u_1 0$ and $u_2 0$ both being negative edges, mark of u_1, u_2 and 0 must be '$-$', a contradiction.

If $|U(R)| = 1$ and R is not a local ring, then there will be nonunits $a_1, a_2 \in R$ and unit $u \in R$ such that $Ra_1 + Ra_2 = Ru + Ra_1 = Ru + Ra_2 = R$, where $a_1 a_2$ is a positive edge and ua_1, ua_2 are negative edges. Due to Theorem 7, $d^-(a_1) = 0$ or $d^-(a_2) = 0$, this is again a contradiction.

Sufficiency is trivial. □

4.3. Line signed graph of co-maximal ring sum signed graph

Theorem 66 *If $|U(R)| \geq 3$, then the line signed graph of the co-maximal ring sum signed graph is not balanced.*

Proof Suppose that $|U(R)| \geq 3$; then in the co-maximal ring sum signed graph $d^-(u_i) \geq 2$ and $d(u_i) > 2$, where $u_i \in R$ is a unit of the ring. Then, according to Theorem 3, the line signed graph of the co-maximal ring sum signed graph is not balanced. □

Theorem 67 *If R is a local ring, then $L(\Gamma_\Sigma^\oplus(R))$ is balanced if and only if $|U(R)| \leq 2$.*

Proof Suppose that $L(\Gamma_\Sigma^\oplus(R))$ is balanced. On the contrary let $|U(R)| \geq 3$, which will be a contradiction to our assumption as per Theorem 66.

Next, let $|U(R)| \leq 2$ then in $\Gamma_\Sigma^\oplus(R)$ there will exist at most one negative edge. Hence, its line signed graph is all-positive and therefore $L(\Gamma_\Sigma^\oplus(R))$ is balanced. □

Example 68 *If R is isomorphic to one of the following rings: $Z_2, Z_3, Z_4, Z_2 * Z_2, \frac{Z_2[x]}{\langle x^2 \rangle}$, then the line signed graph of the co-maximal ring sum signed graph is balanced.*

Theorem 69 *The line signed graph of the negation of the co-maximal ring sum signed graph is balanced if and only if $R \cong Z_2$.*

Proof Necessity: Let the line signed graph of the negation of the co-maximal ring sum signed graph be balanced. First, suppose that R is not a local ring. Then there exist at least two maximal ideals M_1, M_2 (say). Now, from the definition of $\eta(\Gamma_\Sigma^\oplus(R))$, one can easily conclude that $d^-(u_i) \geq 2$, where $u_i \in R$ is unit of the ring, which is a contradiction to our assumption as per Theorem 3. Next suppose R is a local ring and $|U(R)| \geq 2$. Let $0 \in R$ be zero of the ring. Then from the construction of $\eta(\Gamma_\Sigma^\oplus(R))$, $d^-(0) \geq 2$, which is again a contradiction as per Theorem 3. Hence, the line signed graph of the negation of the co-maximal ring sum signed graph is not balanced.

Sufficiency is trivial. □

Theorem 70 *If $|U(R)| \geq 3$, then the line signed graph of the co-maximal ring sum signed graph is not clusterable.*

Proof Let $|U(R)| \geq 3$. Now from the construction of the co-maximal ring sum signed graph there will exist a unit, say $u \in R$, such that $d^-(u) \geq 2$ and $d^+(u) \geq 1$. Therefore, in its line signed graph there must exist a cycle of length three with exactly one negative edge, which is a contradiction as per the Davis criterion. □

Theorem 71 *If R is a local ring, then the line signed graph of the co-maximal ring sum signed graph is clusterable if and only if $|U(R)| \leq 2$.*

Proof First suppose that the line signed graph of the co-maximal ring sum signed graph is clusterable. If $|U(R)| \geq 3$, then as per Theorem 70 we get a contradiction to our assumption.

Next suppose that $|U(R)| \leq 2$ and R is a local ring. From the definition of a co-maximal ring sum signed graph one can easily conclude that there exists at most one negative edge in $\Gamma_{\Sigma}^{\oplus}(R)$. Therefore, its line signed graph $L(\Gamma_{\Sigma}^{\oplus}(R))$ is all-positive and hence clusterable. □

Theorem 72 *The line signed graph of the negation of the co-maximal ring sum signed graph $L(\eta(\Gamma_{\Sigma}^{\oplus}(R)))$ is clusterable if and only if $R \cong Z_2$.*

Proof Necessity: Let the line signed graph $L(\eta(\Gamma_{\Sigma}^{\oplus}(R)))$ be clusterable. First suppose that R is not a local ring. Now, from the definition of the negation of the co-maximal ring sum signed graph, one can easily conclude that there exists a cycle of length three with exactly one positive edge and two negative edges. Therefore, in its line signed graph this cycle maps onto a cycle of length three with exactly one negative edge, which is contrary to the Davis criterion, as per Theorem 4. Next suppose that R is a local ring with $|U(R)| \geq 2$. Then there will exist a cycle $u_1u_2au_1$ with two negative and one positive edges(where $u_1, u_2 \in R$ are units of the ring and $a \in R$ is a nonunit of the ring). Therefore, in its line signed graph $L(\eta(\Gamma_{\Sigma}^{\oplus}(R)))$ this cycle maps onto a cycle with exactly one negative edge, again in contradiction to the Davis criterion, Theorem 4.

Sufficiency is trivial. □

5. Isomorphism of co-maximal signed graphs

Theorem 73 *For a co-maximal graph $\Gamma(R)$, the co-maximal join signed graph and the co-maximal ring sum signed graph are isomorphic if and only if $|U(R)| = 1$.*

Proof Necessity: Suppose $\Gamma_{\Sigma}^{\vee}(R) \cong \Gamma_{\Sigma}^{\oplus}(R)$. If possible, let $|U(R)| \geq 2$. Now, for some two vertices i and j in the co-maximal graph, there are the following three possibilities:

(1) $i \in U(R)$ and $j \in U(R)$ or

(2) $i \notin U(R)$ and $j \notin U(R)$ or

(3) $i \in U(R)$ and $j \notin U(R)$ or vice versa.

In condition (1) ij is a positive edge in $\Gamma_{\Sigma}^{\vee}(R)$, while in $\Gamma_{\Sigma}^{\oplus}(R)$ ij is a negative edge. In condition (2) ij is a negative edge in both $\Gamma_{\Sigma}^{\vee}(R)$ and $\Gamma_{\Sigma}^{\oplus}(R)$. Similarly, in condition (3) ij is a positive edge in both $\Gamma_{\Sigma}^{\vee}(R)$ and $\Gamma_{\Sigma}^{\oplus}(R)$. Since i and j are arbitrary vertices in a co-maximal graph, this is true for all the vertices. Thus, the number of negative edges in $\Gamma_{\Sigma}^{\oplus}(R) > \Gamma_{\Sigma}^{\vee}(R)$, which is a contradiction to the hypothesis.

Sufficiency: Suppose $|U(R)| = 1$. It is clear that the underlying structures of $\Gamma_{\Sigma}^{\oplus}(R)$ and $\Gamma_{\Sigma}^{\vee}(R)$ are the same. Suppose ij is a negative edge in $\Gamma_{\Sigma}^{\vee}(R)$; then according to the definition of $\Gamma_{\Sigma}^{\vee}(R)$, $i \notin U(R)$ and $j \notin U(R)$. Now, as per the definition of $\Gamma_{\Sigma}^{\oplus}(R)$, ij is a negative edge in $\Gamma_{\Sigma}^{\oplus}(R)$ also. Now suppose ij is a positive edge in $\Gamma_{\Sigma}^{\vee}(R)$. Then we have the following possibilities:

(i) $i \in U(R)$ and $j \in U(R)$ or

(ii) $i \in U(R)$ and $j \notin U(R)$ or vice versa.

Since $|U(R)| = 1$, condition (i) is not possible. Then the only possibilities are $i \in U(R)$ and $j \notin U(R)$ or vice versa. As per the definition of $\Gamma_\Sigma^\vee(R)$, ij is a positive edge in $\Gamma_\Sigma^\oplus(R)$ also. Therefore, $\Gamma_\Sigma^\oplus(R) \cong \Gamma_\Sigma^\vee(R)$. Hence the Theorem holds. □

Theorem 74 *For a co-maximal graph $\Gamma(R)$, the co-maximal meet signed graph and the co-maximal join signed graph are never isomorphic.*

Proof Given the co-maximal graph, there are two possibilities, i.e. either $|U(R)| = 1$ or $|U(R)| \geq 2$.

Case I: Suppose $|U(R)| = 1$. From the construction, the co-maximal meet signed graph $\Gamma_\Sigma(R)$ is all-negative, while the co-maximal join signed graph $\Gamma_\Sigma^\vee(R)$ is not an all-negative signed graph. Thus the number of negative edges in $\Gamma_\Sigma(R) > \Gamma_\Sigma^\vee(R)$. Thus, $\Gamma_\Sigma(R)$ is not isomorphic to $\Gamma_\Sigma^\vee(R)$, when $|U(R)| = 1$.

Case II: Suppose $|U(R)| \geq 2$. Now, for some two vertices i and j in a co-maximal graph, we have the following three possibilities:

(i) $i \in U(R)$ and $j \in U(R)$ or

(ii) $i \notin U(R)$ and $j \notin U(R)$ or

(iii) $i \in U(R)$ and $j \notin U(R)$ or vice versa.

In condition (i) ij is a positive edge in both $\Gamma_\Sigma(R)$ and $\Gamma_\Sigma^\vee(R)$. In condition (ii) ij is a negative edge in both $\Gamma_\Sigma(R)$ and $\Gamma_\Sigma^\vee(R)$. In condition (iii) ij is a positive edge in $\Gamma_\Sigma^\vee(R)$ but in $\Gamma_\Sigma(R)$ ij is a negative edge. Since i and j are arbitrary vertices in a co-maximal graph, this is true for all the vertices of a co-maximal graph. Thus, the number of negative edges in $\Gamma_\Sigma(R) > \Gamma_\Sigma^\vee(R)$. Hence, $\Gamma_\Sigma(R)$ is not isomorphic to $\Gamma_\Sigma^\vee(R)$, when $|U(R)| \geq 2$. Hence the Theorem holds. □

Theorem 75 *For a co-maximal graph $\Gamma(R)$, the co-maximal meet signed graph and the co-maximal ring sum signed graph are never isomorphic.*

Proof Given the co-maximal graph, there are two possibilities i.e. either $|U(R)| = 1$ or $|U(R)| \geq 2$.

Case I: Suppose $|U(R)| = 1$. Now, from the construction, the co-maximal meet signed graph $\Gamma_\Sigma(R)$ is all-negative, while the co-maximal ring sum signed graph $\Gamma_\Sigma^\oplus(R)$ is not an all-negative signed graph. Therefore, the number of negative edges in $\Gamma_\Sigma(R) > \Gamma_\Sigma^\oplus(R)$. Thus, $\Gamma_\Sigma(R)$ is not isomorphic to $\Gamma_\Sigma^\oplus(R)$, when $|U(R)| = 1$.

Case II: Suppose $|U(R)| \geq 2$. Now, for some two vertices i and j in a co-maximal graph, there are the following three possibilities:

(i) $i \in U(R)$ and $j \in U(R)$ or

(ii) $i \notin U(R)$ and $j \notin U(R)$ or

(iii) $i \in U(R)$ and $j \notin U(R)$ or vice versa.

In condition (i) ij is a positive edge in $\Gamma_\Sigma(R)$ but in $\Gamma_\Sigma^\oplus(R)$ ij is a negative edge. In condition (ii) ij is a negative edge in both $\Gamma_\Sigma(R)$ and $\Gamma_\Sigma^\vee(R)$. In condition (iii) ij is a positive edge in $\Gamma_\Sigma^\oplus(R)$ but in $\Gamma_\Sigma(R)$ ij is a negative edge. Since i and j are arbitrary vertices in a co-maximal graph, this is true for all the vertices of a co-maximal graph. Thus, the number of negative edges in $\Gamma_\Sigma(R) > \Gamma_\Sigma^\oplus(R)$. Hence, $\Gamma_\Sigma(R)$ is not isomorphic to $\Gamma_\Sigma^\oplus(R)$, when $|U(R)| \geq 2$. Hence the Theorem holds. □

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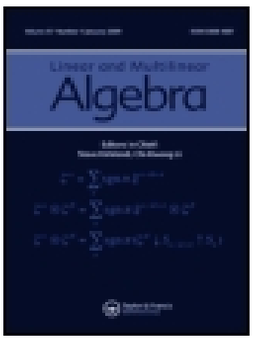

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Spectral analysis of *t*-path signed graphs

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ABSTRACT

Formally, a *signed graph* S is a pair (G,σ) that consists of a graph $G=(V,E)$ and a sign mapping called signature σ from E to the sign group $\{+,-\}$. Given a signed graph S and a positive integer t, the *t-path signed graph* $(S)_t$ of S is a signed graph whose vertex set is $V(S)$ and two vertices are adjacent if and only if there exists a path of length t between these vertices and then by defining its sign $s_t(e)$ to be '-' if and only if in every such path of length t in S all the edges are negative. The *negation* $\eta(S)$ of a signed graph S is a signed graph obtained from S by reversing the sign of every edge of S. Two signed graphs S_1 and S_2 on the same underlying graph are *switching equivalent* if it is possible to assign signs '+' ('plus') or '−' ('minus') to the vertices of S_1 such that by reversing the sign of each of its edges that have received opposite signs at its ends, one obtains S_2. In this paper, we characterize signed graphs whose negations are switching equivalent to their t-path signed graphs for $t=2$ and also characterize signed graphs such that the spectrum of their t-path signed graphs, where $t=1$, and 2, is symmetric about the origin.

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1. Introduction

Many graph-theoretic data mining problems can be solved by spectral methods. Spectral graph theory is the study of graphs using methods of linear algebra [4]. One such a way is to represent the edge set of a graph by an adjacency matrix whose eigenvectors and eigenvalues can be used for further analysis.

For the preliminary notation and terminology in graph theory, we refer Harary [1] and West [2], and for signed graphs, we refer Zaslavsky [3,4]. Graphs considered in this paper are simple and finite.

Formally, a signed graph is an ordered pair $S=(S^u,\sigma)$, where $S^u=(V,E)$ is a graph called the *underlying graph* of S and $\sigma: E\to\{+,-\}$ is a function from the edge set E of S^u into the set $\{+,-\}$ called the *signature* (or *sign* in short) of S. An *independent positive* (*negative*) edge of S is a positive (negative) edge of S such that there is no positive (negative) edge incident at each end of this edge. The *positive* (*negative*) *degree* of a vertex $v\in V(S)$ denoted by $d^+(v)(d^-(v))$ is the number of positive (negative) edges incident to the vertex v. A signed graph is *all-positive* (respectively, *all-negative*) if all its edges are positive (negative); further, it is said to be *homogeneous* if it is either all-positive

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or all-negative and *heterogeneous* otherwise. A graph (signed graph) is said to be *totally disconnected* if there is no edge in the graph (signed graph), *i.e*. it is a null graph (signed graph).

Let S be a signed graph on n vertices. Then, the adjacency matrix $A = [A_{ij}]$ of order $n \times n$ associated with S is defined by

$$A_{i,j} = \begin{cases} 0 & \text{if the vertices i, j are not connected} \\ 1 & \text{if there is positive edge between the vertices i, j} \\ -1 & \text{if there is negative edge between the vertices i, j} \end{cases}$$

where, $1 \leq i, j \leq n$ [5]. The degree of a vertex i in a signed graph S is defined as $d_i = \Sigma_j |A_{i,j}|$. Ample research has been done in the area of spectra of signed graphs [6]. The *characteristic polynomial* of a square matrix A of order n is a polynomial defined by $det(A - \lambda I)$ where I denotes the $n \times n$ identity matrix. We use $\phi(A)$ as a notation for the characteristic polynomial of A. Eigenvalues of a matrix A are roots of the characteristic polynomial. The *spectrum* of a signed graph S is the set of eigenvalues of its adjacency matrix along with their multiplicities. For a signed graph S with n vertices having distinct eigenvalues $x_1, x_2, \ldots, x_k$ with multiplicities $m_1, m_2, \ldots, m_k$, we write the spectrum of S as $spec(S) = \{x_1^{m_1}, x_2^{m_2}, \ldots, x_k^{m_k}\}$. Two signed graph S_1 and S_2 are said to be *co-spectral* if and only if $spec(S_1) = spec(S_2)$.

A *signed clique* in signed graph S is an induced subgraph which is a signed complete graph. A clique is said to be negative if every edge of the clique is negative. Similarly, if every edge of the clique is positive, then it is called positive clique. A *block* in a signed graph is a maximal subgraph which has no cut-vertex. If each block of S is a complete graph, then S is called block graph.

The *negation* of a signed graph S is a signed graph obtained from S by reversing the sign of every edge of S. $\langle V_i \rangle$ determines the *induced subsigned graph* of S on the vertex subset V_i of $V(S)$ whereas $\langle V_i \rangle^u$ determines the underlying subgraph of S^u which is induced on the vertex subset V_i of $V(S^u)$.

The sign of a cycle (this is the edge set of a simple cycle) is defined to be the product of the signs of its edges; in other words, a cycle is *positive* if it contains an even number of negative edges and *negative* if it contains an odd number of negative edges. A signed graph is said to be *balanced* if every cycle in it is positive. A signed graph S is called *totally unbalanced* if every cycle in S is negative. A *chord* is an edge joining two nonadjacent vertices in a cycle.The following characterization of a balanced signed graph is well known.

Theorem 1.1 [7]: *A signed graph S is balanced if and only if its vertex set $V(S)$ can be partitioned into two subsets V_1 and V_2 (one of them possibly empty) such that every negative edge of S joins a vertex of V_1 with one of V_2 while no positive edge does so.*

The spectral criterion for a signed graph to be balanced given by Acharya [8] is as follows:

Theorem 1.2 [8]: *A signed graph is balanced if and only if it is co-spectral with the underlying graph.*

Lemma 1.3 [9]: *A signed graph in which every chordless cycle is positive, is balanced.*

A *marked signed graph* is an ordered pair $S_\mu = (S, \mu)$, where $S = (S^u, \sigma)$ is a signed graph and $\mu : V(S^u) \to \{+, -\}$ is a function from the vertex set $V(S^u)$ of S^u into the set $\{+, -\}$, called a *marking* of S. *Switching* S with respect to a marking μ is the operation of changing the sign of every edge of S to its opposite whenever its end vertices are of opposite signs. The resulting signed graph $\mathbf{S}_\mu(S)$ is called a *switched signed graph*. A signed graph S is said to *switch* to another signed graph S' written $S \sim S'$, whenever there exists a marking μ such that $S' \cong \mathbf{S}_\mu(S)$, where '$\cong$' denotes the usual equivalence relation of isomorphism in the class of signed graphs. Hence, if $S \sim S'$ we shall say that S and S' are *switching equivalent*. Two signed graphs S_1 and S_2 are *signed isomorphic* (written $S_1 \cong S_2$ or sometimes $S_1 = S_2$) if there is a one-to-one correspondence between their vertex sets which preserve adjacency as well as sign.

2. *t*-Path invariant graphs

Escalante et al. (*see* [10]) introduced *t-path graphs* in the theory of graphs. The t-path graphs are the generalization of *open neighbourhood graphs* introduced by Acharya [11]. The *t-path invariant* graph by Escalante and Montejano [10] are the graphs which satisfy the following equation

$$(G)_t \cong G \tag{2.1}$$

The solution for Equation (2.1) was discovered only for $t = 2, 3$. For the higher value of t, it still is an open problem. Following Theorem gives the characterization to define the structure of 2-path invariant graphs.

Theorem 2.1 [10]: *A graph G of order p is a 2-path invariant graph if and only if $G = \overline{K}_p$ or K_p with $p \geq 3$, or the odd p-cycle C_p, $p = 2m + 1$, $m \geq 2$.*

2.1. A system of signed graph equivalence

Mishra [12] extended the notion of t-path graphs in the theory of signed graphs as follows: a t-path signed graph of a signed graph S is a signed graph whose underlying structure is $((S)_t)^u$ and for any edge $e = uv$, $\sigma(uv) = -$ if and only if every $u - v$ path of length t in S all edges are negative. By the same pattern as discussed above, *switching invariant t-path signed graphs* are the signed graphs which satisfy the following equation

$$(S)_t \sim S, \quad t = 2, 3, \ldots \tag{2.2}$$

The solution of Equation (2.2) was given by Gill and Patwardhan [13] and Acharya [14], for $t = 2$ and 3 respectively. Here, in this paper, we describe all the solutions to

$$\eta(S) \sim (S)_t, \quad t = 2 \tag{2.3}$$

which we will call a *negation-switching invariant t-path signed graph*. For $t = 1$ and $t = 3$ the solution already exist [15,16].

The following Theorem determines the solution to $S \sim \eta(S)$.

Theorem 2.2 [15]: *For a connected signed graph $S = (S^u, \sigma)$, $S \sim \eta(S)$ if and only if either*

(i) *S^u is bipartite or*
(ii) *there exist subsets V_1 and V_2 of $V(S)$ such that*
  (a) *$S = \langle V_1 \rangle \cup \langle V_2 \rangle$ and $\langle V_1 \cap V_2 \rangle$ is bipartite,*
  (b) *$\langle V_1 \rangle^u \cong \langle V_2 \rangle^u$ such that degrees of corresponding vertices are preserved in S also and*
  (c) *each odd (even) cycle in $\langle V_1 \rangle$ is of opposite (same) sign to the corresponding cycle in $\langle V_2 \rangle$.*

Theorem 2.3 [15]: *For a given signed graph $S = (S^u, \sigma)$, $S \cong \eta(S)$ if and only if the edge set $E(S)$ can be partitioned into two subsets E_1 and E_2 such that $\langle E_2 \rangle \cong \langle \eta(E_1) \rangle$ and degrees of corresponding vertices are preserved in S.*

2.2. Negation-switching invariant 2-path signed graphs

In view of Theorem 2.1, we see that if S is a solution to $\eta(S) \sim (S)_2$, then S is either a totally disconnected signed graph, or $S \in \psi(K_p)$ for some integer $p \geq 3$, or $S \in \psi(C_{2m+1})$ for $m \geq 2$, where $\psi(K_p)$ and $\psi(C_{2m+1})$ are all possible signed graphs on complete graphs and an odd cycle, respectively. Therefore, to completely determine the structure of negation switching invariant 2-path signed graphs, it is enough to search solutions of (2.3) in the sets $\psi(C_{2m+1})$, $m \geq 2$ and $\psi(K_p)$, $p \geq 3$. Towards this end, we need following notions: Two signed graphs S_1 and S_2 are said to be *weakly isomorphic* (*e.g. see* Sozánski [17]) or *cycle isomorphic* (*e.g. see* Zaslavsky [18]) if there exists an isomorphism $f : (S_1)^u \to (S_2)^u$ such that the sign of every cycle Z in S_1 equals the sign of $f(Z)$ in S_2 (*i.e.* f preserves both the vertex adjacencies, and the signs of the cycles of S_1 in S_2), where the sign of any subsigned graph of a signed graph is defined as the product of the signs of its edges. The following theorem will also be useful in our further investigation when $\psi(G)$ denotes the set of all the signed graphs on the graph G.

Theorem 2.4 [17]: *Given a graph G, any two signed graphs in $\psi(G)$ are switching equivalent if and only if they are cycle isomorphic.*

Let Z be a heterogeneous cycle in a signed graph S. By a *negative section* of Z we mean a maximal set P of vertices of Z such that the subsigned graph consisting of the edges of Z joining vertices in P is all-negative and connected. The following theorem determines the solution for $(S)_2 \sim \eta(S)$ that may be found in $\psi(C_{2m+1})$, $m \geq 2$.

Theorem 2.5 [13]: *For any integer $m \geq 2$, $Z \in \psi(C_{2m+1})$ is a solution to $S \sim (S)_2$ if and only if either Z is homogeneous or it has an even number of negative sections.*

Theorem 2.6: *For any integer $m \geq 2$, a heterogeneous signed graph $S \in \psi(C_{2m+1})$ is a solution to $(S)_2 \sim \eta(S)$ if and only if it has an odd number of negative sections.*

***Proof*:** Let S be a solution to $\eta(S) \sim (S)_2$. Then $(\eta(S))^u \cong ((S)_2)^u$ and hence by Theorem 2.1 it implies that $(S)_2^u = \overline{K}_p$ or K_p with $p \geq 3$ or the odd p-cycle C_p, $p = 2m+1$, $m \geq 2$. Thus, $S \in \psi(C_{2m+1})$, $m \geq 2$. If S is homogeneous then $\eta(S)$ is also homogeneous but of the opposite sign. By Theorem 2.4, $\eta(S) \not\sim (S)_2$. Therefore, S must be heterogeneous. Suppose the number of negative sections with length one is r and other negative section

are of lengths $k_1, k_2, \ldots, k_t$ in some order. Now, it is easy to see by the definition of $(S)_2$ that it has one negative edge for each consecutive pair of negative edges in S. Hence, in every negative section in S, there is one less negative edge in $(S)_2$. Therefore,

$$|E^-((S)_2)| = \sum_{i=1}^{t} (k_i - 1)$$

and

$$|E^-(S)| = r + \sum_{i=1}^{t} k_i.$$

Also,

$$|E^-(\eta(S))| = 2m + 1 - r - \sum_{i=1}^{t} k_i.$$

Thus, by Theorem 2.4 the following chain is seen to complete the proof:

$\eta(S)$ and $(S)_2$ are switching equivalent
$\iff$ $\eta(S)$ and $(S)_2$ are cycle isomorphic
$\iff$ $2m + 1 - r - \sum_{i=1}^{t} k_i + \sum_{i=1}^{t} (k_i - 1) \equiv 0 \pmod 2$
$\iff$ $2m + 1 - r - t \equiv 0 \pmod 2$
$\iff$ $1 - r - t \equiv 0 \pmod 2$
$\iff$ $r + t \equiv 1 \pmod 2$
This completes the proof. □

Remark: However, it may be observed that the proof of Theorem 2.6 is existential when S is heterogeneous. Therefore, it is desirable to have a marking scheme switching $\eta(S)$ to $(S)_2$ in this case, which we give in the following section. For the validity of arguments we now describe an equivalent formulation of the problem by representing such labelled heterogeneous signed cycle C_{2m+1} by using a vector method.

2.3. A binary vector method

A labelled heterogeneous signed cycle $Z = (v_1, v_2, v_3, \ldots, v_n, v_1)$ on C_n may be represented by using the n-dimensional row vector $A = (a_1, a_2, a_3, \ldots, a_n)$ of $1's$ and $-1's$ such that for each $i = 1, 2, 3, \ldots, n$,

$$a_i = s(v_i, v_{i+1})$$

where indices are reduced modulo n. Thus, each maximal string of $-1's$ in A is a negative section in Z and vice versa. The operation of taking 2-path signed graph then corresponds to obtaining another n-dimensional row vector $(A)_2 = (b_1, b_2, b_3, \ldots, b_n)$ of $1's$ and $-1's$ from A such that

$$b_i = a_{2i-1} \oplus a_{2i}, \ \forall i = 1, 2, 3, \ldots, n$$

with indices reduced modulo n and where the binary operation $\oplus$ is given in *Table*-(a). It is easy to see that in $(A)_2$ there is one less negative entry for each negative section in A.

$\oplus$	1	−1
1	+1	+1
−1	+1	−1

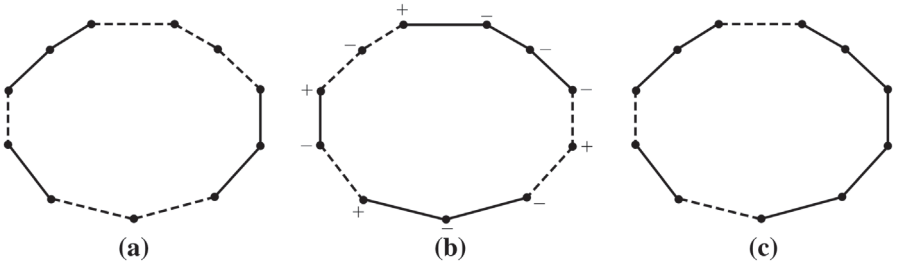

Figure 1. A signed graph Z_{11}, its negation $\eta(Z_{11})$ and its 2-path signed graph $(Z_{11})_2$ in (a), (b) and (c), respectively.

Table $-$ (a)

Yet another operation of taking negation of signed graph corresponds to n-dimensional row vector $\eta(A) = (\eta(a_1), \eta(a_2), \ldots, \eta(a_n))$ where $\eta(a_i) = -a_i$, $1 \leq i \leq n$. Now we choose a method of marking of $\eta(Z)$ such that $\eta(Z) \sim (Z)_2$. We define a marking $\mu = (\mu_1, \mu_2, \ldots, \mu_n)$ for $\eta(Z)$ as follows:

Let $\mu(v_1) = \mu_1 = +$ (we can also take $\mu_1 = -$) and for each integer i, $2 \leq i \leq n$, we let

$$\mu_i = \mu(v_{i-1}), \text{ if } \eta(a_{i-1}) = b_{i-1};$$
$$\mu_i = -\mu(v_{i-1}), \text{ if } \eta(a_{i-1}) \neq b_{i-1}$$

It is easy to verify that the marking obtained is the required sort of marking of $\eta(Z)$.

For example the marking of cycle $\eta(Z_{11})$ shown in Figure 1 is precisely the one obtained by above sign vector form such that $\mathbf{S}_\mu(\eta(S)) \cong (S)_2$ and hence $\eta(S) \sim (S)_2$. Thus, for Figure 1, we have the following information:

$$A = (-,-,-,+,+,-,-,+,-,+,+)$$
$$\eta(A) = (+,+,+,-,-,+,+,-,+,-,-)$$
$$(A)_2 = (-,+,+,+,+,+,-,+,-,+,+)$$
$$\mu = (+,-,-,-,+,-,-,+,-,+,-)$$

The following lemma is easy to prove.

Lemma 2.7: *Let $S \in \psi(K_n)$ and $uv \in E(S)$. If all the other edges of S incident at u and v are negative, then uv is a negative edge in $(S)_2$.*

The following theorem gives the solution to $(S)_2 \sim \eta(S)$ for $S \in \psi(K_n)$, $n \geq 3$.

Theorem 2.8: *$S \in \psi(K_n)$, $n \geq 3$, is a solution to $(S)_2 \sim \eta(S)$ if and only if any one of the following conditions is satisfied:*

(i) *$V(S)$ can be partitioned into $k+2$ subsets $V_1, V_2, \ldots, V_{k+2}$ such that the induced sub-signed graph $\langle V_1\rangle, \langle V_2\rangle, \ldots, \langle V_k\rangle$ are an all-positive path of length one (it may be zero), and $\langle V_{k+1}\rangle$, $\langle V_{k+2}\rangle$ is all-positive, all-negative induced complete sub-signed graph on $\frac{n-2k}{2} \geq 3$ vertices respectively (if $\langle V_{k+1}\rangle$ is zero, then $\langle V_{k+2}\rangle$ is also zero) and all the edges across $\langle V_i\rangle$, $i \in \{1, 2, \ldots, k+2\}$ are negative or*

(ii) *$V(S)$ can be partitioned into two subsets V_1 and V_2 such that the induced subsigned graphs $\langle V_1\rangle$ and $\langle V_2\rangle$ are all-negative and the edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are all-positive.*

***Proof*:** Necessity: Suppose that $(S)_2 \sim \eta(S)$. If S is homogeneous, then $\eta(S)$ and $(S)_2$ are not switching equivalent because one of them would be balanced and the other would be unbalanced. Hence, we suppose that S is a solution to $(S)_2 \sim \eta(S)$, where S is heterogeneous. Now, we show that one of the two conditions holds in S. First, suppose case (i) is not possible. Hence we have the following subcases:

(a) Let $\frac{n-2k}{2} < 3$, then $k < \frac{n-4}{2} \neq \frac{n}{2}$. Thus from case (1) we get a contradiction. Therefore, $\frac{n-2k}{2} \geq 3$.
(b) Suppose $\langle V_i\rangle, i \in \{1, 2, \ldots, k\}$ are all-negative and $\langle V_{k+1}\rangle$, $\langle V_{k+2}\rangle$ is all-positive, all-negative respectively and all the edges across $\langle V_i\rangle, i \in \{1, 2, \ldots, k+2\}$ are positive. Then $(S)_2$ is all positive and $\eta(S)$ has a negative triangle. Hence, $\eta(S) \not\sim (S)_2$. Therefore, subcase (b) does not hold.
(c) Suppose $\langle V_i\rangle, i \in \{1, 2, \ldots, k\}$ are all-positive and $\langle V_{k+1}\rangle$, $\langle V_{k+2}\rangle$ are heterogeneous and all the edges across $\langle V_i\rangle, i \in \{1, 2, \ldots, k+2\}$ are positive. Then $(S)_2$ is all-positive and $\eta(S)$ has a negative triangle. Hence, $\eta(S) \not\sim (S)_2$. Therefore, subcase (c) does not hold.
(d) Suppose $\langle V_i\rangle, i \in \{1, 2, \ldots, k\}$ are all-positive and $\langle V_{k+1}\rangle$, $\langle V_{k+2}\rangle$ is all-positive, all-negative respectively and all the edges across $\langle V_i\rangle, i \in \{1, 2, \ldots, k+2\}$ are positive. Then $(S)_2$ is all positive and $\eta(S)$ has a negative triangle. Hence, $\eta(S) \not\sim (S)_2$. Therefore, subcase (d) does not hold.
(e) Suppose $\langle V_i\rangle, i \in \{1, 2, \ldots, k\}$ are all-positive and $\langle V_{k+1}\rangle$, $\langle V_{k+2}\rangle$ are all-positive and all the edges across $\langle V_i\rangle, i \in \{1, 2, \ldots, k+2\}$ are positive. Then $(S)_2$ is all positive and $\eta(S)$ has a negative triangle. Hence, $\eta(S) \not\sim (S)_2$. Therefore, subcase (e) does not hold.

Next, we consider the case when there is no positive independent edge in S. Now we prove (ii). Suppose this is not the case. Hence we have the following subcases:

(a) Suppose one of $\langle V_i\rangle, i \in \{1, 2\}$, is all-positive and all edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are positive, then $(S)_2$ is all-positive and hence balanced. On the other hand, $\eta(S)$ is heterogeneous and unbalanced. As $\eta(S)$ and $(S)_2$ are signed graphs on K_n, $n \geq 4$, we get a contradiction to the hypothesis. Therefore, subcase (a) does not hold.
(b) Suppose $\langle V_i\rangle, i \in \{1, 2\}$ are all-positive and all edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are negative, then $(S)_2$ is all-positive and $\eta(S)$ is heterogeneous. As $\eta(S)$ and $(S)_2$ are signed graphs on K_n, $n \geq 4$, we get a contradiction to the hypothesis. In case $|V_i| = 2$ for any $i \in \{1, 2\}$, it is easy to see that $(S)_2$ has exactly one negative edge for the set $\langle V_i\rangle$ having cardinality two and all the other edges are positive. On the other hand, in $\eta(S)$, $\langle V_i\rangle, i \in \{1, 2\}$, are all-negative and all the edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are positive. It is clear that $\eta(S) \not\sim (S)_2$ in this case too. Hence, subcase (b) does not hold.
(c) Suppose one of $\langle V_i\rangle, i \in \{1, 2\}$, is all-positive and all the edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are negative, then in $(S)_2$, $\langle V_1\rangle$ is all-positive, and $\langle V_2\rangle$ is all-negative and all edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are positive. But in $\eta(S)$, $\langle V_1\rangle$ is all-negative,

and $\langle V_2\rangle$ is all-positive and all the edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are positive. If $|V_1| \neq |V_2|$ it follows that $\eta(S) \not\sim (S)_2$, a contradiction to the hypothesis.

(d) Suppose $\langle V_i\rangle$, $i \in \{1,2\}$ are all-positive and all edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are positive, then S is all-positive and by the definition $(S)_2$ is all-positive but $\eta(S)$ is all-negative. So there exist some negative cycles in $\eta(S)$ but all the cycles in S_2 are positive. Hence, by Theorem 2.4, $\eta(S) \not\sim (S)_2$.

(e) Suppose $\langle V_1\rangle$ is heterogeneous, $\langle V_2\rangle$ is all-positive (all-negative), and all edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are positive. Then, $(S)_2$ is all-positive while $\eta(S)$ has at least one negative triangle. Thus, $\eta(S) \not\sim (S)_2$.

(f) Suppose $\langle V_1\rangle$ is heterogeneous, $\langle V_2\rangle$ is all-positive (all-negative), and all edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are negative. Then, $(S)_2$ and $\eta(S)$ both are heterogeneous. Here $\langle V_1\rangle$ is heterogeneous in both $(S)_2$ and $\eta(S)$, and $\langle V_2\rangle$ is all-negative (all-positive) in $\eta(S)$ while all-positive (all-negative) in $(S)_2$. So if they are cycle isomorphic then as in Theorem 2.2, there exists an isomorphism under which $(S)_2$ and $\eta(S)$ are switching equivalent. But here such isomorphism does not exist. A similar argument works when $\langle V_1\rangle$ is heterogeneous $\langle V_2\rangle$ is heterogeneous and edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are either positive or negative.

(g) Suppose one of $\langle V_i\rangle$, $i \in \{1,2\}$, is all-positive, say $\langle V_1\rangle$ and edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are heterogeneous. In this case, $\langle V_1\rangle$ is all-positive, $\langle V_2\rangle$ is either heterogeneous or all-positive and edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are either heterogeneous or all-positive in $(S)_2$ while $\langle V_1\rangle$ is all-negative, $\langle V_2\rangle$ is all-positive and edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are heterogeneous in $\eta(S)$. So by Theorem 2.2, $\eta(S) \not\sim (S)_2$.

(h) Suppose $\langle V_i\rangle$, $i \in \{1,2\}$ are all-positive and edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are heterogeneous, then $(S)_2$ is all-positive and $\eta(S)$ is heterogeneous. Here $(S)_2$ is balanced while $\eta(S)$ is unbalanced, hence $\eta(S) \not\sim (S)_2$.

(i) Suppose $\langle V_1\rangle$ is heterogeneous, $\langle V_2\rangle$ is all-positive (all-negative), and edges across $\langle V_1\rangle$ and $\langle V_2\rangle$ are heterogeneous. In this case, also using the argument of Theorem 2.2, it is easy to see that $\eta(S) \not\sim (S)_2$. Hence, the only possibility is (ii), thus (ii) must hold.

Sufficiency: Suppose S is heterogeneous and $S \in \psi(K_n)$, $n \geq 3$ and any of the two conditions is satisfied by the signed graph S. To show that $(S)_2 \sim \eta(S)$, we first consider the case when (i) is satisfied by S. By definition, $\eta(S)$ contains k independent negative edges and one complete all-positive(all-negative) subsigned graph on $\frac{n-2k}{2}$ vertices, also all other edges are positive. By Lemma 2.7 independent positive edge in S becomes independent negative edge in $(S)_2$, and $\frac{n-2k}{2}$ vertices with all-negative degree made a complete all-negative subsigned graph, also remaining $\frac{n-2k}{2}$ vertices made a complete all-positive subsigned graph and all other edges are positive. Hence $(S)_2 \cong \eta(S)$, whence in particular, $(S)_2 \sim \eta(S)$ trivially.

Now, we consider the case when (ii) is satisfied. From the definition of $(S)_2$, we see that $(S)_2$ is all-positive and hence balanced. On the other hand, $\eta(S)$ is also balanced as negative edges lie across V_1 and V_2. Hence $(S)_2 \sim \eta(S)$. □

Figure 2 shows the illustration of Theorem 2.8.

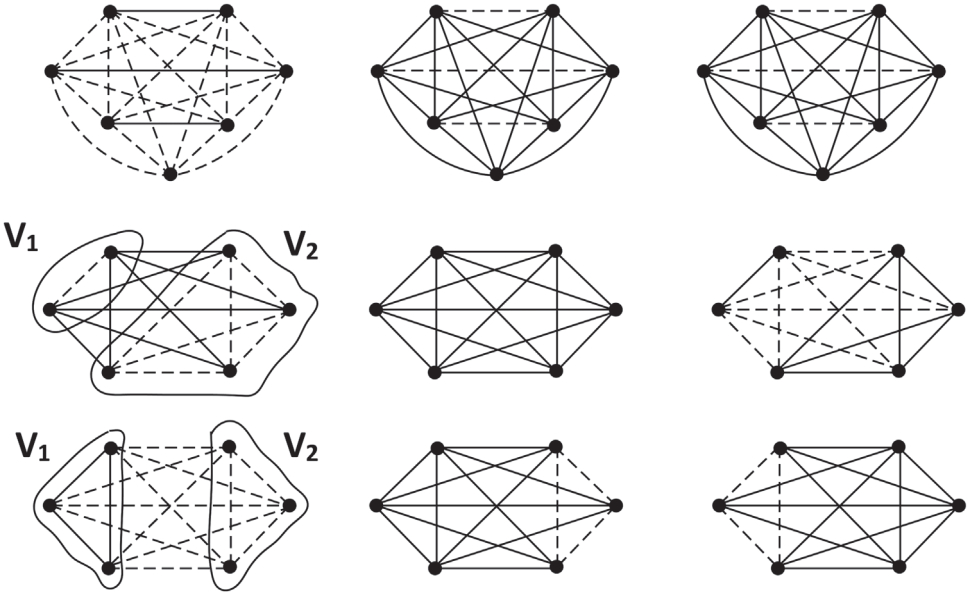

Figure 2. Illustration of Theorem 2.8.

Theorem 2.9 [14]: *If m is an integer such that $4 \leq m \neq 3k$ for any integer $k \geq 2$, then $S \in \psi(C_m)$ is a solution to $(S)_3 \sim S$ if and only if S has an even number of negative sections of length one.*

Theorem 2.10 [16]: *If m is an integer such that $4 \leq m \neq 3k$ for any integer $k \geq 2$, then $S \in \psi(C_m)$ is a solution to $(S)_3 \sim \eta(S)$ if and only if the number of negative sections of length one in C_m is of the same parity as that of m.*

Observation 1: From Theorems 2.5 and 2.6, it is easy to see that when $S \in \psi(C_{2m+1})$, then a solution to $S \sim \eta(S) \sim (S)_2$ is not possible.

Observation 2: From Theorems 2.10 and 2.9, we can state that $S \in \psi(C_{2m+1})$, where m is an even integer such that $4 \leq m \neq 3k$ for any $k \geq 2$, is a solution to $S \sim \eta(S) \sim (S)_3$ if and only if the number of negative sections of length one in C_m are even.

Remark 2.11: If m is an odd integer in Observation 2, then a solution to $S \sim \eta(S) \sim (S)_3$ is not possible.

3. Characterization of signed graphs whose spectrum is symmetric about the origin

In this Section, we determine the symmetric properties of the spectra of the adjacency matrix of a signed graph. Moreover, we prove a fundamental connection between the symmetry of the spectra and negation switching invariant signed graphs. For unsigned graphs, it is well known that the spectrum is symmetric if and only if the graph is bipartite [19]. But authors in [19] are unable to characterize this result for signed graphs. For signed graphs, bipartite property and symmetry of spectra about the origin are not equivalent. Bipartite signed graphs also have spectrum symmetric about the origin, but the reverse

implication does not hold, as it has been observed that there exist non-bipartite signed graphs which too have symmetric spectra [20].

Lemma 3.1 [8]: *If S is a signed graph with characteristic polynomial*

$$\phi_S(x) = x^n + c_1(S)x^{n-1} + \cdots + c_{n-1}(S)x + c_n,$$

then

$$c_j(S) = \Sigma_{L\in\pounds_j}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)} s(Z),$$

for all $j = 1, 2, \ldots, n$, where $\pounds_j$ is the set of all basic figures L of S of order j, $p(L)$ denotes the number of components of L, $c(L)$ denotes the set of all cycles of L and $s(Z)$ the sign of cycle Z.

Lemma 3.2 [20]: *Let S be a signed graph of order n. Then the following statements are equivalent:*

(i) *Spectrum of S is symmetric about the origin.*
(ii) $\phi_S(x) = x^n + \Sigma_{k=1}^{\lfloor\frac{n}{2}\rfloor}(-1)^k b_{2k}(S)x^{n-2k}$, *where* $b_{2k}(S) = \mid c_{2k} \mid$ *for all* $k = 1, 2, \ldots, \lfloor\frac{n}{2}\rfloor$,
(iii) *S and $-S$ are co-spectral, where $-S$ is the signed graph obtained by negating sign of each of S.*

Property 3.3: A signed graph S is said to have property **N** if odd cycles are even in number say $Z_1, Z_1^{'}, Z_2, Z_2^{'}, Z_3, Z_3^{'}, \ldots, Z_m, Z_m^{'}$ such that, $Z_i^u \cong Z_i^{'u}$ and $s(Z_i) = -s(Z_i^{'})$, for every i, $1 \leq i \leq m$.

Theorem 3.4: *S is switching equivalent to $\eta(S)$ if and only if the spectrum of S is symmetric about the origin.*

***Proof*:** Necessity: Let $S \sim \eta(S)$, then by Lemma 2.2

(i) S^u is bipartite or
(ii) There exist subgraphs V_1 and V_2 of S such that
  (a) $S = \langle V_1\rangle \cup \langle V_2\rangle$ and $\langle V_1 \cap V_2\rangle$ is bipartite.
  (b) $\langle V_1\rangle^u \cong \langle V_2\rangle^u$ such that degree of corresponding vertices are preserved in S, and
  (c) each odd (even) cycle in $\langle V_1\rangle$ is of opposite (same) sign to the corresponding cycle in $\langle V_2\rangle$.

Also since $S \sim \eta(S)$, all cycles in S are either of even length or odd cycle in S are even in number.

When S contains no cycle of odd length, then S is a bipartite signed graph. Also by Lemma 3.1, we see that the characteristic polynomial of S is of the form $\phi_S(x) = x^\delta\psi(x^2)$, where $\delta = 0$ or 1 and $\psi(x^2)$ is a polynomial in x^2. Therefore, from Lemma 3.2, spectrum of S is symmetric about the origin.

Next, suppose S has odd cycles also. Now from condition (*ii*) one can easily determine that $c_{2k+1} = 0$ in a characteristic polynomial defined in Lemma 3.1. Therefore, the

characteristic polynomial of S can be written as

$$\phi_S(x) = x^n + \Sigma_{k=1}^{\lfloor \frac{n}{2} \rfloor}(-1)^k b_{2k}(S)x^{n-2k},$$

where $b_{2k}(S) = \mid c_{2k} \mid$. Thus using Lemma 3.2, the spectrum of S is symmetric about the origin.

Sufficiency: Let the spectrum of S be symmetric about the origin, then characteristic polynomial of S can be written as

$$\phi_S(x) = x^n + \Sigma_{k=1}^{\lfloor \frac{n}{2} \rfloor}(-1)^k b_{2k}(S)x^{n-2k},$$

where $b_{2k}(S) = \mid c_{2k} \mid$ and $c_{2k+1} = 0$.

Now two cases are possible.

Case 1: S has no basic figure of an odd order: Under this condition, S does not contain any odd cycle. Therefore, S is a bipartite graph. Now from Lemma 2.2, $S \sim \eta(S)$.

Case 2: S has basic figures of odd order containing at least one odd cycle.

Claim: For a signed graph S having the property **N** have basic figures of odd order even in number.

Now we prove the above claim using mathematical induction on order of basic figures. First, let the order of basic figures be three. Therefore, the number of components that is cycles in each basic figure is equal to one. Thus

$$c_3(S) = \Sigma_{L\in\pounds_3}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)} s(Z)c_3(S) = -2\Sigma_{L\in\pounds_3}s(Z)$$

Since the spectrum is symmetric about the origin, therefore from Lemma 3.2, $c_3 = 0$ which is possible only if number of cycle of length three are even in number, hence the claim holds for basic figures of order three containing odd cycles of length at most three.

Now suppose that our claim is true for basic figures of order less than or equal to $2r+1$. Next, let on the contrary the claim be not true for the basic figures of order $2r+3$ containing odd cycles of length at most $2r+3$. Therefore, basic figures of order $2r+3$ are odd and signed graph S does not have the property **N**, i.e. for some cycle, Z_k of length $2r+3$ there does not exist any cycle $Z_k^{'}$ of same order such that $s(Z_k) = -s(Z_k^{'})$. Now, basic figures of order $2r+3$ can be obtained in the following manner from the basic figures of order $2r+1$.

Subcase 2.1. **An edge is added in the basic figures of order** $2r+1$**:** In this case, number of components increases by one but the sign of cycles remain same as that in basic figures

of order $2r+1$. Now, if c'_{2r+3} denotes the coefficient of $x^{n-(2r+3)}$ arising in this case, then

$$\begin{aligned} c_{2r+1}(S) &= \Sigma_{L\in\pounds_{2r+1}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)}s(Z)=0\\ \Rightarrow c'_{2r+3}(S) &= \Sigma_{L\in\pounds_{2r+3}}(-1)^{p(L)+1}2^{|c(L)|}\prod_{Z\in c(L)}s(Z)\\ \Rightarrow c'_{2r+3}(S) &= -\Sigma_{L\in\pounds_{2r+3}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)}s(Z)=0 \end{aligned}$$

Thus basic figures of order $2r+3$ containing odd cycles of length at most $2r+1$ are even in number.

Subcase 2.2. **Length of the cycle of order less than** $2r-1$ **is increased by two in basic figures of order** $2r+1$**:** Now, let c''_{2r+3} denotes the coefficient of $x^{n-(2r+3)}$ arising in this case.

(i) If the sign of cycle does not change in the basic figure of order $2r+3$, then we can say that

$$c''_{2r+3}(S)=0$$

and basic figures of order $2r+3$ containing odd cycles of length at most $2r+1$ are even in number and signed graph S has the property **N**.

(ii) If sign of the cycle changes, then

$$\begin{aligned} c_{2r+1}(S) &= \Sigma_{L\in\pounds_{2r+1}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)}s(Z)\\ \Rightarrow c''_{2r+3}(S) &= \Sigma_{L\in\pounds_{2r+3}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)}s'(Z)\\ \Rightarrow c''_{2r+3}(S) &= \Sigma_{L\in\pounds_{2r+3}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)}s(Z)\\ &\quad+\Sigma_{L\in\pounds_{2r+3}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)}s'(Z)=0 \end{aligned}$$

Because basic figures containing cycles of length less than or equal to $2r+1$ are even in number, also S has the property **N** for all odd cycles of order less than or equal to $2r+1$.

Subcase 2.3. **Length of cycles of order** $2r+1$ **is increased:** Let this types of basic figures be odd in number and also signed graph S does not have property **N**. Since we know that

spectrum of the signed graph is symmetric about the origin, which implies

$$c_{2r+3}(S) = \Sigma_{L\in\pounds_{2r+3}}(-1)^{p(L)}2^{|c(L)|}\prod_{Z\in c(L)} s(Z) = 0$$
$$\Rightarrow c_{2r+3}(S) = c_{2r+3}^{'} + c_{2r+3}^{''} + \Sigma_{L\in\pounds_{2r+3}}(-1)2\prod_{Z\in c(L)} s(Z)$$
$$\Rightarrow c_{2r+3}(S) = 0 + 0 + \Sigma_{L\in\pounds_{2r+3}}(-1)2\prod_{Z\in c(L)} s(Z) = -2\Sigma_{L\in\pounds_{2r+3}}s(Z)$$

Since $s(Z) \in \{-1, 1\}$, therefore for $c_{2r+3}(S)$ to be equal to zero number of cycles must be even in number say $Z_1, Z_1^{'}, Z_2, Z_2^{'}, Z_3, Z_3^{'}, \ldots, Z_m, Z_m^{'}$, such that $s(Z_i) = -s(Z_i^{'})$. Thus the number of basic figures containing cycles of length $2r + 3$ are also even. Hence by induction, we can say that this is true for every odd number. Therefore, the claim is true.

Since $S^u \cong (\eta(S))^u$ and $V(S) = V(\eta(S))$, degrees of the corresponding vertices in S^u and $(\eta(S))^u$ are preserved. It is clear that there exists a cycle isomorphism between S and $\eta(S)$ such that even cycles get mapped to itself and Z_i get mapped to $Z_i^{'}$ for all $1 \le i \le m$. Therefore, S and $\eta(S)$ are cycle isomorphic. Hence, $S \sim \eta(S)$. □

Theorem 3.5 [15]: *For a given signed graph $S = (S^u, \sigma)$, $S \cong \eta(S)$ if and only if the edge set $E(S)$ can be partitioned into two subsets E_1 and E_2 such that $\langle E_2\rangle \cong \langle\eta(E_1)\rangle$ and degrees of corresponding vertices are preserved in S.*

Remark 3.6: For a given signed graph $S = (S^u, \sigma)$, if the edge set $E(S)$ can be partitioned into two subsets E_1 and E_2 such that $\langle E_2\rangle \cong \langle\eta(E_1)\rangle$ and degrees of corresponding vertices are preserved in S, then the spectrum of S is symmetric about the origin.

Remark 3.7: From Observation 2, we can easily infer that if the number of negative sections of length one in C_m are even, then spectra of $(S)_3$ is symmetric about the origin.

4. Eigenvalues of *t*-path signed graph

A *vertex cover* of a graph is a set of vertices such that each edge of the graph is incident to at least one vertex of the set. In this Section, we derive characteristic polynomial and eigenvalues of a t-path signed graph, where $t = 2$ or 3. Here $K_n^{m,r}$, denote a signed complete graph with n vertices, having m number of vertex disjoint cliques each of order r. Let us consider that there are k number of negative cliques of order $n_1, n_2, \ldots, n_k$, respectively and cover the vertex set of a complete signed graph (say S). Thus the adjacency matrix of such a graph S can be written as:

$$A(S) = \begin{bmatrix} -A(K_{n_1}) & J_{12} & \ldots & J_{1k} \\ J_{12}^T & -A(K_{n_2}) & \ldots & J_{2k} \\ & \ldots\ldots\ldots\ldots & & \\ J_{1k}^T & J_{2k}^T & \ldots & -A(K_{n_k}) \end{bmatrix}$$

Theorem 4.1 [21]: *Characteristic polynomial of $A(K_{mr}^{m,r})$ is given by $\phi(K_{mr}^{m,r}) = (1 - \lambda)^{m(r-1)}(1 - 2r - \lambda)^{m-1}(1 + r(m - 2) - \lambda)$.*

Theorem 4.2 [21]: *Let S be a complete graph on n vertices with $k > 2$ disjoint negative cliques of order $n_1, n_2, \ldots, n_k$ such that $n_1 + n_2 + \cdots + n_k = n$. Suppose $\overline{n_i}$, $i = 1, \ldots, t$, $t \leq k$ be the distinct numbers in the set $\{n_1, n_2, \ldots, n_k\}$. Then,*

(a) *0 is an eigenvalue of $A(S) - I_n$ with algebraic multiplicity $n - k$ corresponding to eigenvectors $X = [X_1 X_2 \ldots X_k]^T$, $X_i \in R^{n_i}$ such that $\Sigma X_i = 0$ for all i.*

(b) *$-2\overline{n_i}$, $i = 1, \ldots, t$ are nonzero eigenvalues of $A(S) - I_n$ with multiplicity $m_i - 1$ where m_i is the number of distinct clusters in G of order n_i. The other nonzero eigenvalues are the roots of the polynomial $1 + p(\lambda)$ where $p(\lambda) = \Sigma_{i=1}^{t} \frac{m_i \overline{n_i}}{-2\overline{n_i} - \lambda}$. Moreover, the eigenvectors corresponding to the nonzero eigenvalues of $A(S) - I_n$ are of the form $X = [\alpha_1 1_{n_1}^T \ \alpha_2 1_{n_2}^T \ \ldots \ \alpha_k 1_{n_k}^T]^T$ where $0_k \neq \alpha = [\alpha_1 \ \alpha_2 \ \ldots \ \alpha_k]^T$ satisfies $N_\lambda \alpha = 0$. Such an α determines an eigenvector corresponds to the eigenvalue λ for which $\lambda(\alpha_i - \alpha_j) = 2(n_j \alpha_j - n_i \alpha_i)$, $i, j = 1, \ldots, k$.*

Theorem 4.3: *The negative cliques of different orders covers the vertex set in a complete 2-path signed graph $(S)_2$ of a signed graph S if and only if $d^+(v_i) \leq 1$, for all $v_i \in V(S)$.*

***Proof*:** Necessity: For $S \in \psi(K_n)$, let $(S)_2$ be having negative cliques of different orders which cover the vertex set of $(S)_2$. On the contrary let $d^+(v_i) \geq 2$, for all $v_i \in V(S)$. This implies that there exists at least one vertex $v_j \in V(S)$ such that $d^+(v_j) \geq 2$. v_j is adjacent to every vertex of S. Now from the definition of 2-path graph we can easily see that $(S)_2$ is an all-positive graph, a contradiction to our assumption that $(S)_2$ is having negative cliques of different orders which cover the vertex set of $(S)_2$. Hence, $d^+(v_i) \leq 1$, for all $v_i \in V(S)$.

Sufficiency: Suppose that $d^+(v_i) \leq 1$, for all $v_i \in V(S)$. Now there are two possibilities, first, $d^+(v_i) = 0$, for all $v_i \in V(S)$. Therefore, $(S)_2$ is an all-negative graph. Second, $d^+(v_i) = 1$, for some $v_i \in V(S)$ and all other vertices have positive degrees equal to zero. In this case there exist a positive edge between any two vertices and all other edges incident to these two vertices are negative, then in its 2-path graph these two vertices will be connected by negative edge and all other incident edges are positive, and this is true for all the vertices of S such that $d^+(v_i) = 1$. Therefore, there are negative cliques of different orders which cover the vertex set of $(S)_2$. □

4.1. An algorithm to compute negative cliques in 2-path signed graphs of complete signed graph S

In this section, we write an algorithm which computes the number of negative cliques of different length and negative cliques such that *m* negative cliques are there each of length *r* which cover the vertex set of $(S)_2$ for a given $S \in \psi(K_n)$.

[Algorithm to compute the number of negative cliques of different length such that all the vertices of $(S)_2$ are covered]

Algorithm 1: **Input: The adjacency matrix** $A_{n \times n} = a_{ij} \in \{-1, 0, +1\} : 1 \leq i, j \leq n$

Step 1 initialize $n = length(A)$; $countpos = 0$; $countneg = 0$

Step 2 for i=1 to n do

Step 3 $B = A(i, :)$

Step 4 **Check if** $(sum(B = 1) = 1)$
If true $countpos = countpos + 1$

Step 5 **Check if** $(sum(B < 1) = n)$
If true $countneg = countneg + 1$

Step 6 **Check if** $(sum(B = 1) > 1)$
If true set $countpos = 0$ **and** $countneg = 0$
break;
Else print "number of negative cliques of length two $= countpos/2$ **and one negative clique of length** $countneg$"

Complexity of the computation involved in above algorithm

In Step 2, we visit each row, since there are n rows, complexity for this step is $O(n)$.

In Step 3, we have to calculate sum (B) of each row. Since there are n entries, complexity for this step is $O(n)$.

In Step 4, 5 and 6, we have to check value of B, therefore complexity for these steps is $O(n)$.

Thus, total complexity involved $= O(n) + O(n) = O(n)$.

Example 4.4: Let S be a given signed graph. We calculate the number of negative cliques and their size in $(S)_2$ such that these negative cliques cover all the vertices of $(S)_2$. The adjacency matrix for a signed graph S and its 2-path signed graph $(S)_2$ is given by:

$$S = \begin{bmatrix} 0 & -1 & -1 & -1 & -1 \\ -1 & 0 & 1 & -1 & -1 \\ -1 & 1 & 0 & 1 & -1 \\ -1 & -1 & 1 & 0 & -1 \\ -1 & -1 & -1 & -1 & 0 \end{bmatrix} \quad \text{and} \quad (S)_2 = \begin{bmatrix} 0 & 1 & 1 & 1 & -1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ -1 & 1 & 1 & 1 & 0 \end{bmatrix}$$

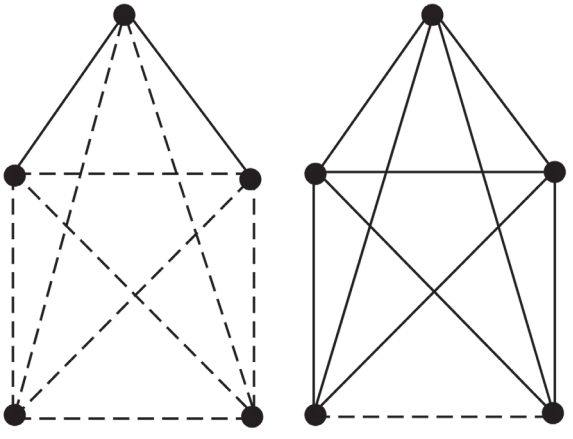

Figure 3. A signed graph S and its 2-path signed graph $(S)_2$.

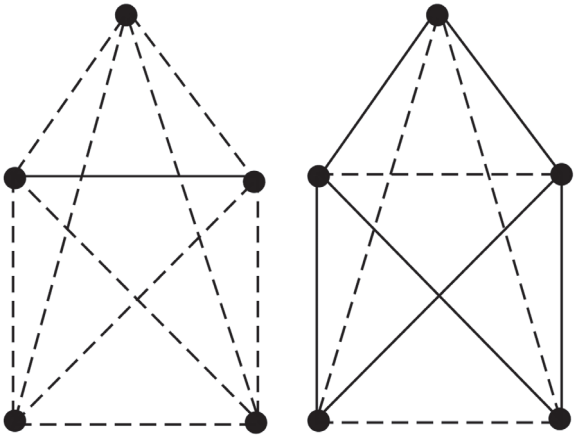

Figure 4. A signed graph S and its 2-path signed graph $(S)_2$.

From the above matrix calculate the number of 1′s in each row. *countpos* > 1 in the third row. The entries a_{23} and a_{34} are positive. Therefore, program break. As we can see in the 2-path matrix of S there is only one negative clique of length 2 which does not cover the vertex set of $(S)_2$ (Figure 3).

Example 4.5: Let S be a given signed graph. We calculate the number of negative cliques and their size in $(S)_2$ such that these negative cliques cover all the vertices of $(S)_2$. The adjacency matrix for a signed graph S and its 2-path signed graph $(S)_2$ is given by:

$$S = \begin{bmatrix} 0 & 1 & -1 & -1 & -1 \\ 1 & 0 & -1 & -1 & -1 \\ -1 & -1 & 0 & -1 & -1 \\ -1 & -1 & -1 & 0 & -1 \\ -1 & -1 & -1 & -1 & 0 \end{bmatrix} \quad \text{and} \quad (S)_2 = \begin{bmatrix} 0 & -1 & 1 & 1 & 1 \\ -1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & -1 & -1 \\ 1 & 1 & -1 & 0 & -1 \\ 1 & 1 & -1 & -1 & 0 \end{bmatrix}$$

From the above matrix calculate the number of 1 in each row which is only at a_{12} and a_{21}. Next, construct 2-path graph matrix from above matrix using algorithm described in [22]. Now we can see that -1 is present at a_{12} and a_{21} entries which make a negative clique of order two, and at a_{34}, a_{35}, a_{43}, a_{45}, a_{53}, a_{54} which makes a negative clique of order three in $(S)_2$ (Figure 4).

[Algorithm to compute the number of negative cliques of the same length such that all the vertices of $(S)_2$ are covered by these cliques]

Algorithm 2: **Input: The adjacency matrix** $A_{n\times n} = a_{ij} \in \{-1, 0, +1\} : 1 \leq i, j \leq n$

Step 1 **initialize** $n = length(A)$; $countpos = 0$; $countneg = 0$

Step 2 **for i=1 to n do**

Step 3 $B = A(i, :)$

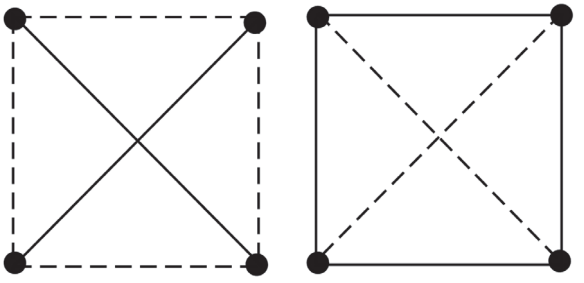

Figure 5. A signed graph S and its 2-path signed graph $(S)_2$.

Step 4 **Check if** $(sum(B = 1) = 1)$
If true $countpos = countpos + 1$

Step 5 **Check if** $(sum(B < 1) = n)$
If true $countneg = countneg + 1$

Step 6 **Check if** $(sum(B = 1) > 1)$ **or** $countneg \geq 3$
If true set $countpos = 0$ **and** $countneg = 0$
break;
Else print "number of negative cliques of length two $= countpos/2 + countneg$
and one negative clique of length $countneg$**"**

Complexity of the computation involved in above algorithm

In Step 2, first for loop is running n times. Thus, complexity for this step is $O(n)$.

In Step 4, 5 and 6, all three if statements inside the for loop are running n times. Thus, complexity for this step is $O(n)$.

Thus, total complexity involved $= O(n) + O(n) = O(n)$.

Example 4.6: Let us suppose that S is a given signed graph and we have to calculate negative cliques of the same length in $(S)_2$ such that these negative cliques cover all the vertices of $(S)_2$. The adjacency matrices for given signed graph S and its 2-path signed graph is given by:

$$S = \begin{bmatrix} 0 & -1 & 1 & -1 \\ -1 & 0 & -1 & 1 \\ 1 & -1 & 0 & -1 \\ -1 & 1 & -1 & 0 \end{bmatrix} \quad \text{and} \quad (S)_2 = \begin{bmatrix} 0 & 1 & -1 & 1 \\ 1 & 0 & 1 & -1 \\ -1 & 1 & 0 & 1 \\ 1 & -1 & 1 & 0 \end{bmatrix}$$

Now check each row of this matrix and calculate the number of 1's in each row. As we can see in each row of this matrix only one 1 is present at a_{13}, a_{24}, a_{31}, a_{42}. Next, construct 2-path graph matrix from above matrix using an algorithm described in [22]. From adjacency matrix of $(S)_2$ we can observe that only a_{13}, a_{24}, a_{31}, a_{42} entries are -1 and all other entries are either zero or one, so the negative edges in $(S)_2$ are 13 and 24 which makes negative cliques of order two (Figure 5).

For a given signed graph $S \cong K_n$, assume that there are m negative cliques in $(S)_2$ each of order r, which cover the vertex set of $(S)_2$. Therefore, n must be even and values of m and

r are $\frac{n}{2}$ and 2 respectively. In this case $n = mr$. To calculate the characteristic polynomial of $(S)_2$ we refer Theorem 4.1, when $(S)_2 \cong K_{mr}^{m,r}$ and since we have $m = \frac{n}{2}$ and $r = 2$, we have following observation:

Observation 3: Characteristic polynomial of $A(K_{mr}^{m,r})$ is given by

$$\phi(K_{mr}^{m,r}) = (-1)^{\frac{n}{2}-1}(1-\lambda)^{\frac{n}{2}}(\lambda+3)^{\frac{n}{2}-1}(n-3-\lambda).$$

Remark 4.7: Determinant of $(S)_2$, when $(S)_2 \cong K_{mr}^{m,r}$ is given by $(-3)^{\frac{n}{2}-1}(n-3)$ and its eigenvalues are 1, -3 and $(n-3)$ with multiplicity $\frac{n}{2}$, $\frac{n}{2}-1$ and 1 respectively.

Observation 4: For a given signed graph $S \cong K_n$, if negative cliques in $(S)_2$ are of different orders, which cover the vertex set of $(S)_2$, then they are of the type:

(1) One clique of order $m \geq 3$(odd, when n is odd) or $m \geq 4$(even, when n is even) and
(2) $\frac{n-m}{2}$ cliques of order 2.

The characteristic polynomial $\phi(S)$ for $S \cong K_n$, satisfying Observation 4 is dealt elsewhere.

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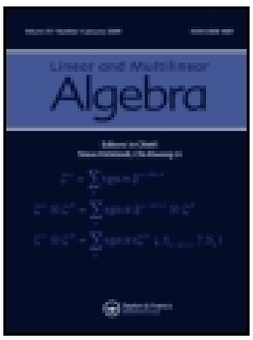

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Embedding of sign-regular signed graphs and its spectral analysis

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Embedding of sign-regular signed graphs and its spectral analysis

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ABSTRACT

A *signed graph* is a graph whose edges carry the weight '+' or '−'. A signed graph S is called *sign-regular* if $d^-(v)$ is same for all $v \in V$ and $d^+(v)$ is same for all $v \in V$. The problems of embedding (i,j)-sign-regular signed graphs in $(i+k,j+l)$-sign-regular signed graphs is one of the fascinating problem from application point of view which is dealt in this paper with insertion of least number of vertices in S and the problem of finding least number of non-isomorphic co-regular signed graphs is explored. We also define the relationship between characteristic polynomial of graph G and the graph in which it embeds.

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1. Introduction

Embedding of the graph has regularly been studied in many areas as communications, automotive to medical, military purposes and also optimal distortion embedding of distance regular graphs has been studied into Euclidean space which is extensively used to design approximation algorithm. Even in daily life it is used extensively like in cellphone, digital cameras, MP3 player, portable digital assistant and automobile antilock brake system, etc. Seeing its importance and its studies by various authors in the literature [1–10] we were motivated towards working out theoretically the embedding sign-regular signed graphs in higher order sign-regular signed graphs.

To better understand the paper, for the preliminary notation and terminology, Behzad and Chartrand [11], Harary [12], West [13] and Zaslavsky [14–16] are referred. A *signed graph* is an ordered pair $S = (S^u, \sigma)$, where $S^u = (V, E)$ is a graph, called the *underlying graph* of S and $\sigma : E \to \{+,-\}$ is a function from the edge set E of S^u into the set $\{+,-\}$. $\sigma(e)$ is then said to be the sign of e. The set $\{e \in E(S^u) : \sigma(e) = +\}$ and $\{e \in E(S^u) : \sigma(e) = -\}$ are called the set of positive and negative edges of S respectively. If for every edge $e \in E(S^u)$, $\sigma(e) = +(\sigma(e) = -)$ then S is said to be *homogeneous*, and if it is not the case, then S is said to be *heterogeneous*.

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Edges in the graph are said to be *adjacent* if they are incident to a common vertex and *independent* if no two of them are adjacent. By a *matching* in a graph G, we mean an independent set of edges in G. The *edge independence number* $\beta_1(G)$ of a graph G is the maximum cardinality of an independent set of edges. $\overline{S^u}$ is said to be the *complement* of a graph S^u when $E(S^u) \cup E(\overline{S^u}) = E(K_n)$, when $V(S^u) = V(\overline{S^u})$, $\mid V \mid = n$ and $E(S^u) \cap E(\overline{S^u}) = \Phi$. A graph is called *r-regular* if all its vertices are of degree r. A signed graph S is said to be sign-regular if the number of positive edges (negative edges), $d^+(v)(d^-(v))$ incident at a vertex v in S, is independent of the choice of v in S, that is S is (i,j)-sign-regular, where $i = d^+(v)$ is the positive degree of every vertex v in S and $j = d^-(v)$ is the negative degree of every vertex v in S(*see* [17]). There is a much older notion of regularity in signed graphs proposed by Chartrand *et al.* (*see* [18]), viz., a signed graph Σ is *regular* (we call it *net-regular*) if the *net-degree* $d_\Sigma(u) = d^+_\Sigma(u) - d^-_\Sigma(u)$ of u is independent of the choice of $u \in V(\Sigma)$. A signed graph Σ is called net-regular if every vertex has the same net-degree. A signed graph $\Sigma = (G, \sigma)$ to be co-regular if the underlying graph G is r-regular for some positive integer r and Σ is net-regular with net-degree k for some integer k. An r-regular graph G is said to be co-regularizable with co-regular pair (r,k) if we can find a signed graph Σ of net-degree k with the underlying graph G.

There are several applications of the theory of graph spectra. In chemistry, the theory of graph spectra has application in a theory of unsaturated conjugated hydrocarbons known as the Huckel molecular orbital theory, it also has applications in physics, computer science, mathematics(many problems in combinatorial optimization can be treated using eigenvalues), biology, geography and social sciences. Let G be a simple graph on n vertices. Then, the adjacency matrix $A = [a_{ij}]$ of order $n \times n$ associated with G is defined by

$$A_{i,j} = \begin{cases} 1 & \text{if there is an edge between the vertices i, j} \\ 0 & \text{otherwise} \end{cases}$$

where, $1 \leq i, j \leq n$.

A *u-v path* in a signed graph S is an alternating sequence of vertices without repetition, beginning with u and ending at v such that consecutive vertices in the sequence are adjacent, and we can express it as $u = v_0, v_1, \ldots, v_k = v$. A path is called *homogeneous* if all its edges have the same sign and *heterogeneous* otherwise. The number of edges in a path is called the *length* of the path. P_n denotes a path of length $n-1$. $P_n^-(P_n^+)$ denotes the all negative(all positive) path of length $n-1$.

The *Cartesian product* $S_1^u \Box S_2^u$ of two graphs S_1^u and S_2^u is a graph with vertex set $V(S_1^u) \times V(S_2^u)$ and two vertices (u_1, u_2) and (v_1, v_2) are adjacent in $S_1^u \Box S_2^u$ if and only if u_1 is adjacent to v_1 in S_1^u and $u_2 = v_2$ or u_2 is adjacent to v_2 in S_2^u and $u_1 = v_1$. In the tensor product of graphs S_1^u and S_2^u, the degree of a vertex (u, v) is defined as $deg(u, v) = deg(u)deg(v)$. Thus if S_1^u and S_2^u are regular then $S_1^u \Box S_2^u$ is also regular.

Let $S = (S^u, \sigma)$ be a signed graph. S is called *Cartesian product* of two signed graphs $S_1 = (S_1^u, \sigma_1)$ and $S_2 = (S_2^u, \sigma_2)$ if $S^u \cong S_1^u \Box S_2^u$ and for any edge $(u_1, u_2)(v_1, v_2)$ of S^u,

$$\sigma((u_1, u_2)(v_1, v_2)) = \begin{cases} \sigma_1(u_1 v_1) & \text{if } u_2 = v_2, \\ \sigma_2(u_2 v_2) & \text{if } u_1 = v_1. \end{cases}$$

The Cartesian product of two signed graphs S_1 and S_2 is shown in Figure 1.

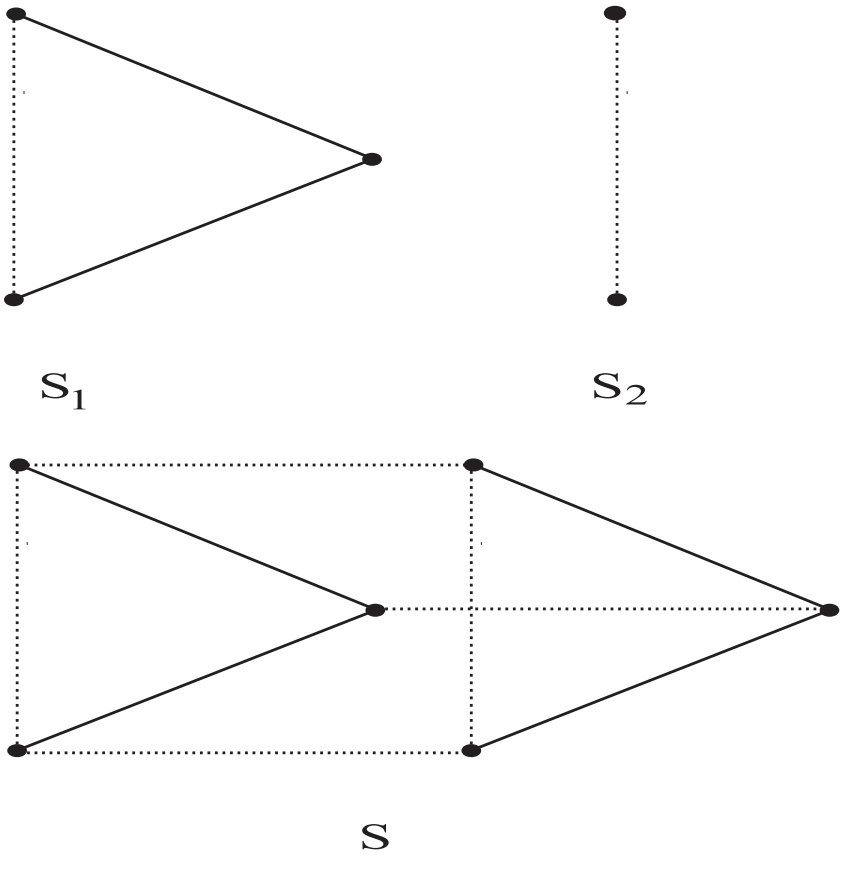

Figure 1. $S = S_1 \square S_2$.

A brief description of the paper is as follows:

In Section 3, we find out minimum number of extra vertices (denoted by $\ell(S)$) required for embedding of an (i,j)-sign-regular signed graphs in $(i+1,j+1)$-sign-regular signed graphs. The next section deals with the problem posed by Hameed et al. [19], where we define the number of non-isomorphic co-regular signed graph. Section 5, depicts a relation between the characteristic polynomials of a graph G and the graph $G'(G*)$, obtained from G by adding some vertices and edges. In this section, we have established the relationship between the characteristic polynomial of the graph G and the graph G' in which it gets embedded.

2. Embedding of a sign-regular signed graphs

For a graph G', the *embedding* of G into a graph G' we mean that there exists a subgraph of G' which is isomorphic to G. It is generally denoted as $G \subseteq G'$ (*see* [20]). Embedding, $G \subseteq G'$ is said to be *proper or strict* if $G \subset G'$. Now we embark upon the finding of the results about the embedding of sign-regular signed graphs. In [21], embedding of (i,j)-sign-regular signed graphs in $(i+1,j)$-sign-regular signed graphs is given. In this paper we are generalizing those results by giving embedding of (i,j)-sign-regular signed graphs in

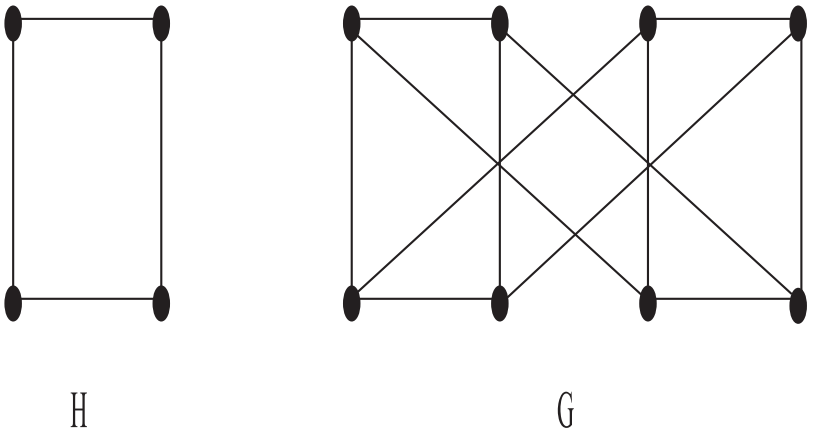

Figure 2. $G = H\Box P_2$.

$(i+1, j+1)$-sign-regular signed graphs. Some of the results obtained here were presented in the IEEE sponsored conference at Dhaka, Bangladesh [22].

Note: Henceforth, throughout the paper, we consider $S = (S^u, \sigma)$ to be (i,j)-sign-regular signed graph of order n.

Gardiner (*see* [23]) made an observation and also gave proof to the fact that in case of graph G, when G is r-regular, it can be embedded in $G\Box P_2$ which is $(r+1)$-regular graph. Embedding of a 2-regular graph G in a 3-regular graph $G = H\Box P_2$ is shown in Figure 2. Then following can be easily observed in signed graphs.

Remark 2.1: If a signed graph S is (i,j)-sign-regular, then $S\Box P_2^-$ and $S\Box P_2^+$ are respectively $(i, j+1)$ and $(i+1, j)$-sign-regular and contain S an induced sub-signed graph.

From the Remark 2.1, it is observed that $S_1 \subseteq S_2$, where S_1 is (i,j)-sign-regular signed graph and S_2 is $(i+1, j+1)$-sign-regular signed graph. The next important thing that one can think about is the optimal number of vertices to be added to S to obtain such kind of embedding. Let the number of extra vertices added be denoted by $\ell(S)$.

For finding minimum number of independent edges in a graph G, Bollobas and Eldridge [24] proposed the following result:

Theorem 2.2 ([24]): *For a graph G of order n, if $\delta = \Delta$ is even, then G has at least $\lceil \frac{n\Delta}{2(\Delta+1)} \rceil$ independent edges, where $\delta(G)(\Delta(G))$ denotes minimum(maximum) degree in a graph G.*

In this paper, $K_n^{(i,j)}$ denotes the complete signed graph with positive degree i and negative degree j, where $i+j = n-1$.

3. Embedding of a (i,j)-sign-regular signed graphs in a $(i+1, j+1)$-sign-regular signed graphs

Lemma 3.1 ([12]): *A graph G is 2 -factorable if and only if G is r-regular for some positive even integer r.*

Theorem 3.2: *For a signed graph S where both n and $i+j$ are of opposite parity, then*

$$\ell(S) = \begin{cases} i+j+1 & \text{if } n = i+j+1, \\ 0 & \text{if } n \neq i+j+1 \text{ and } n \text{ is even}, \\ 1 & \text{if } n \neq i+j+1 \text{ and } n \text{ is odd} \end{cases}$$

Proof: Suppose $n = i+j+1$. Now we construct $K_{i+j}^{(i,j-1)}$. The least n possible is $2(i+j)$ for a signed graph to be $(i+1, j+1)$-sign-regular signed graph; for if $n < 2(i+j)$, then we have a contradiction to assumption. Hence,

$$\ell(S) \geq i+j+1. \tag{1}$$

Further, we construct $K_{i+j+1}^{(i,j)}$. Now to increase positive degree and negative degree by one, join the vertices of S to the vertices of $K_{i+j+1}^{(i,j)}$ such that the vertex v of S is joined by a positive edge to a vertex u_l(say) of $K_{i+j+1}^{(i,j)}$ and by negative edge to another vertex u_m(say) of $K_{i+j+1}^{(i,j)}$. The signed graph so obtained is $(i+1, j+1)$-sign-regular. Hence,

$$\ell(S) \leq i+j+1. \tag{2}$$

From Equations (1) and (2), we get

$$\ell(S) = i+j+1.$$

Now suppose $n \neq i+j+1$, $\overline{S^u}$ is $n-(i+j+1)$-regular, then using Lemma 3.1, $\overline{S^u}$ has 2-factor.

If n is even, thus by selecting edges $e_1, e_2, \ldots, e_n$ of 2-factor in $\overline{S^u}$ and increase the positive degree as well as negative degree by one by inserting these edges in S after assigning alternate positive and the negative sign to these edges, the signed graph so obtained is $(i+1, j+1)$-sign-regular. Hence,

$$\ell(S) = 0.$$

If n is odd then by selecting $\frac{n-i-1}{2}$ alternate edges in every 2-factor component in $\overline{S^u}$ and insert them in S as a positive edge. Then choosing $\frac{n-j-1}{2}$ alternate edges of 2-factor components having no end vertex in common with $\frac{n-i-1}{2}$ previously selected alternate edges except one vertex and insert them in S as a negative edge. Next introducing a vertex 'v' and joining $i+1$ vertices $u_1, u_2, \ldots, u_{i+1}$ of S, such that $d^+(u_l) = i$, $1 \leq l \leq i+1$ by a positive edge to v and $j+1$-vertices $w_1, w_2, \ldots, w_{j+1}$ of S, such that $d^-(w_m) = j$, $1 \leq m \leq j+1$ by a negative edge to v, $(i+1, j+1)$-sign-regular signed graph is obtained. Therefore,

$$\ell(S) = 1. \qquad \blacksquare$$

The Theorem 3.2, is illustrated in Figure 3 (the graph H is embedded in G).

Theorem 3.3: *For a signed graph $S = (S^u, \sigma)$ if both n and $i+j$ are of the same parity, then*

$$\ell(S) = \begin{cases} i+j+2 & \text{if } i+j+2 \leq n \leq 2(i+j-2), \\ 0 & \text{if } n \geq 2(i+j) \end{cases}$$

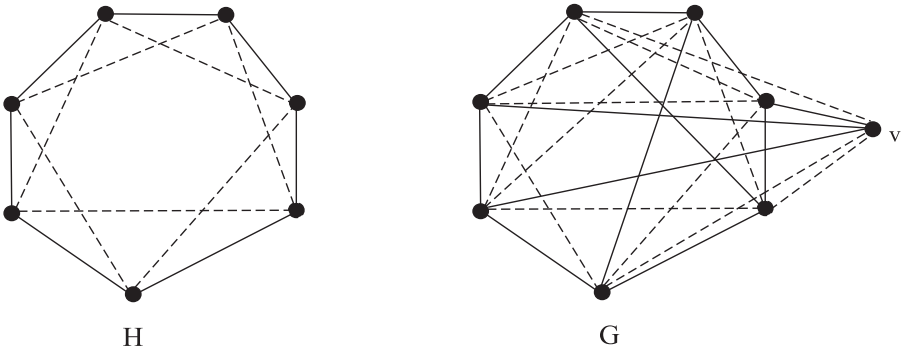

Figure 3. $H \subset G$.

Proof: Suppose $i+j+2 \leq n \leq 2(i+j-2)$. Then both n and $i+j$ must be even. Suppose $\ell(S) \leq i+j+1$. Now we construct $K_{i+j}^{(i,j-1)}$. The least possible n is $2(i+j)$ for the signed graph to be $(i+1, j+1)$-sign-regular signed graph, which is a contradiction to the assumption. Again we construct $K_{i+j+1}^{(i,j)}$. In order to obtain the solution, the vertices of $K_{i+j+1}^{(i,j)}$ are joined to the vertices of S such that a vertex of $K_{i+j+1}^{(i,j)}$ is joined by a positive edge to the vertex of S and by a negative edge to another vertex of S. Then we are left with a vertex of negative degree j and one vertex of positive degree i in the resultant graph. This implies that

$$\ell(S) \geq i+j+2$$

Now using Theorem 2.2, the number of independent edges in $\overline{S^u} \geq \frac{n-i-j-1}{2} \geq \frac{n-i-j-2}{2}$.

Now we select two sets say A and B, of $\frac{n-i-j-2}{2}$ independent edges in $\overline{S^u}$. To increase the negative degree by one, inserting the independent edges of set A in S with a negative sign and to increase the positive degree by one, inserting the independent edges of the set B in S with a positive sign. Next, join remaining $i+j+2$ vertices of positive degree i by positive edge and vertices of negative degree j by negative edge to vertices of an (i,j)-sign-regular signed graph of $i+j+2$ vertices. Therefore,

$$\ell(S) = i+j+2.$$

Next, suppose $n = 2(i+j)$. If $\overline{S^u}$ is 2-connected, then $\overline{S^u}$ is $(i+j-1)$-regular on $2(i+j)$ vertices and so is Hamiltonian. While on the other hand if $\overline{S^u}$ is not 2-connected then $\overline{S^u} = 2K_{i+j}$. In either case, $\overline{S^u}$ has a 2-factor, this implies

$$\ell(S) = 0.$$

When $n \geq 2(i+j+1)$, then the degree of every vertex v_i in $\overline{S^u}$ is given by

$$\begin{aligned} d(v_i) &\geq 2(i+j+1) - (i+j+1) \\ &\geq \frac{n}{2} \end{aligned}$$

Therefore, $\overline{S^u}$ is Hamiltonian, this implies $\overline{S^u}$ is 2-factorable. Therefore,

$$\ell(S) = 0.$$

■

4. Non-Isomorphic co-regular signed graphs with net-regularity index *k*

In this section, we explore the problem posed by Hameed et al. [19]:

Problem 4.1: How many non-isomorphic co-regular signed graphs are possible with a particular admissible net-regularity index *k*?

More precisely, we give lower bound for Problem 4.1. We use the sequence of a positive and negative degrees of vertices with net-regularity index *k*.

Theorem 4.2: *For a co-regular signed graph with n vertices and net-regularity index k, if N represents the number of the non-isomorphic co-regular signed graph, then*

For n even,

$$N \geq \begin{cases} \dfrac{n-k+1}{2} & \text{when } k \text{ is odd,} \\ \dfrac{n-k}{2} & \text{when } k \text{ is even,} \end{cases}$$

For n odd,

$$N \geq \begin{cases} \dfrac{n-k+3}{4} & \text{when } k \text{ is even and } \dfrac{n+k+1}{2} \text{ odd ,} \\ \dfrac{n-k+1}{4} & \text{when } k \text{ is even and } \dfrac{n+k+1}{2} \text{ even,} \end{cases}$$

Proof: Let S be a co-regular signed graph with n vertices and net-regularity index k. we consider two cases:

Case 1. When n is even.

Since the difference between positive and negative degree is k, we can write the positive and negative degrees of vertices in a sequence form. More general, consecutive terms of the sequence is $(n-a, n-(a-k))$, where $a \leq n$. Also, sum of the positive and negative degree of any vertex must not exceed $n-1$, i.e.

$$(n-a)+(n-(a-k)) \leq n-1$$

$$\text{or } \frac{n+k+1}{2} \leq a$$

Therefore,

$$\frac{n+k+1}{2} \leq a \leq n \tag{3}$$

When n and k both are even, then all possible values of a are as follows:

$$\frac{n+k+2}{2}, \quad \frac{n+k+4}{2}, \ldots, n$$

Now to find out the number of the non-isomorphic co-regular signed graphs, we calculate the total number of terms in the above sequence.

$$\textit{Total number of terms} = n - \frac{n+k+2}{2} + 1 = \frac{n-k}{2}$$

Therefore,

$$N \geq \frac{n-k}{2} \tag{4}$$

If n is even and k is odd, then from Equation (3), all possible values of a are as follows:

$$\frac{n+k+1}{2}, \quad \frac{n+k+3}{2}, \ldots, n$$

Now to find out the number of the non-isomorphic co-regular signed graphs, we calculate the total number of terms in the above sequence.

$$\textit{Total number of terms} = n - \frac{n+k+1}{2} + 1 = \frac{n-k+1}{2}$$

Therefore,

$$N \geq \frac{n-k+1}{2} \tag{5}$$

Case 2. When n is odd.

Since n is odd, therefore, the degree of every vertex must be even, which implies that both positive and negative degrees of the co-regular signed graph must be even. First, let k be even. Now, to calculate the number of the non-isomorphic co-regular signed graphs, we have to omit all even values of a in Equation (3). Therefore, all possible values of a are as follows:

$$\frac{n+k+1}{2}, \quad \frac{n+k+3}{2}, \ldots, n$$

If $\frac{n+k+1}{2}$ is even, then the above sequence starts from $\frac{n+k+3}{2}$

$$\frac{n+k+3}{2}, \quad \frac{n+k+7}{2}, \ldots, n$$

Now, the total number of terms in this sequence

$$= \frac{n - \frac{n+k+3}{2}}{2} + 1 = \frac{n-k+1}{4}$$

Therefore,

$$N \geq \frac{n-k+1}{4} \tag{6}$$

If $\frac{n+k+1}{2}$ is even, then total number of terms in this sequence

$$= \frac{n - \frac{n+k+1}{2}}{2} + 1 = \frac{n-k+3}{4}$$

Therefore,

$$N \geq \frac{n-k+3}{4} \tag{7}$$

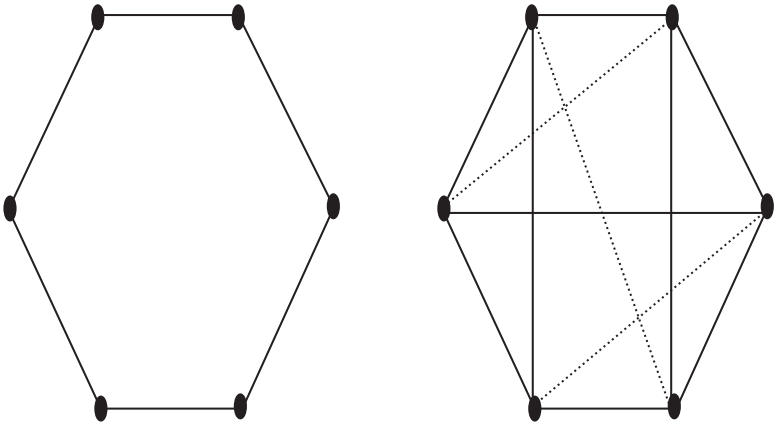

Figure 4. Non-isomorphic co-regular signed graph for $n = 6$ and $k = 2$.

Now, from Equations (4) –(7), we can easily conclude that For n even,

$$N \geq \begin{cases} \frac{n-k+1}{2} & \text{when } k \textit{ is odd}, \\ \frac{n-k}{2} & \text{when } k \textit{ is even}, \end{cases}$$

For n odd,

$$N \geq \begin{cases} \frac{n-k+3}{4} & \text{when } k \textit{ is even and } \frac{n+k+1}{2} \textit{ odd}, \\ \frac{n-k+1}{4} & \text{when } k \textit{ is even and } \frac{n+k+1}{2} \textit{ even}, \end{cases}$$

■

Example 4.3: For $k = 2$, number of non-isomorphic co-regular signed graph of order n are

$$N \geq \begin{cases} \frac{n+1}{4} & \text{when } n \textit{ is odd and } \frac{n+3}{2} \textit{ odd}, \\ \frac{n-1}{4} & \text{when } n \textit{ is odd and } \frac{n+3}{2} \text{ even}, \\ \frac{n-2}{2} & \text{when } n \textit{ is even}, \end{cases}$$

Here we draw non-isomorphic co-regular signed graphs for $n = 6$ and $k = 2$ (see Figure 4).

5. Spectral analysis of the embedding of sign-regular signed graph

In this section we establish the relation between the characteristic polynomial of a sub-signed graph and the signed graph in which it is embedded, where the signed graph is all-positive. For which we first derive the relationship between the characteristic polynomial of G and the characteristic polynomial of G plus one vertex i.e. $G + v$ and characteristic polynomial of G plus one edge i.e. $G + uv$. The formula for the characteristic polynomials of the graph $G-v$ obtained from G by removing one vertex v and the edges adjacent to v is discussed in [25]. Further, we generalize these results for multiple vertices and edges addition. The characteristic polynomial of the graph is given by Cvetkovic in 1971.

Theorem 5.1 ([25]): *Let v be a vertex of graph G and let $\mathcal{C}(v)$ be the collection of cycles containing v. Then $\phi(G)$ satisfies*

$$\phi(G) = x\phi(G-v) - \sum_{u \text{ adj } v} \phi(g-u-v) - 2\sum_{Z\in\mathcal{C}} \phi(G-V(Z)). \tag{8}$$

Theorem 5.2 ([26]): *Let G be a graph, its characteristic polynomial is given by $\phi(G) = \sum_{i=0}^{n} a_i\lambda^{n-i}$. Let U_i be the basic figure of order i of the graph G whose components are either K_2 or cycles. Then*

$$a_i = \sum_{U_i\in G} (-1)^{P(U_i)} 2^{c(U_i)}$$

where $P(U_i)$ and $c(U_i)$ denotes the number of components and the number of cycles in the basic figure of order i.

Gardiner [23] gave the results for the minimum number of vertices required to embed a k-regular graph into $(k+1)$-regular graph

Theorem 5.3 ([23]): *Let G be a k-regular graph on n vertices. Then G always embeds in a $(k+1)$-regular graph. Let $\nu(G)$ be the minimum number of extra vertices required to realize such an embedding.*

(i) *If $\overline{G}$ has a 1-factor, then $\nu(G) = 0$.*
(ii) *If $\overline{G}$ has no 1-factor and n, k have opposite parity, then $\nu(G) = 1$.*
(iii) *If $\overline{G}$ has no 1-factor and n, k have the same parity, then $n < 2k$ and $\nu(G) = k+2$.*

In the results proved below $\mathcal{P}(S)$ denotes the collection of paths between any two vertices of S

Theorem 5.4: *The relationship between characteristic polynomial of G and $G+uv$ is as follows*

$$\phi(G) = \phi(G+uv) + \phi(G-u-v) + 2\sum_{Z_j\in\mathcal{P}(uv)} \phi(G-V(Z_j)) \tag{9}$$

Proof: Let G be a finite graph of order n and now we add an edge uv in G and get a new graph $G+uv$. Let M and M' be a basic figure of order i of G and $G+uv$, respectively. Now from Theorem 5.2, $\phi(G) = \sum_i a_i x^{n-i}$. Now we establish a one-to-one correspondence between those basic figures contributing to a_i on the left and those contributing to one of the terms on the right in (9). Moreover, if M contribute a value m to the coefficient of x^{p-i} on the left, then one can see that M' also contributes m' in each case. The effect of this newly added edge in basic figures of $G+uv$ with respect to G gives rise to three possibilities:

(i) Since $uv \notin M$. If M' is the same basic figure, which can be viewed as a supergraph of G, then M' contributes m to the coefficient of x^{p-i} in $\phi(G+uv)$.

(ii) Let uv contributes in basic figures of order two in M'. Let M be $M' - V(K_2)$ viewed as a subgraph of $G + uv - V(K_2)$ which is similar to $G - V(K_2)$. In this case, $M = M' - V(K_2) = M - V(K_2)$, so M' contributes

$$(-1)^{P(M')}(2^{c(M')}) = -(-1)^{P(M)}(2^{c(M)}) = -m \text{ to } x^{p-i} \text{ in } \phi(G-u-v). \quad (10)$$

Hence, it supplies mx^{p-i} to $-\phi(G-u-v)$. Since $G+uv$ is a supergraph of G, so we have to subtract this term from the right side to get one-to-one correspondence. Therefore, it becomes $\phi(G-u-v)$.

(iii) Let uv contributes in cycles in basic figures of M'. For this case, we have $M = M' - V(C(uv))$, which can also be written as $M - V(\mathcal{P}(uv))$, where $\mathcal{P}(uv)$ denotes the collection of paths from u to v in G. So M' contributes

$$(-1)^{P(M')}(2^{c(M')}) = -\frac{1}{2}(-1)^{P(M)}(2^{c(M)}) = -\frac{m}{2} \text{ to } x^{p-i} \text{ in } \phi(G-\mathcal{P}(uv)). \quad (11)$$

Similar to the above case, M' contributes mx^{p-i} in $2\phi(G - V(\mathcal{P}(uv)))$.

Thus, from each of the above mentioned cases, we can conclude

$$\phi(G) = \phi(G+uv) + \phi(G-u-v) + 2\sum_{Z_j \in \mathcal{P}(uv)} \phi(G - V(Z_j)) \qquad \blacksquare$$

The next Theorem gives a relationship between the characteristic polynomial of graph G and $\phi(G+v)$, where neighbours of the vertex v are the vertices in S, where $S \subseteq V(G) = \{1, 2, \ldots, n\}$ also, S is nonempty set. The method of proof is similar to Theorem 5.4, and is omitted.

Theorem 5.5: *The relationship between the characteristic polynomials of G and $G+v$ is*

$$\phi(G) = \frac{1}{x}(\phi(G+v) + \sum_{u \in S} \phi(G-u) + 2\sum_{Z_j \in \mathcal{P}(G)} \phi(G - V(Z_j))) \quad (12)$$

In the following result we obtain a relationship between the characteristic polynomial of G^* and G, where G^* is the graph obtained from G by adding one edge uv and one vertex v' whose neighbours are the vertices in S, where $S \subseteq V(G) = \{1, 2, \ldots, n\}$ also, S is nonempty set. Now using Theorems 5.5 and 5.4, we have the following result

Corollary 5.6: *For the graphs G and G^*, their characteristic polynomials are related as:*

$$\phi(G) = \frac{1}{x}\Bigg[\phi(G^*) + \sum_{u \in S}\phi(G-u) + 2\sum_{Z_i \in \mathcal{C}(S)} \phi(G - V(Z_i)) + \phi(G+v-v_i-v_j) + 2\sum_{Z_j \in \mathcal{C}(e_{ij})} \phi(G+v-V(Z_j))\Bigg] \quad (13)$$

The next two theorems are the generalization of Theorems 5.4 and 5.5. Here G'_v is the graph obtained from G by adding some new vertices say, $\{v_1, v_2, \ldots, v_m\}$, whose neighbours are the vertices in S_i, where $S_i \subseteq V(G) = \{1, 2, \ldots, m\}$ also S is nonempty set and G'_e be the graph obtained from G by adding some new edges say $\{e_1, e_2, \ldots, e_m\}$, where e_{ij} is an edge between v_i *and* $v_j\}$. Let $\mathcal{C}(e_{ij})$ denotes the collection of cycles containing the edge e_{ij} and $\mathcal{L}(e_i)$ is collection of end vertices of the edge.

Theorem 5.7: *Let G and G'_v be finite graphs. Then*

$$\phi(G) = \frac{1}{x^n}\left[\phi(G'_v) + \sum_{i=0}^{n} x^{m-i-1}\left\{\sum_{v\in S_{i+1}} \phi(G + X_i - v) + 2\sum_{Z_i \in \mathcal{C}(v_{i+1})} \phi(G + X_i - V(Z_i))\right\}\right] \tag{14}$$

where $X_0 = \{\}$ and for $i \geq 1$, $X_i = \{v_1, v_2, \ldots, v_i\}$.

Proof: Let G be a finite graph of order n and now we add m new vertices say, $\{v_1, v_2, \ldots, v_m\}$ and get a new graph G'_v. Let M and M' be a basic figure of order i of G and G'_v respectively. Now from Theorem 5.2, $\phi(G) = \sum_j a_j x^{n-j}$. Now we establish a one-to-one correspondence between those basic figures contributing to a_i on the left of equation and those contributing to one of the terms on the right in Equation (14). Moreover, if M contribute a value m to the coefficient of x^{p-i} on the left, then one can see that M' also contributes m in each case. The effect of this newly added vertices in basic figures of G'_v with respect to G gives rise to following possibilities:

(i) Since $v_i \notin M\ \forall 1 \leq i \leq m$. If M' is the same basic figure, which can be viewed as a supergraph of G, then M' contributes $\frac{k}{x^m}$ to the coefficient of x^{p+m-j} in $\phi(G'_v)$.

(ii) Let v_1 contributes in basic figures in M'. Then there are two possibilities:

(a) Let v_1 contributes to basic figures of order two in M'. Let M be $M' - V(K_2)$ viewed as a subgraph of G'_v which is similar to $G-v$ where, $v \in S_1$. In this case, $M = M' - V(K_2) = M - v$, so M' contributes

$$(-1)^{P(M')}(2^{c(M')}) = -(-1)^{P(M)}(2^{c(M)}) = -m.$$

Hence, it supplies $-m$ to $x^{p+m-1-j}$ in $-\phi(G - v)$. Since G'_v is a supergraph of G, so we have to subtract this term from the right side to get one-to-one correspondence. Therefore, it becomes $x^{m-1}\phi(G - v)$.

(b) Let v_1 contributes in cycles in basic figures of M'. For this case, we have $M = M' - V(\mathcal{C}(v))$. So M' contributes

$$(-1)^{P(M')}(2^{c(M')}) = -\frac{1}{2}(-1)^{P(M)}(2^{c(M)}) = -\frac{m}{2}.$$

Similar to the above case, M' contributes to $-\frac{m}{2}$ in $x^{p+m-1-j}$ in $2x^{m-1}\phi(G - V(\mathcal{C}(v)))$.

Now let v_2 contributes in basic figures of order two in M'. Then again there are two possibilities arise:

(a) Let v_2 contributes in basic figures of order two in M'. Let M be $M' - V(K_2)$ viewed as a subgraph of G'_v which is similar to $G - v + v_1$ where, $v \in S_2$. In this case, $M = M' - V(K_2) = M - v$, so M' contributes

$$(-1)^{P(M')}(2^{c(M')}) = -(-1)^{P(M)}(2^{c(M)}) = -m.$$

Hence, it supplies $-m$ to $x^{p+m-2-j}$ in $-\phi(G - v + v_1)$. Since G'_v is a supergraph of G, so we have to subtract this term from the right side to get one-to-one correspondence. Therefore, it becomes $x^{m-2}\phi(G - v + v_1)$.

(b) Let v_2 contributes in cycles in basic figures of M'. For this case, we have $M = M' - V(\mathcal{C}(v)) + v_1$. So M' contributes

$$\begin{aligned}(-1)^{P(M')}(2^{c(M')}) &= -\frac{1}{2}(-1)^{P(M)}(2^{c(M)}) \\ &= -\frac{m}{2} \text{to } x^{p+m-2-j} \text{ in } \phi(G - V(\mathcal{C}) + v_1).\end{aligned}$$

Similar to the above case, M' contributes $-\frac{m}{2}$ to $x^{p+m-2-j}$ in $\phi(G - V(\mathcal{C}) + v_1)$. Therefore, $-\frac{m}{2}2x^{m-2}$ to x^{p-j} in $\phi(G - V(\mathcal{C}) + v_1)$.

In similar manner we can take the remaining vertices as defined in above cases and take $X_i = \{v_1, v_2, \ldots, v_i\}$, for $1 \le i \le m$ and $X_0 = \{\}$. Thus, from each of the above-mentioned cases, we can conclude

$$\phi(G) = \frac{1}{x^n}\left[\phi(G'_v) + \sum_{i=0}^{n} x^{m-i-1}\left\{\sum_{v \in S_{i+1}} \phi(G + X_i - v) + 2\sum_{Z \in \mathcal{C}(v_{i+1})} \phi(G + X_i - V(Z_i))\right\}\right] \quad \blacksquare$$

The proof of the following theorems are similar to that of Theorem 5.7 and is omitted.

Theorem 5.8: *Let G and G'_e be finite graphs. Then*

$$\phi(G) = \phi(G'_e) + \sum_{i=0}^{m-1}\left[\sum_{v_i \in \mathcal{L}(e_{i+1})} \phi(G + Y_i - v_i) + 2\sum_{Z_i \in \mathcal{C}(e_{i+1})} \phi(G + Y_i - V(Z_i))\right] \tag{15}$$

where, $Y_0 = \{\}$ and $Y_i = \{e_1, e_2, \ldots, e_m\}$ for $i \ge 1$.

Theorem 5.9: *Let G be a finite graph of order n. Let G' be the graph obtained from G by adding some new edges say $\{e_1, e_2, \ldots, e_m\}$, where e_{ij} is an edge between v_i and v_j} and a vertex v whose neighbours are the vertices in S, where $S \subseteq V(G) = \{1, 2, \ldots, n\}$ also, S is*

nonempty set. Let $\mathcal{C}(e_i)$ denotes the collection of cycles containing the edge e_i. Then

$$\phi(G) = \frac{1}{x}\left[\phi(G^*) + \sum_{u\in S}\phi(G-u) + 2\sum_{Z_i\in\mathcal{C}(S)}\phi(G-V(Z_i)) + \sum_{i=0}^{m-1}\left\{\sum_{v_i\in\mathcal{L}(e_{i+1})}\phi(G+v+Y_i-v_i) + 2\sum_{Z_i\in\mathcal{C}(e_{i+1})}\phi(G+v+Y_i-V(Z_i))\right\}\right] \tag{16}$$

where, $Y_0 = \{\}$ and $Y_i = \{e_1, e_2, \ldots, e_m\}$ for $i \geq 1$.

Corollary 5.10: *Let G be a k-regular graph on n vertices and it embeds in a $(k+1)$-regular graph G', such that $\overline{G}$ has a 1-factor. Then the relation between characteristic polynomial of G and G' is*

$$\phi(G) = \phi(G') + \sum_{i=0}^{\frac{n}{2}}\left[\sum_{v_i\in\mathcal{L}(e_{i+1})}\phi(G+Y_i-v_i) \quad +2\sum_{Z_i\in\mathcal{C}(e_{i+1})}\phi(G+Y_i-V(Z_i))\right]$$

where, $Y_0 = \{\}$ and $Y_i = \{e_1, e_2, \ldots, e_{\frac{n}{2}}\}$ for $i \geq 1$.

Proof: The proof directly follows from Theorems 5.3 and 5.8.

OR

Let G be a k-regular graph on n vertices, such that $\overline{G}$ has a 1-factor and embeds in a $(k+1)$-regular graph G'. Therefore, from Theorem 5.3, G' is obtained from G by adding $\frac{n}{2}$ edges of one factor in $\overline{G}$. Thus by Theorem 5.8,

$$\phi(G) = \phi(G') + \sum_{i=0}^{\frac{n}{2}}\left[\sum_{v_i\in\mathcal{L}(e_{i+1})}\phi(G+Y_i-v_i) + 2\sum_{Z_i\in\mathcal{C}(e_{i+1})}\phi(G+Y_i-V(Z_i))\right]$$

■

Corollary 5.11: *Let G be a k-regular graph on n vertices and it embeds in a $(k+1)$-regular graph G', such that G' has no 1-factor and n, k have opposite parity. Then the relation between characteristic polynomial of G and G' is*

$$\phi(G) = \frac{1}{x}\left[\phi(G') + \sum_{u\in S}\phi(G-u) + 2\sum_{Z_i\in\mathcal{C}(S)}\phi(G-V(Z_i)) + \sum_{i=0}^{\frac{n-k-3}{2}}\left\{\sum_{v_i\in\mathcal{L}(e_{i+1})}\phi(G+v+Y_i-v_i) + 2\sum_{Z_i\in\mathcal{C}(e_{i+1})}\phi(G+v+Y_i-V(Z_i))\right\}\right]$$

where, $Y_0 = \{\}$ *and* $Y_i = \{e_1, e_2, \ldots, e_{\frac{n-k-3}{2}}\}$ *for* $i \geq 1$ *and* v *is a vertex whose neighbours are the vertices in* S*, where* $\phi \neq S \subseteq V(\overline{G}) = \{1, 2, \ldots, k+1\}$*,* $\mathcal{L}(e_i)$ *denotes the collection of end vertices of* e_i*.*

Proof: Since $\overline{G}$ has no 1-factor and n, k have opposite parity, therefore, from Theorem 5.3, we have to add $\frac{n-k-1}{2}$ new edges and a vertex say v' with $k+1$ neighbours to G. Thus, from Theorem 5.9,

$$\phi(G) = \frac{1}{x}\left[\phi(G') + \sum_{u \in S}\phi(G-u) + 2\sum_{Z_i \in \mathcal{C}(S)}\phi(G - V(Z_i)) + \sum_{i=0}^{\frac{n-k-3}{2}}\left\{\sum_{v_i \in \mathcal{L}(e_{i+1})}\phi(G+v+Y_i-v_i) + 2\sum_{Z_i \in \mathcal{C}(e_{i+1})}\phi(G+v+Y_i-V(Z_i))\right\}\right]$$

■

6. Conclusion

The proof of the Theorems in Section 3 can also be worked out by an alternative method of matching as it has been shown in the proof of Theorem 6 (see, [21]). It is a well-posed problem in graph theory in the realm of embedding that every graph can be embedded as a subgraph in a regular graph and also it remains induced. Dr B. D. Acharya in personal communication in 2012 (see 'Acharya BD. Personal communication; 2012') inspired the authors to work on the following conjecture:

Conjecture 6.1 (see 'Acharya BD. Personal communication; 2012'): *Every signed graph with maximum positive degree* Δ^+ *and maximum negative degree* Δ^- *can be embedded in a* $(\Delta^+ + 1, \Delta^- + 1)$*-sign-regular signed graph.*

In the literature we have the following Theorem which deals with proof of the above mentioned Conjecture 6.1 for co-regular signed graph:

Theorem 6.2 ([19]): *Every signed graph* S *can be embedded in an* (r, k)*-co-regular signed graph for all* $r \geq \Delta_S^+ + \Delta_S^-$ *and for all* k *with the same parity as that of* r *satisfying* $2\Delta_S^+ - r \leq k \leq r - \Delta_S^-$*.*

From Theorem 6.2, we can easily conclude the following:

Remark 6.3: Every signed graph S can be embedded in an (i, j)-sign-regular signed graph for all $i + j \geq \Delta^+ + \Delta^-$ satisfying $2\Delta^+ - i \leq i \leq i - 2\Delta^-$, where Δ^+ and Δ^- denote maximum positive and negative degree of S respectively.

Relationship between characteristic polynomial of (i, j)-sign-regular signed graph and the characteristic polynomial of $(i+1, j+1)$-sign-regular signed graph in which it embeds is dealt elsewhere.

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Influence of Social Media on the Scholastic Development of Students

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Keywords: Social Media, Students, Scholastic performance, Technological advancements

ABSTRACT

Social Media Platforms are the platforms that give individuals the opportunity to interact, using two way communication. It means that anyone who has got an online account can share their opinions with other social media users. Every other person is now using the Social Media; no matter what their age or gender is. So, it becomes extremely important to understand how it influence the scholastic development and performance of the students. The young generation is the one that is caught in the rapid technological advancements and developments. This study is focussed to find out whether Social Media like Facebook affects the performance of students academically. The findings shows that there is no relationship between social media and scholastic performance as it is clearly projected in their overall grade average which doesn't change with the number of hours spent on social media. Neither does it affect the amount of time they invest in studying.

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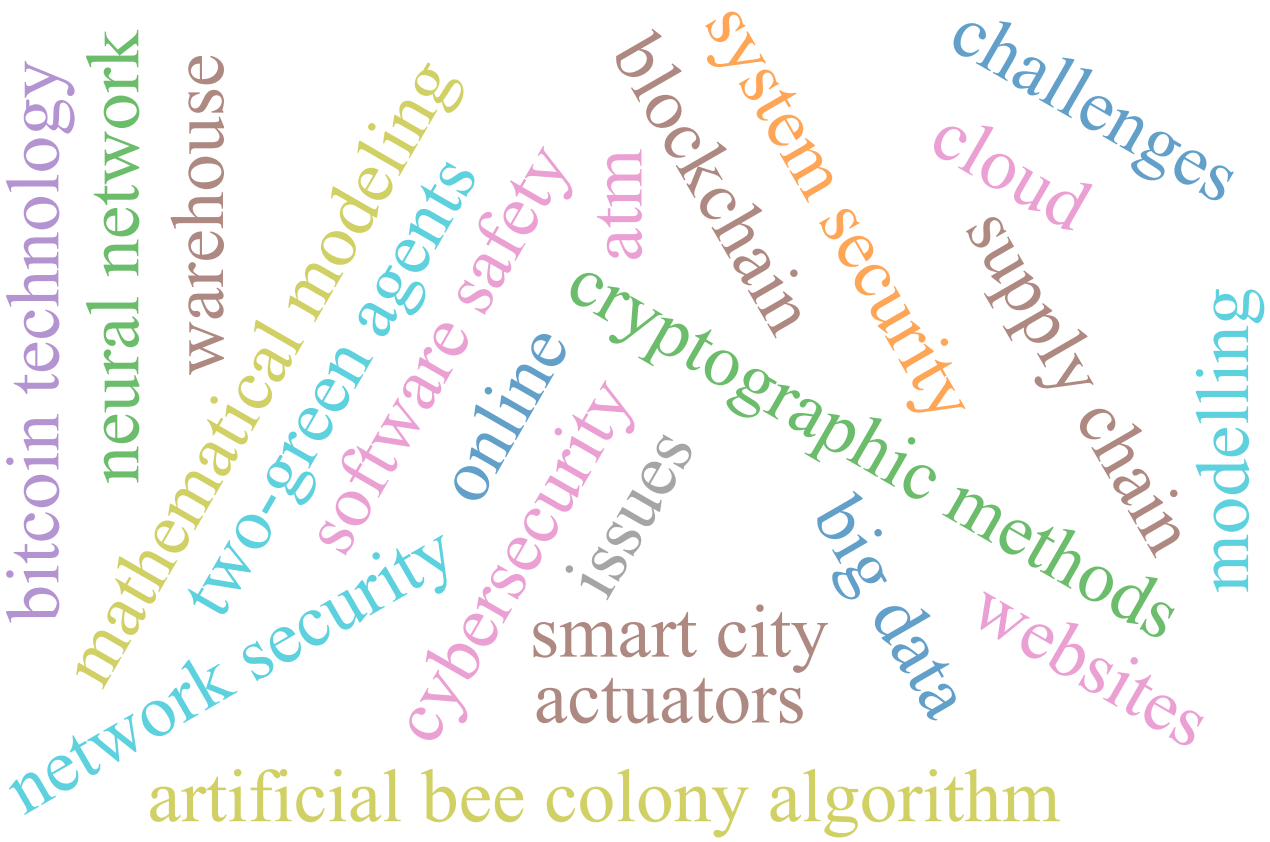

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TRINITY JOURNAL OF MANAGEMENT, IT & MEDIA (TJMITM)

Science of Media Writing: What, Why, How, Where, When and for Whom to write?

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Keywords: Science, Media Writing, Eloquent Writing, Clarity, Target Audience

ABSTRACT

One of the major ways of communicating with the audiences in the media is through writing. And for that, a person should understand the craft properly. Science is about getting objective knowledge. It's all about asking questions, making observations, and distinguishing between what we know and what we don't. To understand how things work, science helps us develop rules — laws that should be viewed with skepticism. Writing is also skill based and requires following rules and regulations. To be eloquent i.e. fluent or persuasive in writing requires a proper understanding of the language of the target audience. The science of media writing helps to identify how to use this language to bring more clarity and make it understandable for the target audiences. The aim of this study is to throw light on the what, why, how, where and for whom of media writing. This is a small initiative to bring into notice and understand how to improve your writing skills by understanding the answers to these questions. This paper will bring into light what you can write, why you should write, how to write it, where you can publish it and who your target audience will be. This will eventually improve your writing game and establish you as a skilled communicator in the field of media writing. The study is unique in the sense that an attempt has been made to find out the answers to these questions in the best possible manner by going through various examples and books available in the field of writing.

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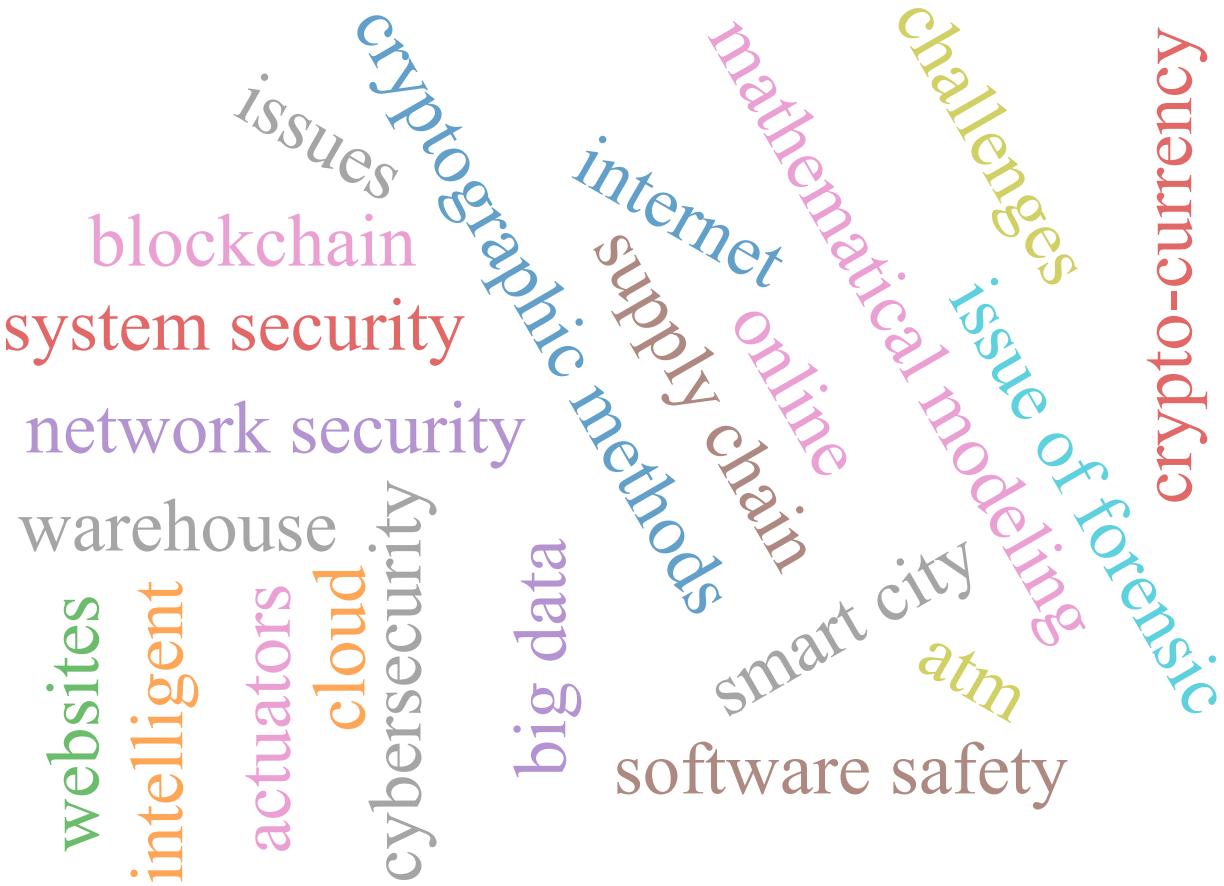

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Role Of Electronic Media In Promoting Environmental Sustainability In India

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Abstract: This research paper aims to explore the role of electronic media, specifically television, in promoting environmental awareness, development, literacy, social awareness, and political consciousness, with a focus on contributing to the Sustainable Development Goals (SDGs). The study investigates how India's English-language electronic media represent environmentally sustainable development activities and compares the level of environmental reporting among five prominent news channels: DD News, CNN-News 18, NDTV 24x7, Times Now and Republic TV. Furthermore, the paper examines media's understanding of environmental sustainability, their coverage of related issues, and the level of responsibility they assume in this regard.

Keywords - Environmental awareness, climate change, environmental sustainability, electronic media, Television News, SDGs

I. INTRODUCTION

India, accounting for 2.4 per cent of the world's land area, supports a staggering 16 per cent of the global population (Kumar 2023). Unfortunately, like many other nations, India is grappling with the challenges posed by climate change. Consequently, the country's natural resources have been exploited in an unsustainable manner for several generations, leading to severe environmental degradation. The burden on India's land and resources has become overwhelming due to the massive population overgrowth.

The repercussions of this environmental degradation are substantial, with India facing an annual loss of $87 billion (Kulkarni, 2022). For instance, in 2014, the government sanctioned $137 million to address the devastating floods in Kashmir (India Today 2016), and an additional $11 billion was allocated for compensating the damages caused by cyclone ‘Hudhud’ (The Economic Times 2015). Climate change has also begun to impact agricultural productivity, as projected by the Agriculture Ministry's report presented to a parliamentary committee. The report suggests that numerous crops may experience a decrease in yield due to climate change, although soybean, Bengal gram, groundnut, coconut (on the West coast), and potato (in Punjab, Haryana, and western Uttar Pradesh) could potentially see improvements. The ministry also believes that altering farming practices to adapt to climate change could increase crop yields by 10 to 40 per cent after 2021. Nevertheless, as of today, some states in the Northeast and northern India are grappling with floods, while suffocating heatwaves torment the western region (Gupta and Pathak 2016).

A government report titled 'India Habitat III-National Report,' released by the Ministry of Housing and Urban Poverty Alleviation, emphasizes the pressing need to strike a balance between India's projected growth trajectory and environmental sustainability. The report acknowledges that India faces significant environmental challenges triggered by extreme weather conditions, necessitating substantial adjustments in urban planning, land-use management, and infrastructure strategies and norms (The Hindu 2016).

Undoubtedly, the environment versus development debate has been at the forefront of Indian discourse for the past two decades. Pollution remains a major issue, intricately linked with the challenges of development. While progress is imperative, effective pollution control measures must also be implemented to safeguard humanity. The Kyoto Protocol recognized the principle that countries emitting higher levels of carbon into the atmosphere bear greater responsibility for saving the world. However, this principle is now under scrutiny (UNFCC 2023). Merely expressing concern about the deteriorating state of water, air, forests, and the sky on Environment Day is insufficient. The Indian Government's aspirations to enhance infrastructure and achieve higher economic growth rates have encountered obstacles due, in part, to disputes over environmental policies and land ownership.

In this context, the media plays a crucial role in raising awareness about environmental sustainability and driving action to protect the environment. This study focuses on examining the current and potential impact of electronic media in promoting environmental awareness.

II. ENVIRONMENTAL SUSTAINABILITY AND MEDIA

The role of electronic media in fostering public understanding of environmental issues is significant. Solving today's complex local and global environmental challenges and progressing towards sustainability cannot solely rely on "experts." It requires the active involvement and support of an informed public in their various capacities as consumers, voters, employers, business leaders, and community members, as emphasized by the Canadian Environmental Grantmakers' Network (2006).

Mass media, including electronic media, have become indispensable partners in global biodiversity conservation and management. They serve multiple roles, not only by raising awareness about environmental problems and the challenges associated with achieving sustainability but also by influencing human perception, attitudes, and behaviour towards environmental resources (Ogunjinm et al., 2013). However, in India, there have been limited systematic studies examining the extent, quality, breadth, and public perceptions of media coverage related to environmental sustainability. One such study conducted by Kapoor (2011) focused on the role of mass media in promoting environmental issues in the city of Allahabad in Uttar Pradesh. The study concluded that there is an urgent need for effective mass communication strategies to generate environmental awareness (Kapoor, 2011).

The media has always been recognized for its significant role in society, as it serves as a vital source of information that shapes people's understanding and perception of the world they inhabit (UNESCO, 2011). Consequently, the media can play a crucial role in raising awareness about environmental sustainability and its associated impacts. This study aims to assess the credibility of English-language news channels in promoting awareness of environmental sustainability. It will investigate how India's English-language electronic media portray activities related to sustainable development and analyse which TV news channel demonstrates a greater commitment to environmental reporting compared to its counterparts. Television news channels play a dual role in addressing environmental sustainability issues. On one hand, they serve as platforms to explain environmental policies, regulations, and plans to the public. On the other hand, they reflect the concerns of the public regarding various environmental problems, thereby exerting pressure on decision-makers to address specific environmental issues (Prakash, 2013).

III. STATEMENT OF THE PROBLEM

Television serves as an influential medium to disseminate information and shape public opinion. By analysing the representation of environmentally sustainable development activities on English-language news channels in India, this study aims to shed light on the media's role in promoting sustainable development. The Sustainable Development Goals, adopted by the United Nations, provide a comprehensive framework for addressing global challenges, including environmental sustainability. This research investigates the extent to which the media contributes to these goals through their coverage of environmental issues. Television serves as a powerful medium for promoting environmental awareness, development, literacy, social consciousness, and political engagement. It plays a crucial role as the primary source of information for the general public. Therefore, it carries the responsibility of setting the agenda on environmental issues and prioritizing them accordingly. However, a review of documents related to environmental evaluation and annual reports reveals a lack of comprehensive recognition of awareness creation regarding these issues in electronic media.

Furthermore, the researcher firmly believes that policymakers and implementers should be aware of how environmental awareness activities have been carried out, their progress since their inception, and their successes and failures. Without this understanding, it is impossible to ensure progress in mitigating the causes and consequences of environmental problems in development activities. Considering the aforementioned context, the problem that requires investigation is the actual and potential role of television news channels in terms of their commitment to raising awareness about environmental issues. There is a necessity to assess the contribution of electronic media in achieving sustainable development goals.

IV. OBJECTIVES OF THE STUDY

1. Assessing the role of electronic media in raising awareness of environmental sustainability issues: The study aims to examine the extent to which electronic media, particularly television news channels, contribute to creating awareness about environmental sustainability. It will explore the coverage and representation of these issues to determine the effectiveness of the media in promoting environmental awareness among the general public.

2. Analysing the time allocation for environmental sustainability issues: The study seeks to investigate the amount of airtime dedicated to environmental sustainability topics by television news channels. By analysing the duration and frequency of coverage, it aims to assess the priority given to environmental sustainability issues in the media agenda.

3. Examining the current status of television news content on environmental sustainability: The study will assess the quality and depth of television news content related to environmental sustainability issues. It will analyse the themes, perspectives, and approaches taken while reporting on these topics, providing insights into the current state of environmental sustainability coverage in the media.

By addressing these objectives, the study aims to provide a comprehensive understanding of the role and effectiveness of electronic media, specifically television news channels, in creating awareness of environmental sustainability issues.

V. METHODOLOGY

The study utilizes a qualitative research design, employing content analysis as the primary method. A sample of five English-language news channels in India, namely DD News, CNN-News 18, NDTV 24x7, Times Now, and Republic TV, was selected for analysis. A systematic approach is employed to examine the channels' coverage of environmentally sustainable development activities over a specific period. The analysis focuses on understanding the media's interpretation of environmental sustainability, the depth and breadth of their coverage, and the level of responsibility they assume in addressing these issues.

The study employed the following methodology for data collection and analysis:

Selection of news channels: The five English-language news channels, namely DD News, CNN-News18, Republic TV, Times Now, and NDTV 24x7 were chosen based on their viewership, longevity, and popularity. These channels represent a diverse range of news sources.

Focus on Prime-Time programming: Primetime programming, which typically spans from 8 to 11 pm, was selected as the time period for data collection. This time slot is considered the industry benchmark for news channels and attracts a significant viewership.

Data collection: A two-week period, specifically from 1st to 14th June 2023 was chosen for data collection. This timeframe includes World Environment Day (celebrated on June 5 every year), which allows for an examination of how news channels prioritize environmental sustainability-related coverage. The researcher watched several programs during this period, as well as reviewed content directly from the YouTube channels of the selected news channels.

Categorization of news stories: The reviewed news content was categorized into various predefined categories such as politics, business, sports, environment, crime, and others. The researchers then specifically reviewed and classified the news stories related to environmental sustainability as a separate category.

By following this procedure, the study collected and analysed data from the selected news channels to determine the extent of coverage and focus on environmental sustainability-related issues during the designated prime time period.

VI. ANALYSIS OF NEWS COVERAGE AND FINDINGS

The findings of the content analysis provide insights into how India's English-language electronic media represent environmentally sustainable development activities. The study examines the frequency, quality, and diversity of coverage across the selected news channels. By comparing the channels, it identifies which one exhibits a higher degree of environmental reporting and engagement. The analysis also explores the media's understanding of environmental sustainability, the strategies employed in covering related issues, and the level of responsibility they perceive in the context of sustainable development.

Based on the trend of environmental news coverage from 1st to 14th June 2023, the following observations were made:

1. Accident & Natural Disaster coverage: This category received the highest coverage among environmental issues during the mentioned period. It indicates that incidents related to accidents and natural disasters were extensively covered by the news channels.

2. Active coverage by Times Now, Republic TV & CNN News 18: These three news channels were particularly active in providing broader coverage of environmental issues during the mentioned timeframe.

3. Weather, Environment & Wildlife coverage: These topics received an average level of coverage across all four channels. However, CNN News 18 had a slight edge over the others in terms of coverage in these categories.

4. Minimal coverage on Agriculture: The issue of agriculture had the least coverage among the environmental topics during the specified period. It suggests that agricultural-related environmental concerns received relatively less attention from the news channels.

5. Highest coverage by NDTV 24x7: NDTV 24x7 had the highest overall coverage of environmental issues during prime time. It indicates that this news channel dedicated more airtime to environmental news compared to the others.

6. In terms of the total primetime devoted to environmental issues, NDTV 24x7 had the maximum coverage, followed by CNN News 18, Republic TV, and Times Now.

These findings provide insights into the trends and priorities of the selected news channels in their coverage of environmental issues during the specified period. The current study has yielded the following findings:

1. Minimal coverage of environmental sustainability issues: Environmental sustainability issues accounted for only approximately 0.35% of the news coverage on popular English news channels. This indicates a lack of emphasis and attention given to these issues in the media.

2. Limited focus on environmental sustainability: The analysis of trends in coverage during the period of 1st to 14th June 2023 revealed that news channels rarely prioritized environmental sustainability issues, except for coverage related to World Environment Day. This suggests a lack of consistent focus on these topics.

3. The dominance of AV format in coverage: A significant finding from the analysis of TV shows was that 68% of the stories on environmental sustainability issues were aired in the last segment as AV

(Anchor Visual) format. This format allows for a limited in-depth and comprehensive exploration of environmental sustainability issues.

VII. LIMITATIONS AND FUTURE RESEARCH

This study is limited to five English-language news channels in India and focuses specifically on their coverage of environmentally sustainable development activities. Future research could expand the scope to include regional language channels and investigate the coverage of other SDGs. Additionally, a comparative analysis with international news channels would provide a broader perspective on the representation of sustainable development in the media. Finally, conducting audience research to assess the impact of media coverage on public awareness and engagement with environmental sustainability could further enrich the understanding of the media's role in promoting sustainable development.

VIII. CONCLUSION

The study concludes that there was insufficient emphasis and coverage given to environmental sustainability issues in the media. The limited attention and brief coverage indicate a lack of necessary skills and training among journalists in understanding and reporting on environmental sustainability concepts. The editorial policies of news channels may contribute to the inadequate and inconsistent coverage of environmental sustainability topics on television.

Furthermore, it is crucial to identify the obstacles to environmental awareness and conduct comprehensive research to determine the most effective ways for the media to address environmental issues based on the country's specific context. Training programs should be implemented to equip journalists with the necessary knowledge and understanding of environmental sustainability issues.

Overall, these findings highlight the need for greater attention, emphasis, and training within the electronic media industry to effectively cover and report on environmental sustainability issues. By understanding how India's English-language news channels cover environmentally sustainable development activities, media organizations, policymakers, and other stakeholders can gain insights into the strengths and weaknesses of current media practices. These insights can inform strategies to enhance the media's contribution to achieving Sustainable Development Goals and fostering a more environmentally conscious society.

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Issue of Gender and Violence in Graphic Fiction: Raj Comics Universe and the Depiction of Female Characters and Violence

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Abstract: Comics and graphic fiction in India have treaded on a fluctuating journey of sorts. The decade of the 90's was definitely a golden decade for comics and graphic fiction in India. Raj Comics as a torchbearer of sorts in graphic fiction in India can be studied to ascertain the issues with gender and violence in graphic fiction. The Raj Comics universe with its ensembled superhero universe is a big sample space for scholarly study in the finer aspects of graphic fiction. The study can also be vital in terms of psychographics and demographics of the Hindi heartland as the Raj Comics found its true footing in Hindi speaking states. The influence of Amar chitra katha can be seen on many comics of the era as the graphic artists often hopped from one project to other, simultaneously illustrating several works of graphic fiction at a time. An interesting observation is the depiction of female gender in graphic fiction in India. To add to it the visual depiction of violence within the realm of visual aesthetics of violence is also a worthy study in the direction of scholarly study of the comics and graphic fiction narrative in India.

Keywords: Gender, Narrative, Graphic fiction, Comics, Aesthetics.

1. INTRODUCTION

Graphic fiction and comics in India have an illustrious history. The graphic art is hugely inspired by the various art movements in India, most notably the miniature art school. Graphic fiction can well be a part of Graphic novels or comic books . Graphic novels contain complete narratives, whether or not they are part of a larger series. Comic books contain excerpts of serialized narratives. The Indian graphic fiction industry is itself an important area of study within media economics. It is important to study the Indian contexts within graphic fiction and comics art as the cultural aspects and mass media consumption is different from the european, Japanese manga and american narratives. There can be a silent whisper of how Indian graphic fiction in the form of comics and the issues of degree of influence in character and subject development being heavily borrowed from the western counterparts. The Raj comics with its market reach and efficient distribution system in a way penetrated into north indian homes like

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no other before it. These works of graphic fiction were in forms of periodical comics and special issues often telling a complex narrative in parts or series. The depiction of female characters in Raj comics is an interesting case study in the broader area of representation of gender in media.

Gender representation of mother and sisters

The mothers and sisters have been portrayed within the specific cultural milieu. The graphical representation in fiction of such characters is devoid of any layering. They play a mere supporting part in the progression of the larger narrative. The narrative would not delve into any "Oedipus complex" or "Electra complex" in the story plot.

The outfits and makeup art of female characters

The outfits and makeup art of female characters is synonymous with tight fitting body suits and venetian masks. Shakti the lone female superheroine in Raj comics is a different case study with a getup reminiscent of any ascetic or hermit of the mountains. Though her customers are also revealing in a way and giving boost to male sexual appetite fuelled with a degree of voyeurism. Apart from costumes and getup another factor are the dialogues which are often in an action reaction mode, sans any meaningful conversation. The study of female representation within the context of Raj Comics is important as it has in a way defined the graphic fiction and comics space in a mass mediated space of the Hindi heartland. The aspect of male fetishization of females is often incorporated in a subtle subliminal manner in the graphic art representation of female gender.

Aesthetics of violence in Indian graphic art

The aesthetics of violence in graphic fiction has its genesis in cinema. The hand drawn graphic sequences of fights rely heavily on wrestling traditions of the subcontinent and popular culture. The kung fu martial arts and free style fighting is also used to depict the fighting prowess of certain characters. Violence is an essential harbinger of sorts as a definite means to bring peace. Almost all the superheroes are well versed in one or the other fighting art tradition. Nagraj in snake fighting, kung fu and martial arts. Super commando Dhruv in commando fighting techniques. The hugely popular Doga is a superhero with a certain reflection of an antihero. The birth of Doga(Alter ego of bodybuilder Suraj) is due to the violence and its aftermath in a society where power and money rules the roost. Doga in his crusade to end the organized crime often uses violent means of torture and combat. He is a skilled marksman, boxer, and is apt in the finer details of martial art and wrestling. The Lion Gym where he trains and also is a trainer is where he learned the all round combat skills. Doga can be a cold blooded assassin and also can be a crusader against crime. Super commando Dhruv often relies on his mental acumen and cognitive skills to combat the enemies. Nagraj on the other hand is a lethal killing machine with supernatural powers and fighting skills. The character of Nagraj saw a reboot of a kind after almost 10 years of his launch as the writing and illustration team behind the character got changed. The visual narrative style also saw a complete overhaul with Nagraj also relying on intellect and cognitive powers to end crime, violence taking a backseat or needed only when the situation can be subsided with other skills of communication. Violence is an essential ingredient in Indian graphic novels/ comics where climax and conflict in the narrative structure is incomplete without the selling proposition of violence.

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Male gaze an important tool to sell graphic fiction

Male gaze has been an important aspect when visual narratives are conceptualized. The dames in distress and femme fatales often find their way in visual narratives of graphic fiction to easily objectify the female characters in these narratives. Even the female superheroins in some of the graphic art fiction are modelled on the lines of femme fatales. Their costumes are always ready to reveal a certain body contour to the reader who does a role reversal by shifting between the dual roles of reader and viewer. A kind of male fascination with mammary glands is readily addressed with depiction of the female torso in graphical fiction over the years. The notions of manufactured beauty also get represented in a certain sexist gender representation in graphic fiction. The stringent censorship laws in India in mass media and a niche market for mass mediated graphic fiction which finds its existence in public space makes it difficult to copy the western or japanese standards which are often laden with sexual violence and rape depictions.

Depiction of female body parts in graphic fiction in India over the years.

The depiction of body parts of female characters with an emphasis on cleavage and torso has been an integral style to represent the female characters particularly the female superheroes. The placement in the panels of graphic fiction medium(comics/novel) is also done to maximize the male gaze to its full impact. The issue needs discussion as the graphic fiction in its genre caters to a certain age group where young minds can have an everlasting impression and perceptions on the female body and its deeply unidirectional representation. Sharp facial features coupled with slender waist and low waist garment makes the female characters species of objectification and sexual gratification of a kind. The graphical representations have fuller lips and long necks to cement a certain body type of these females. The graphical representation of female characters is similar in Amar chitra katha and other popular comics houses of the time. The queens and princesses are shown to be exhibiting enormous beauty with highly sexualized body types representations. Raj comics fantasy realm laced with mythological aspects is clearly visible in a superhero ‘Bhokal’(Bhokal is a fictional superhero appearing in Raj Comics. Most stories are based on dark fantasy with blood and gore. He is a legendary winged warrior prince of a fictional fabled Pari Lok (fairyland). He descended to earth to take part in a fighting tournament and landed in Vikasnagar, becoming a zealous defender of the people of Vikasnagar) where the female characters are often ‘blondes’(Turin-Turin: aka Rajkumari Sofia (princess Sofia). Turin is a princess from another planet. First love interest of Bhokal and later became his wife. Turin left Bhokal after Saloni and Rupsi became pregnant with Bhokal's child. Later on it was found that Maya controlled Bhokal's mind to destroy his reputation and his relationship with Turin)

Sexist Nomenclature of female characters in graphic fiction

Names like Chandika, Natasha, Miss Killer, Nagina when portraying the fierce female characters whereas names like sweta, saudangi, Monika(Lomdi(Vixen in a loose translation)), Visarpi. Nagrani, Bharti, Richa(Black Cat), Jane(Common love interest of Kobi Bhediya in Raj Comics).Mamta Pathak(alter ego Paralayanka), Kshipra, Sheena are other love interests of Parmanu(Inspector Vinay) in Raj Comics’s Parmanu. The names are often deeply coated in sexism. The nomenclature is a grim copy of deep sexism that goes with the naming of the Bond girls in the recurring James bond film series.

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The Depiction of Rape Scenes in Popular Hindi Cinema: A Critical Examination of Representation of Gender in Media

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Abstract: **The portrayal of female gender in performing arts has been a product of constant societal change. From the days when Female parts were acted upon by male counterparts to the advent of motion pictures and the role of women in making the medium their own , the journey has been long. This can be also studied under the context of anthropology, gender issues, and women emancipation. The female characters have been always fixed into the narrative by the virtue of a certain appeal they exhibit. From Laura Mulvey's male gaze theory in cinema to the aesthetics of violence in cinema , both have been depicted in experimental ways in films. The portrayal of rape scenes dishonoring the basic existential being of any women have been shot in a number of ways to make a case in point in the film narrative. The shooting of such sequences and the psychological impact of this on the female casts is a critical study within cinema studies. Much to the women empowerment and vocal voices there has been a critical debate on how to film the female body and more so traumatic sequences such as the depiction of rape in the narrative.**

Keywords: Rape, Portrayal, Gender, Narrative, Filming

1. INTRODUCTION

From the early mehboob khan film Amar to Insaaf ka tarazu there have been interesting and challenging times when such sequences required a kind of sensitive treatment while shooting the scenes. Rape scenes or attempt to rape have found a profound space in hindi cinema more so after the 1970's. Some of these sequences have found critics' examination and media coverage of a kind but many have gone into oblivion as far as discourse of a kind concerning these scenes is concerned. Most of the rape scenes have been shot with a voyeristic intent and have often passed the censorship test on their way to be included in the final reel of the film. The Kuleshov effect is also used to full effect where multiple shots convening a specific meaning are played simultaneously to bring required impact into the scene. The Kuleshov effect in a way also deals with censorship issues in a rather convenient manner. Many B grade films have thrived on such gory depiction of the violation of the female body catering to a specific adult target audience and their psychographics and demographics. Cineartists bodies

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and crusaders of emancipation for female artists in cinema have fought a long battle for imposition of guidelines and norms on movie sets while shooting rape sequences in films.

Rape sequences have been shot in mostly close up angles where the violation of the female body and the expressions of trauma have been portrayed. The film Dushman with a psychopath postman playing a rapist who rapes and kills the women, a depiction of Jack the ripper on screen. Marital rapes have been depicted in some films like Daraar(1997), Agnisakshi(1996) both in visual narrative as well as a latent backdrop. 7 Khoon Maaf (2011), is an interesting (and long) take on Ruskin Bond's Susanna's Seven Husbands, 7 Khoon Maaf delves into the very hush-hush territory of marital rape. Susanna's (Priyanka Chopra) third husband Musafir (Irrfan Khan) is a poet, a charmer by the day and a fiend who assaults and rapes her night after night.

A dominant narrative of child rape in critically acclaimed films like Jaago(2004) and in Pitaah(2002) do present a scenario where even girl child are not spared by the colloquial psyche of a society where potential rapists are in abundance.

Raja Ki Aayegi Baraat(1996) starring Rani Mukherjee in the lead role is raped what follows the traumatic incident is that the rapist and the rape victim gets married in a popular solution propounded by the society. The rape scene is filmed where a group of childred close their eyes as they bear witness to the horryfying gory scene where the disgruntled insulted male character(He was earlier slapped by the female lead in a scene for his misogynist pro dowry remarks at a wedding) .

The perpetrators of rape in bombay films are also depicted in a way. Sploit, brash, with a peculiar sense of getup. Their are certainly lechereous men hell bent on proving their masculinity and dominance by forcibly mounting on weaker sex to satiate their quest for lust and power. The resultant self defence by weaker sex involves slapping such rapists, bitting their hands or kicking phallus. The result is that the rapist becomes even more ferocious and then his lustful endeavours take violent dimensions.The disturbing visuals showing a rape scene are often picturized in a multicamera setup where some preexisting cultural signages associated with violation of female honor such as the bangles geeting crushed or forehead tika being swooshed off or the lipstick getting wiped of its lusture and color are some of the signifiers of female honor getting trampled upon by one or the other forms of penetrative forceful sex. The rehabilitation of rape victims after the unfateful aftermath is equally disturbing with peer pressure on getting married to the rapist or aborting the conceived child are common. Name calling happens with society addressing the rape victims as symbols of loose character, impure and worthy of ostracization. Such characters also known as the victims of rape either tread on the path of vengenance , self harm(often resulting in sucide) or simply trying to live with the trauma.

Guilty(2020) an OTT film is a film in the recent past which delves on serious debate about the psyche of rape and issues with victimhood. How in college and university spaces the conflict between class and privilege can bear serious consequences. The rape sequence in the film is shown in flashback with alot of voyerism playing a part in the background, as one of the accomplice of the rapist is filming the event with all the diabolical quirkiness in action. The

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juxtaposition of the #Metoo movement in the narrative proves to be a vital cog in understanding the concepts related to consensual sex and issue with consent.

Mohra(1994) - The gang rape scene is bone chilling and proves to be an important turn in the narrative where a law abiding citizen in order to avenge the turmoil caused in his life due to the death of his rape victim sister and then sucided by his wife to protect her honour from the same rapists turns into a cold assasin, out to cleanse the society of drug mafias . As the rapists were under the influence of drugs and so was the male friend of the victim who couldn't protect her. It is important to note that the girl needs a male protection of sorts to venture out in late night parties. The rape scene is filmed with a loud western music playing in the background, maybe a signifier of how western influence corrupts the youth leading them to debauchery and an increase in sex drive.

Matroobhoomi - A Nation without women(2003) is a film set in an alternate setting where due to widespread female infanticide, a crisis of extreme distortion in sex ratio occurs. A girl is obliged to wed five male members of a family and barring one, who truly loves her, all the other takes turn to have forcible sex with her. Even the patriarch of the family makes sexual advances towards her daughter in law and rapes her.

Ankush(1986) is a vigilante film where the vagabonds , good for nothing street loafers, take revenge when a woman who is also behind their transformation gets raped. The film tells the story of four lower middle class unemployed young men in Mumbai who feel disconnected with society and are wasting their lives, when new neighbours, the beautiful young girl Anita and her grandmother, change their perspective. The men change their attitude and are trying to blend in with the normal, honest and hard-working society of 1980s India when Anita is raped at the hands of her employers. However, the culprits are let off for lack of evidence and Anita commits suicide. Having lost faith in the law of the land, the men take revenge on each culprit, killing them. They are later tried, with all four receiving capital punishment for doing what they thought was right. The depiction of rape scene is done with acute sensitivity without voyeristic intent and is one of the few examples where a necessity in narrative is done with an aplomb of camera work and direction.

The rape scenes have been filmed in a number of perspectives and styles, some incite a kind of voyeristic appeal whereas some have a sense of deep sensitivity in them. In the absence of guidelines and lack of pre contractual agreement as to the the filming of rape scenes clauses there have been multiple instances when a sensitive and traumatic experience of rape has been filmed with a kind of eroticism and voyerism. The censorship rules over the times have also influenced the framing of such sequences in the narrative. The certification process in India has given a rating of ‘A’ to the films and the fight on the part of the makers of the film is to get a ‘UA’ certificate.

Insaaf ka tarazu(1980) is a big budgeted film from a big production house B R chopra films where an important sequence is the rape of the female lead by a maniac villian. The narrative which follows this is a courtroom battle for justice and truth. The sequence is known to present a struggle and fear full of traumatic upheavals.In Insaaf ka Tarazu , Justicia is a woman, a blinded woman. The Tarazu of Insaaf in this story interestingly tips in the favour of the criminal

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time and again. First, Zeenat Aman is shown being brutally raped by Raj Babbar in a graphic scene that sexualises her more, portrays a criminal act less. Right from the helpless woman's bra straps being dramatically removed (expect background music) to the enormous amount of her skin showed, the rapist just throws "rapist looks" but the camera stays on her.

The critically acclaimed Damini(1993) has been touted as one of the most realistic woman-centric films in Bollywood. Damini A Raj kumar Santoshi film has a traumatic rape sequence in it , inflexion point of the plot. A rape done by members of priveledge class on someone who comes from a lower starta of society.

It goes on to tell the story of how a rich family breeds absolute brutes. Damini witnesses the rape of their domestic help at the hands of her husband's brother. The rape done amidst the festivities of Holi is traumatic to the core. A girl is grabbed and taken to unused area in a big palatial house where the perpetrators notably under the influence of intoxicants takes violent turn to rape the victim. The victim happens to be an innocent and bright maid of a promising future at the same household. The violation of her body and soul is so extreme that a scene where the daughter in law of the household who witnessed the scene when visits the victim in a hospital, the victim is shown to be bleeding profusely.

Vinod Mehra and Rekha play newly weds in Ghar (1978), are really happy with their youthful love. However, paradise is lost when Mehra's character Vikas Chandra gets attacked by a bunch of miscreants who then abduct his wife and rape her.Disturbingly close to the Delhi gang-rape case in its order of events, the young couple walk out of a late movie and get no cabs to get back home.

Madhuri Dixit plays Kajri, a young "low caste" girl (the camera loves to linger more on Madhuri’s curves than the issue at hand) who gets raped by a powerful man in Prem Granth (1996). However, this man remains in the background as the story follows a search led out for Kajri by her guileless lover Somen (Rishi Kapoor) who finally discovers a woman who has lost a child. A child born to her by way of rape.The film ends at a vengeful note with the rapist being burnt on Dussehra (again the Goddess Durga motif) which in turn raises a gamut of problematic questions. The film's approach to a sensitive issue like rape is crude and conveniently primitive.

The media portrayal of sensitive issues like rape have been depicted in various ways in cinema. A need for gender sensitization can be an important aspect in creating a sort of literacy on gender issues and crime. The role of cinema as a powerful mass medium, the impressions it is capable of leaving on masses and the predominant ways of depicting the gender on screen is an important study with several dimensions noteworthy of public discourse.

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The Lethal Film Noir Femme Fatale: A Precursor to Bond Girls in James Bond Films.

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Abstract: ***Film noir as a film making style gained prominence in a post world war II world. The filming style of noir with its unique americanization became a force of sorts in the mid 1940's and in much part of the post war booming decade of 50. One of the interesting contribution of film noir apart from aesthetics of visual and lighting techniques is the depiction of female characters which came to be known as femme fatale. Femme fatale in its synonyms and various contours came to be recognized as a character with its diabolical charm and fatal attraction became the reason for the ultimate demise of the male protagonist. The development of femme fatale chracters also paved way for future fetishization of female characters in cinema. The highly popular 007 Bond series is an excellent nursery of sorts where the female characters often found themselves to be either femme fatale or femme atrappe. The paper aims to establish some of the occurrences of this sort of character in Bond films and how their resemblance with the ones in the film noir era was an experiment in creating fierce female characters on the celluloid. The depiction and celluloid portrayal in a way helped establish and explore the various contours of female characters.***

Keywords: Femme Fatale, Bond Girl, Feminism, Film Noir, Fetishization.

1. INTRODUCTION

The lethal archenemy of James Bond was a master manipulator, fatally attractive and reminiscent of the bygone war spies who were apet in honeypotting and were placed in narratives to act as one of the reasons in intensifying the conflict within the screenplay. The mannerism of Bond girls, their depiction, characterization all over the years bear historical resemblance to the film noir femme fatales.The characterization of Bond girls over the years has gone through sea changes but the intrinsic value of the same characters being often typecast in the sand casts of femme fatates is clearly visible till now.

Femme fatale was an important ingredient within the Film noir universe. The portrayal of female characters in these dark themed films was born out of the male insecurities of the time.

Femme fatale of the classic age of hollywood

The classic age of Hollywood in a way coincides with the Film noir films. The aura of film noir was deeply influenced by the way in which female characters were often placed. The

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charm and enchanting mannerism of the female characters often gave way to the ongoing conflict in the plot setting. The fall of the precariously placed antihero was a highly dependent variable and the dependence was closely related to the fallen character of the femme fatales. Barbara Stanwyk, Rita Hayworth, GEne Tierney , Ava Gardner were all the prominent female leads of the 40's and early 50's. They brought in new dimensions to the portrayal of femme fatales. Each had a distinct style and it made it extremely exciting for the audience to see them in the film noir films of the times.

Progress of the film noir

The era of film noir had its ups and downs. The post world war II noir films were able to capture the general mood of the populace. The ongoing war gloom mixed with a kind of skepticism was clearly visible in the initial start to the hollywood film noir. The timeline of noir films have their own crests and troughs with films finding it a challenge to continuously experiment with the similar story plots. The later period of Hollywood film noir in the 50's was finding it difficult to remain true to the signature themes of film noir. The film noir style eventually shifted to the other greener pastures. The most interesting and alluring aspect of the film noir: Femme fatales found their way in the narratives of French new wave and the more popular and post WWII cold war era crime and spy films of James Bond, an adaptation of the literary thriller and adventure genre created by an ex serviceman Ian Fleming. The lethal female leads in the bond films imported a kind of influence from the femme fatales and their portrayal in the film noir genre. Film noir as a cinematical style and theme based concept found its place in similar narratives and settings and the influence made it easy to film certain aspects of crime thriller spy films of the later period.

Influences

The influence of femme fatales of film noir on a number of film genres is immense. The neo-noir female characters were a direct descendent of their film noir counterparts. The vamps and villains in the Bond films borrowed heavily from the characters of film noir. The classic Femme fatales would act as inspiration when characters with similar plot value would want to fill the bill. Andrea Anders(The man with the golden gun) and Octupussy(Octupussy) both played by the brilliant Maud Adams. Dianan Riggs As Tracy Bond(On Her Majesty's Secret service)one of the great bond girls till date. Ursula Anders as Honey Riders(Dr. No) in a pioneering portrayal of a bond girl. The post soviet dissolution Bond films had their share of brilliant bond girls with Xenia Onatopp played by Dutch actress Famke Janseen and Vesper Lynd played by Eva Green have brilliant shades of femme fatale in them.

Cultural impact of femme fatales and Bond girls is immense. The "Bond Girl" has become a barometer of culture. The spectrum ranges from femme fatales to objects of desire to more powerful women who still emotionally prop up a male hero.

Some Femme fatale characters in Film noir and Bond films over the years

Phyllis Dietrichson (Double Indemnity : 1944) played by Barbara Stanwyk

The character is considered one of the best femme fatale roles in film noir history.Phyllis is well-known for her skills at seduction. Dietrichson traffics in two of the narrative elements most frequently associated with femme fatales: Sex. Money.

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Rita Hayworth as Elsa "Rosalie" Bannister (The Lady from Shanghai : *1947)* is adroitly punctuated by many of the genre's conventions, and viewers will be hard pressed to find a more impressive and thorough film noir. Through O'Hara's voiceover, we recognise immediately that he knows Elsa is seducing him and making him the fool. His foreboding narration bleeds with a brooding sense of fatalism, and although he is powerless for most of its duration, the one un-noir-like quality of the film is the fact that he does ultimately overcome his transgressions and foolish decisions. Nevertheless, his voiceover is underlined by a melodramatic nostalgia.
Elsa is splendid as the femme fatale, revealing very little about her intentions and duplicity but often revealing much of her body to O'Hara. As a former "lady of the night", Elsa wisely hides her precarious Shanghai past. She speaks as much with her physical beauty as she does with her psychological angst, and her body is a vehicle for expressing this inner pain. The scenes of her bathing along the rocks during a pit stop and singing on the boat make obvious allusions to her role as a siren. Her clothing throughout the film symbolizes her shifting allegiances. At times she wears white, at other times she wears black, and during other scenes she wears both. Throughout the film, she acts as the queen bee manipulating all of the film's male characters: O'Hara, Grisby, and Bannister. Most of her machinations are conducted off-screen, which adds to her sense of mystery, allure and power. Welles forces us to imagine her craftily designed plans instead of actually seeing them.

Xenia Onatopp(Golden Eye : 1994) Played by Famke Janseen
Onatopp, born in the Georgian Soviet Socialist Republic, is a former officer and fighter pilot in the Soviet Air Force. After the collapse of the Soviet Union, she joins the crime syndicate Janus, led by traitorous MI6 agent Alec Trevelyan. Early in the movie, Bond (Pierce Brosnan) gets into a car chase with her, meets her at a casino, and places her under surveillance.
She lures a Canadian admiral, Chuck Farrell, onto a yacht moored off Monte Carlo and kills him during sex by crushing his ribs with her thighs, achieving orgasm in the process. Meanwhile, Trevelyan's henchman General Arkady Grigorovich Ourumov (Gottfried John) steals the dead admiral's NATO ID, granting him and Onatopp access to a Eurocopter Tiger aboard a French warship anchored off Monte Carlo.

Paul Simpson argues that with Onatopp, the femme fatale made a "welcome reappearance" after the role had previously fallen out of fashion.[4]
Anna Katherine Amacker and Donna Ashley Moore suggest that Onatopp is a "direct throwback to the earlier style of Bond girl, complete with an innuendo-laden name and a blatant sexuality." Robert A. Saunders suggests that she "personifies the hypersexualized archetype of the post-Soviet Russian woman."

Vesper Lynd(Casino Royale : 2006) played by Eva Green
Vesper Lynd was a fictional HM Treasury liaison officer and love interest of James Bond. The official adaptation of the literary character who first appeared in Ian Fleming's 1953 novel, *Casino Royale*, the Bond girl appeared in the 2006 *James Bond* film of the same name, portrayed by French actress Eva Green.
Vesper Lynd was an intelligent and perceptive person who was able to guess information about a man simply based on his behavior and mannerisms as demonstrated during her first meeting with Bond. She was also very attractive and elegant, so like many women, she likely feared

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not being taken seriously by her male colleagues and overcompensates by dressing in a slightly masculine manner, although she also enjoyed wearing evening gowns and makeup. Because of her intellect, Vesper could be suspicious, rebellious and even icy in certain situations, sometimes making false inferences about those around her and therefore; making poor judgments about them, as was the case on several occasions in her relationship with Bond.
Vesper was nevertheless sociable and rather sensitive, hence her ability to bond easily with men, even after tense exchanges. She was also very averse to violence to the point of being traumatized after witnessing a murder in which she herself participated (such as that of Steven Obanno) but she was ready to do anything for Yusef Kabira, including betraying his cause if he were to be in danger, unaware that the man was actually using this asset to manipulate her in secret. Vesper, however, felt horrible feelings of guilt at siding with her enemies to the point of becoming suicidal, which eventually led to her demise.

Elektra King (The World Is not enough : 1998) played by Sophie Marceu

- Elektra has a British father (Sir Robert King) and a mother of Azerbaijani descent. Her father had acquired his wife's oil wealth and merged it into his own construction business, forming King Enterprises. Elektra is both wealthy and beautiful, and becomes famous. She is kidnapped by Victor "Renard" Zokas, a terrorist and former KGB agent. On the advice of M (a family friend), Sir Robert refuses to pay the ransom money.
- Elektra was embittered, and became Renard's lover. She joined in Renard's extortion scheme and mutilated her own ear to send to her father. James Bond initially thought she was suffering from Stockholm syndrome, but it turns out she already had a hatred for her father, based on loyalty to her mother. She and Renard attempt to blow up her family's oil pipeline, and she kidnaps M, Bond, and Christmas Jones. Elektra tortures Bond with a garrote, but when Valentin Zukovsky frees Bond, Bond shoots Elektra.
- Kirsten Smith suggests that "Elektra holds some of the characteristics of the femme fatale displayed in her clothing choices, her quest for power over all the men in her life, and her ability to use sex to enhance her position." Smith goes on to say, however, that Elektra is also a "damaged and complex woman trying to redeem her mother's name and cultural heritage."
- Dean Kowalski notes that while we are led to believe Renard is the main villain of the film, Elektra is actually the "brains and evil heart of the operation". Kowalski concludes that "Elektra's attitudes and behavior are reminiscent of the *yin* force and exactly what we would expect of a strong (even if misguided) female character."

Evolution of Bond Girls over the years

The Bond girls and their portrayal in cinema has tremendously evolved over the years. The early bond films in a way depicted the cold blodeed assisins and henchwomen in a classic femme fatale way. That changed with the frequent onslaught on the recurring fetishization of female characters in bond films. The bond girls of the 60’s and 70’s with their brooding charm were the epitomes for evilness and fallibility of humankind. The 80’s saw a change of sorts with female characters in Bond films often shown to be headstrong and in a way aiding Bond in his pursuit to foil the attempts made to disturb world peace. Ursulua anderes to octupussy and miranda frost to Vesper lynd the characterization of bond girls is an interesting case study of sorts.

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Gender studies and femme fatales

An important area of study is the linkage of femme fatale case study with gender studies. Femme fatales is a phenomena in cinema that can be also understood through the lenses of gender studies

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Sex symbol or precursor to women empowerment

This is a pertinent question per se the overall meaning one the audience can derive from the characterization of femme fatales over the years. The portaryal of femme fatales as the ultimate seductress and man eater, a perfect epitome of sex symbol or was it the other way around and the femme fatale portrayal brought in narratives of women empowerment to the fore. Cinema as a mass mediated medium enjoys a mass appeal and in a way constructs popular culture. The medium message debate of the 1950's by Mcluhan can be understood in this context. The femme fatale characters were definetly born out of the male anxieties of the time but with the progress of time it also helped the larger audience to realize and understand the importance of understanding the psyche of such onscreen portarals. The society had to accept the new found change and the new found independence that the women of times in western hemisphere were founding themselves to be in.

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A Critical Study of Media Representation of Women in Sports: Construction of Narratives around Sexuality, Male Gaze and Sexism.

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Abstract: Sports and male masculinity have an innate bond with each other. The advent of sports as recreational activity and the manliness that goes with sports have an imbalance from the time memorial which has existed to this day. Sports and games to determine masculinity and judge a fine body has been a practice of sorts from ancient times. The swayamvara(in ancient India, a practice of choosing a husband, from among a list of suitors, by a girl of marriageable age. Swayam in Sanskrit means self and vara means groom in this context) stated in epics where sports competition would be the most appropriate way to judge or select a prospective groom or the medieval tourneys,based on similar lines where sports were played by a gender to win another gender is something common across cultures. When women entered sports first as distant spectators and much later as active participants, issues deeply engraved in the patriarchal mindset of sports have time again emerged as serious fault lines of sorts. There have been problems and issues with female participation in sports , the codes and rules governing them and also the media representation of women in sports over the years. The paper aims to discuss some of the critical issues with regards to female representation in sports by media. The representation has been based on some preconceived notions about the very existence of sports. Hyper masculinity associated with sports and numerous stereotypes with regards to gender and gender roles.

Keywords: Sports, Gender, Sexualization, Male Gaze, Framing

1. INTRODUCTION

Sports and media have helped each other to grow in their own space. The media coverage of various sporting actions has transformed the future of sports in many ways. The way a game is played is often dependent on the variables of media coverage. Media coverage of sporting action is a serious study in itself where programming content and production values come to a testing mode. The advent of electronic media and broadcast journalism the passive coverage of sports suddenly changed to the more active one with live action being reported with the aid of multiple cameras to the delight of the sports audience. The media coverage of female athletes

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is an interesting study where several dimensions of gender issues and their roles in societies often come to unsettling scores.
The sexualization of female Olympians dates to the early 20th century. Because modern sport developed as an avenue for men to cultivate and exhibit manliness, women's encroachment into this realm sparked anxieties. Sexualizing female competitors was one way to calm this angst

The societal norms across cultures have often debarred an active representation of females in sports. As sport enters new global territories, attending to questions of cultural difference is increasingly important to studies of women's sports fanship also. Women sports fans rarely appear as film protagonists, with the notable exception of the 2006 movie *Offside*, which tells the story of Iranian women soccer fans attending a World Cup qualifying match. When women are not playing any sports and participating as spectators even then the situation is grim as they are not allowed wholeheartedly in stadium and arena spaces dominated by toxic male masculinity. Women spectators are perceived to be no match for male spectators in terms of knowledge and other fan motives. Some of the Fan motives are stated below in the table. It is interesting to note that female fans and spectators will find it difficult to fit in as the notions about them in common parlance with respect to sports is often not positive, which in turn is constructed on biased media portrayal.

Fan motive	Definition	Example
Aesthetic Beauty	Drawn to the sport because one appreciates the way it is played or performed	Enjoying the sport of motocross because of the unique skill necessary to perform the range of jumps or tricks required to win judge approval.
Achievement	Internal sense of accomplishment that comes from the success of the team one is supporting	Sense of joy experienced by a New Orleans Saints fan after their team finally won the Super Bowl in 2010 just 4 years after Hurricane Katrina almost destroyed their city
Drama	Thrill obtained from a heated rivalry or key matchup between marquee athletes or teams	Watching the final round of Wimbledon as Roger Federer and Rafael Nadal compete for a Grand Slam win.
Escape	Following a team to experience a sense of departure from the dayto-	Watching the 1980 Olympic hockey team win the gold helped the American public

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	day world around us	forget about difficult economic times
Knowledge	Monitoring how the sport is performed to increase one's understanding for how it should be played	A parent watching the slow motion coverage of an ice dancing routine in hopes of further refining the technique employed by her daughter during future competitions.
Social Connection	Ability to interact with friends, family members, or colleagues with sport serving as a background or rationale for supporting the relationship	Mother and daughter taking a trip to watch the women's field hockey championship as a way to bond

The broadcasters often capture the femininity of female spectators and market it as additional norms of some kind of aesthetic value to the broadcast. They are framed in away which is often misogynist and as a fulfillment to the clamours of male gaze. The coverage is full of sexism and fuels the male libido with imagery of women as trophies and things of consumption. The football coverage of mega events like FIFA Men's World cup is a classic example where latin and hispanic women spectators are often framed in live coverage for their so called 'voluptuous' figures and dressing sense. This in a way disturbingly fuels the existing ignition temperature of male fantasies regarding desirable women. The trend has been experimented with in other sports as well where perpetual camera focus on women is done in such a way that is completely out of context and is hell bent on proving the validity of male gaze and dominant male audience theory.

On the field and as active participants in sports female sportpersons are not spared either with continuous coverage of a kind where camera focus locates focal points of preconceived ' aestheticism'. Female athletes are judged more often on their looks and body types so much so that most of them have accepted the same as the norm of business. Male and female athletes playing a similar sport are portrayed differently.This has resulted in an average person thinking of female sportsperson not as an athlete but a sex symbol. The media coverage delving around on the various contours of the body and shape of female sports stars such as Serena Williams, often cited in media as 'black beauty', Maria Sharapova, Anna Kournikova, Danica Patrick, Sania Mirza, Stephine Rice, Yelena Isinbayeva, widely known as Beauty Bird or Allison Rebecca Stokke Fowler is a testimonial to this. Media and broadcast interests often become a harbinger of change on how a sport involving a kind of gender in participation is played and presented to the target audience which in turn is predominantly male . The consumption of sports has been modelled on the lines of problematic interpretation of binary of win and loss where the intrinsic values that a sporting action is capable of producing often gets eclipsed by trivia of superimposed imaginary of age long gender representation. The objectification of

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female athletes is rampant with photoshoots of female athletes depicting their bare bodies becoming an established media representation norm.

Throughout the 18th & 19th century women's sport was practically non-existent. Leisure activities such as marbles, puzzles and skipping were the only forms of 'sports' that women were allowed or accepted to play. It was shown that in those days women playing sport was both 'unladylike' and potentially dangerous to their reproductive lives (Stell, 1991).
During the 1850's swimming became popular, and many women soon became drawn to this new and exciting era. However, as one can expect from those early days males and females were forbidden to share the swimming pool and therefore had separate days and times in which they could occupy the facilities. As expected again, women did not receive equal time, and to stick with the 'fashion' of that era they were required to wear neck to knee woollen costumes (Stell, 1991).

For the past decade female athletes both domestically and internationally have been portrayed in the media through their looks and body image. How the media portrays a particular sport or athlete can also impact on both the sport's or the athlete's credibility. With that in mind, we need to ask ourselves what sort of images of female athletes are commonly presented to readers, viewers and listeners. And how often do newspapers, magazines, television and radio devote the focus to the talent of women's sport (commission,2008)

45% of media attention towards female athletes is expressed in a sexual way (McCabe,2001). As we have seen Stephanie Rice is not promoted in the media for her talent. Yet she has won 3 Olympic gold medals? The media has used Stephanie Rice not for talent but her looks. One can only wonder if she was less attractive would she get the media attention that she does?

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Media Literacy Among Students In India

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ABSTRACT:-

The media industry is predicted to expand 17 percent in 2022 to $25.2 billion, then recover to pre-pandemic levels by 2024, growing at an 11 percent CAGR to $30.9 billion as per the Dec 2021 CII report on Indian Media and Entertainment sector. In India the average daily media intake is expected to be close to six hours by 2022. Despite India's media growth, media literacy has been a persistent yet under-addressed challenge. Some efforts have been noticed in NEP 2020, however at the level of education and training media literacy can only meet the minimum requirement. It is vital to note that more than 70% of the students are using the internet **(Forbes 2020).** There is an information bombardment. Younger ones may not be equipped to screen these critically and use selectively. Simply put, from an early age, children must be made media literate for their health and well-being, as well as their future engagement in our democracy's civic and economic life. This paper attempts to analyze the concept of media literacy, information literacy, types of literacies, usage, exposure of children, and interventions by governments.

Keywords: Digital Literacy, Media and Information Literacy, Education, UNESCO, Media Literacy, NEP 2020

INTRODUCTION:-

In today's times when media has become omnipresent in nature with everyone using diverse media like Television, Radio, Newspapers, Magazines, OTT platforms, digital media, social media, smart TV's, Mobile OTT devices etc. and communication tools at varied times, it would be appropriate to look at the Indian media landscape and the relevance of media literacy among students.

Today the Indian Media and Entertainment (M&E) industry is a booming sector for the economy and is coming up with meaningful and significant contributions. Proving its strength globally, the Indian M&E industry is on the threshold of a promising phase of growth, backed by increasing consumer demand and improving advertising proceeds. The industry has predominantly been driven by growing digitization and increased internet usage over the last 10 years. **(CII Dec 2021).**

Globally there is a growing need for media education to be included in the school curriculum. On this front Australia has been the front runner with media education being made mandatory and part of schooling from kindergarten through twelfth grade **(Quin and McMahon, 2001).** Also, Asia and the Philippines has been the first country to incorporate media education into the formal school curriculum **(Kumar, 1999:245).** Many other countries have examined and evaluated the relevance and need for media education and are trying to integrate it into school curricular.

Ninan(2011) adds, ―Twenty years after the economic liberalization process began in India the increased growth of advertising in the country has led to more media and greater media access for the average citizen, including those who cannot read. Yet, Ninan asserts that this growth has not led to a propositional focus on economic inequality, agricultural distress, or indeed an array of development loopholes such as school education and the quality.

The pervasive nature of the mass media in today's times, especially with the expansion of

the digital media, means that the young and vulnerable people are exposed to different types of media. **Strasburger et al. (2009)** note that today's youth spend anywhere from one- third to one-half of their waking hours with some form of media. Pre-teens and teens frequently are engaging in more than one media activity at a time; they are media multitasking.

Today, the Internet is the primary source of information, and its use is increasing in both urban and rural areas. Television, radio, newspapers, and magazines are no longer the exclusive sources of information. We now absorb massive amounts of data from a variety of media sources, including text messages, memes, viral videos, social media posts, video games, and commercials, to name a few. But all of these varied media have one thing in common: they were all established for a specific cause. While some of these reasons are amusing, the majority are alarming. The spread of fake news across political, ideological, economic, and social lines in the digital age is a major source of concern. Consumer awareness of the term "information" is critical. Media literacy is defined as the ability to recognize and comprehend the reasons behind the creation of a piece of media. Such literacy is especially important in India, which has 658 million active internet users, the second-largest after China. **(Johnson, J. 2022).**

However, it is vital to note that more than 70% of the students are using the internet **(Forbes 2020).** Given that information bombardment now begins at a young age, it is vital to ensure that this vulnerable population absorbs mediated messages critically and deliberately. Simply put, from an early age, children must be media literate. Teachers, on the other hand, explain false news to pupils using particular instances in this constrained top-down method. This strategy has the benefit of being quick to deploy, but it ignores a bigger social issue of trusting incorrect information. Instead, central policymakers could construct horizontal curricula that affect changes in media use across society.

The **Ontario Association for Media Literacy (AML)** has developed eight fundamental concepts for media literacy that serve as a foundation for all media literacy programs. **(Jolls, Tessa. & Wilson, Carolyn. 2018).**

1) All forms of media are constructed.

2) The media creates reality.

3) In the media, audiences negotiate meaning.

4) The media has a business impact.

5) Media communications are ideological and value-based.

6) The media has social and political consequences.

7) In the media, form and content are inextricably linked.

8) Each medium has its own aesthetic.

Media is at core of the concept of media literacy as it is only the increased growth of media in the lives of people which has created the need for incorporation of media literacy education at various levels of the education system. Let's have a look at the Indian Media and entertainment sector today.

INDIAN MEDIA AND ENTERTAINMENT SECTOR:-

According to a recent EY-FICCI report, the Indian media and entertainment (M&E) business expanded by 16.4% to $1.61 trillion ($21.5 billion) in 2021. The industry is predicted to expand 17 percent in 2022 to $25.2 billion, then recover to pre-pandemic levels by 2024, growing at an 11 percent CAGR to $30.9 billion. Despite the fact that conventional media accounted for 68 percent of industry revenues, digital media increased significantly to become the second-largest segment. The development of digital infrastructure is likewise accelerating. According to the statistics, India has 795 million internet connections, 500 million smartphones, and 10 million connected TVs, in addition to 170 million active TV connections. In 2021, 390 million Indians played online games, consumed 150 billion streams of online music, 40 million Indian households paid for 80 million online video subscriptions, and 400 million subscribers consumed packaged material. By 2024/25, the number of displays is predicted to reach 1 billion.

India is one of the world's largest content providers and is quickly becoming the global content back office. In 2021, India generated 150,000 hours of TV content, 2,500 hours of premium OTT material, and 2,000 hours of movie content, with the help of more than 950 animation and VFX firms, 185,000 electronic artists, and 139 Institutions/Universities (Bapna, A. 2022). Before understanding digital literacy it is significant to understand what is literacy, how many types of literacies are there and how is COVID-19 impacted literacy in India and globally.

IMPACT OF COVID-19 ON LITERACY:-

The COVID-19 pandemic has wreaked havoc on education systems around the world, affecting approximately 1.6 billion students in over 200 nations. More than 94 percent of the world's student population has been affected by school, institution, and other learning facility closures **(Chhetri, R. & Pokhrel, S. 2021)**. This has resulted in significant changes in every part of our life. Traditional educational techniques have been considerably disrupted by social alienation and restricting movement policies. Reopening schools once the restrictions have been lifted is another problem, since many new standard operating procedures have been implemented.

During the second week of March 2020, Bhutan announced the closure of schools and institutions, as well as a reduction in business hours **(Kuensel, 2020)**. The entire nationwide lockdown began on August 1, 2020 **(Palden, 2020)**. In the interim, people were allowed to roam around, offices reopened, schools and colleges reopened for some levels, and others continued with online classes. During the pandemic, e-learning tools were critical in assisting schools and universities in facilitating student learning during the shutdown of universities and schools **(Subedi et al., 2020)**. Physically challenged students can also benefit from online learning because it allows them to participate in learning in a virtual environment with limited movement **(Basilaia & Kvavadze, 2020)**. With the exposure of more and more internet and digital media, digital literacy and media literacy became a challenge specially for developing countries like India as the education system was not well equipped for a sudden shift to online education. Right to education being the Fundamental Right of every child with the enforcement of the **Right to Education act (RTE)** on 10th April 2010 literacy has been recognised as the most important facet of a child's life. Let’s understand the concept of literacy in general followed by various types of literacies and then introduction of the concept of Media Literacy.

LITERACY IN GENERAL:-

Literacy is defined by the United Nations Educational, Scientific, and Cultural Organization **(UNESCO)** as the ability to recognize, understand, interpret, produce, communicate, and compute using printed and written materials in various circumstances. When a person is first introduced to the concept of literacy, it becomes clear that the definition of literacy has broadened beyond the capacity to write and read. The Indian government is currently on a literacy drive across the country. They are sending teachers to India's most remote areas in order to educate the people, regardless of their age or vocation. The educational program has made a daring stride forward, and the results are promising. Students and educated youth should get involved in the literacy effort that the Indian government has started. Classes might take place in a primary school or any other suitable location in the literacy movement's chosen area. **(Ministry of Education, 2021).**

NEP 2020 recognises the importance of various extensions of Literacy in the education process as Literacy isn’t the mere ability to read and write but to give a child wings for exploration and learning across several dimensions like digital, critical, functional and professional literacies which are all close cousins of media literacy. Therefore it is important to understand various types of literacy before we delve deeper into understanding Media Literacy.

TYPES OF LITERACY:-

Literacy is the ability to think, read and write. Our school experiences, on the other hand, have a tendency to limit our concept of literacy. There are many different levels of literacy, all of which

aid in navigating life and fully participating in a democratic society. There are 13 types of literacy **(Lynch, Matthew. 2019)**:

- **Digital Literacy:** It includes a diverse set of abilities, all of which are required to flourish in an increasingly digital society. As print media fades, the capacity to grasp information acquired on the internet becomes increasingly crucial. Students that are digitally illiterate may soon find themselves in trouble.

- **Media Literacy:** According to the National Association for Media Literacy Education, media literacy is the ability to use all kinds of communication to access, analyze, evaluate, create, and act. Understanding underlying messages in web advertisements, making viral video content, and detecting native advertising are all examples of media literacy.

- **Recreational Literacy:** Independent activities that foster positive attitudes, interests, and reading habits.

- **Critical Literacy:** Is a set of attitudes and abilities that promote creative teaching, critical thinking, and active learning. Instead of skimming the surface of what they read, critical literacy encourages pupils to think critically about what they read.

- **Balanced Literacy:** A reading curriculum that provides differentiated reading teaching through the use of multiple different reading strategies.

- **Developmental Literacy:** A type of literacy training that takes into account a child's developmental stage. It basically offers developmentally appropriate literacy teaching.

- **Functional Literacy:** The literacy skills needed to successfully traverse society.

- **Content Literacy:** The use of literacy in specific disciplines such as math or science.

- **Early Literacy:** Before learning to read and write a child's knowledge of communication, reading, and writing.

- **Multicultural Literacy:** Understanding and appreciating the similarities and variations in customs, values, and beliefs.

- **Civic Literacy:** Knowledge of how to actively participate in the local community and society and influence change.

- **Disciplinary Literacy:** The treatment by experts in various disciplines of students' reading, writing, and critical thinking abilities specific to the different disciplines.

- **Information Literacy:** A transformative process in which the learner must find, interpret, evaluate, and use information in multiple formats for their own personal advantage. This could be for personal, social, or global reasons.

This brings the need to understand Media Literacy which provides tools to help people develop receptive media capability, which allows them to critically analyse messages, as well as opportunities for learners to broaden their media experience and develop generative media capability, which allows them to improve their creative skills in creating their own media messages.

MEDIA LITERACY:-

Our children live in a world where powerful media is available at all times. Over the last decade, the amount of time children and teens spend with media has increased dramatically. According to recent research, children aged 8 to 18 spend an average of 7 hours and 38 minutes every day outside of school with entertainment media. (**Lauricella, 2015).**

When used correctly, the media can both entertain and educate our children. However, because most children are not taught to use media responsibly, many media messages contribute to public health issues like obesity, bullying and violence, low self-esteem, melancholy, negative body image, unsafe sexual behavior, and substance addiction, among others (**Lauricella, 2015)**. An important 21st century skill is media literacy education, which educates students to apply critical thinking to media messages and to use media to produce their own messages. Media literacy is essential for children's health and well-being, as well as their future engagement in our democracy's civic and economic life. Media literacy helps in decoding the messages from the media (including the systems in which they exist) **(Dorr, A. 2001)**. It also helps in examining the impact of those messages on your ideas, feelings, and actions. It creates media with care and consideration.

Davies (1996), defined media literacy as the accessing skills, analysis, communicates and evaluates messages received through digital media. It is the need of enhancing technical skills to understand the meanings behind the media and to develop the understanding of various contents available on media. Media literacy, according to **Kubey (2004)**, entails critical analysis of media messages, evaluation of sources of information for bias and credibility, increased awareness of how media messages influence people's beliefs, attitudes, and behaviours, and the creation of messages using various forms of media. The National Association for Media Literacy Education's website also characterises the roles of media literacy in this way.

According to the **Centre for Media Literacy, United Nations Alliance of Civilizations (UNAOC),** the following five key ideas are essential to media literacy:

• All messages in the media are social constructs (i.e., constructed by somebody and never able to reflect reality entirely).

• People that create media messages use rules-based creative languages (i.e., creative components such as words, music, movement, camera angle, and others are utilized to develop a media message in different formats such as a magazine cover, advertisement, etc.).

• Varied people have different reactions to the same media message.

• Media message producers have their own ideals and points of view.

• Media messages are created with a certain goal in mind, usually profit and/or power.

SCENARIO AND CURRENT STATUS OF MEDIA LITERACY:-

Since 1960, when MIL was as known as Media Literacy the focus has been on training various parts of the public (children, young people, and adults) to consume mediated information critically and deliberately in both formal and informal settings (**Ciurel, 2016; Goodman, 2003)**. In 1972, the notion of media literacy shifted to educating and enlightening persons as a "defence effort," with the goal of protecting children and young people from the risks posed by the media, as well as encouraging them to reject and overcome "false" messages and "wrong" values. Grunwald's declaration, issued in early 1982, emphasized the necessity for governmental and educational systems to encourage critical comprehension of "communication phenomena" among individuals from school to university.

In India, print media journalism dominated the pre-independence period. Electronic and digital media began to gradually take over the market. Some forms of media are on their way out. Media training and education gradually but progressively became a necessity. This new period of communication and globalization is thought to have brought about fresh ramifications for mass communication and journalism education. Media literacy aids citizens in the development of critical thinking abilities. **Buckingham (2017)** stated that to build media literacy among young, it is necessary to develop a level of competence that is dependent on three factors: cognitive level, emotional level, and overall social development. In India, online schooling is becoming increasingly popular. Many changes have been made in the education system since the **New Education Policy (NEP)** was implemented in 2020, including online education; however a new set of laws comes with many negatives.

According to **UNESCO**, 1.37 billion students in 138 countries have been affected by the closure of schools and colleges since the outbreak of COVID-19 began. Approximately 60.2 million school teachers and university lecturers are no longer employed. This new media promises on-demand access to content at any time or on any digital platform, yet this proves difficult for both administrators and students. Today's digital media is a hybrid of traditional learning methods such as books and notebooks, as well as digital applications such as eBooks and pdfs. So far, the twenty-first century has been a period of fast development. Many countries are gradually transitioning from industrial to knowledge societies, with considerable societal changes accompanying this transition. To cope with the shifting social and technological contexts in this

new century, people require atypical abilities and skills. A new literacy campaign, led by **UNESCO**, has been started to promote media and information literacy **(MIL)**. The movement's goal is to unite the domains of information literacy and media literacy as a single set of skills required for today's life and work **(UNESCO, 2012)**. However, an imprecise perception of these two fields' limits and regions makes cooperation difficult. Professionals in both professions appear to agree. Professionals in both professions appear to lack a thorough understanding of one another and have failed to find common ground. As a result, they have not been successfully combined. **(Badke, 2009).**

A recent study focused on the US and India found that a lack of attention to digital media literacy in education policies is a key factor in the proliferation of online disinformation **(Chandana, S. 2022).** Policymakers around the world are concerned about social media's ability to optimise and speed up the transmission of misinformation, as well as its negative effects for democracy. Misinformation transmitted through social media applications has been connected to persistent social polarization, the growth of authoritarianism, vaccine hesitancy, and real-life violence (49 percent of the global population are active users). **(Chandana, S. 2022)**. As a result, preserving democratic values necessitates taking steps to curb and control the spread of misinformation on social media platforms.

Regulating social media networks like Facebook and Twitter is the more favored method among governments. However, such interventions are laden with political consequences, as citizens in most liberal democratic systems are wary of government interference in their right to free speech. Another technique is the platform's self-regulation, which allows for rapid and large-scale modifications. However, because engagement is a major source of money for these platforms, they have an incentive to manipulate their algorithms in order to promote emotionally charged falsehoods. Furthermore, research reveals that measures to label misinformation have just a minor impact on the likelihood of consuming and sharing erroneous information.

The National Education Policy 2022 of the Indian government is a squandered opportunity to include media literacy in the curriculum. The policy prioritizes 'higher-order' cognitive abilities like critical thinking and problem-solving, as well as social, ethical, and emotional talents and dispositions." However, the term "digital literacy" is only referenced once in the document, and social media literacy is completely ignored. Because social media is the primary source of pupils' literacy, this is a significant gap. Students should be taught social media literacy, which involves applying critical thinking to the information they are bombarded with on a regular basis via social media.

There are different initiatives and interventions taken by the government of India, UNESCO, CBSE and NCERT in the sphere of digital media literacy and awareness among students and otherwise as well.

WHAT IS MEDIA EDUCATION?

The process of teaching and learning about the media is known as media education (Buckingham, 2003). The term "media education" can be defined in a variety of ways. "Media education is the activity by which people become media literate—able to critically study and grasp the nature, tactics, and impacts of media messages and productions," according to the Media Literacy Week (2010, p.1). (1) Media manufactures; (2) Audiences conclude the meaning of media messages; (3) Media have commercial connotations; (4) Ideological messages strengthen all media are some of the key themes provided by Canadian media educators.

In the United Kingdom, media literacy is defined as "the ability to access, comprehend, and generate communications in a range of contexts" by Ofcom (2010a, p.1). According to the National Association for Media Literacy Education (NAMLE, 2010), media literacy in the United States is defined as a set of communication skills that include the ability to access, analyze, evaluate, and transmit information in various forms.

'Media Education is an endeavor to make media users critically aware of the impact of media on their life, in order to enable them to become creative users of the media,' according to Jacob Srampickal and Leela Joseph, (2002). It can be defined as an educational process in which people become aware of how various media influence their thinking, alter their value system, and transform society. As a result, they become critical and discriminating media consumers, capable of demanding high-quality programming and even producing their own. As a result, they can intelligently respond to media productions and manipulations.'

Advocates for media education in India have attempted to combine the aforementioned definitions. Media literacy is defined in India as a life skill that allows young people to critically understand, analyze, use, and impact media.

NEED FOR MEDIA LITERACY AMONG STUDENTS

Today's educational system faces a major difficulty in teaching children and young how to access and apply the various forms of writing and thinking that lead to judgments that influence them at work, at home, in politics, and in economics. Children and teenagers nowadays spend a lot of time on new sorts of media in addition to traditional media such as television **(Bergsma, LJ 2008 & Oxstrand, B. 2009).** As a result, adolescent concerns are growing in this area. There is an impact of the media on violence, violent behaviours, and crimes **(Huesmann, LR. 2006 & Felson, RB. 1996)**, sexual relationships **(Pinkleton, B. 2012),** educational performance **(Schmidt, ME. 2008)**, body image **(Yamamiya, Y. 2005)**, diet, the rising prevalence of obesity, and sedentary behavior **(Higgins, W. 2012),** drug abuse and smoking **(Primack, BA. 2006)**, alcohol abuse **(Austin E (Ulas, AH. 2012).**

Today's child is raised in a multimedia environment. He does not rely solely on traditional forms of mass media for his information, since he checks his emails, receives current news from Facebook, and logs onto the World Wide Web to check the day's news. As a result, before he leaves his room, he is aware of what is going on in his immediate environment as well as the rest of the globe. This is in contrast to the traditional system, in which one relied on the newspaper in the morning, the radio and television at night to acquire relevant news about his immediate area as well as foreign matters. 'The media and communication technology have become a location for today's young - sometimes the only place that speaks about and to them,' argues **Morduchowicz (2008)**. He claims that understanding how the media portrays reality and informs us about what is going on can help individuals participate, act, and make better judgments. As a result, he believes that today's schools face a difficulty in recognizing how knowledge is disseminated and circulated in new ways. 'If we agree that young people construct their cultural capital outside the classroom, even in relatively autonomous situations, school can no longer be considered as the only valid place to transfer pre-established symbolic baggage,' **Garcia Canclini (2006)** believes.

MEDIA AND INFORMATION LITERACY:-

The process of equipping people to effectively seek, assess, use, and produce information in order to fulfill their personal, social, occupational, and educational goals is known as media and information literacy. The current global concept of media and information literacy is founded on the assumption that its primary function is to offer access to information and knowledge while also promoting free, independent, and pluralistic mediated social environments: “Media Information literacy acknowledges the central importance of information and media in our daily lives. It is at the heart of freedom of expression and information because it allows citizens to express themselves to comprehend the functions of the media and other sources of information, and to critically assess them as users and producers of information and media content, and to make educated decisions". **(UNESCO, 2020).**

Traditionally, media literacy and information literacy have been recognized as independent disciplines of study, but at this time, they are frequently integrated into a broad field with some similar objectives and competencies that are essential for people's daily lives, job, and

studies. As a result, the variety of challenges that are arising in this subject is rather broad, and they involve our everyday access to information, as well as our ability to critically assess, actively contribute, and use information in both online and offline communication formats. This group of challenges is accompanied by a far broader variety of issues, including ethical, socio cultural, political, commercial, intercultural, moral, interethnic, interreligious, and other critical dimensions of information availability and use in modern society. **(Silverblatt, 2016)**.

INTERVENTIONS BY GOI, UNESCO AND OTHERS:-

- **UNESCO:**

There are two components to the MIL Policy and Strategy Guidelines resource. Part 1 is the MIL Policy Brief, which is intended for policymakers and can be used as a summary of the paper. Part 2 is broken out into multiple chapters and suggests:

1) how to use MIL as a development instrument;

2) conceptual frameworks for MIL policies and strategies; and

3) model MIL policies and strategies that countries around the world can use.

UNESCO and partners have developed a complete MIL Toolkit. This toolkit includes the curriculum of MIL for the instructors and teachers which is available on the website, the assessment framework of MIL, guidelines for the promoters to host user generated content, digital multimedia MIL teaching resource tool. Following strategies and policies are identified and presented by UNESCO for media and information literacy **(UNESCO Digital Library, 2011)**:

- **Formal Education:**

The teachers, trainers, instructors and educators of primary and secondary schools, librarians, should be trained to develop the curriculum and guidelines for Media and Information Literacy. New courses for training should be developed. **(UNESCO Digital Library).**

- **Non-Formal Education:**

To create civic media and information groups, such as viewer and listener associations, media watch groups, library cadets, and media and information clubs in schools should be crafted like Internet and library organizations. Media and Information Literacy among the professionals like health professionals, households, parents etc should be generated. **(UNESCO Digital Library).**

- Promotion of Media and Information Literacy and user generated content, adapt and frame guidelines for broadcast and print media. **(UNESCO Digital Library).**

- Government Ministries and other organizations: The training programs and workshops for policy makers and decision framers. **(UNESCO Digital Library).**

- The media and information literacy strategies should be aligned with other related strategies. **(UNESCO Digital Library).**

- **NCERT:**

Many steps have been launched by CIET and NCERT to popularize the notion of media literacy. Mass Media Studies course in Class XI, and initiated work on Class XII.

The National Council of Educational Research and Training **(NCERT)** has included mass media and communication in its textbooks for class VII pupils, which examines how the media sets the agenda and how the market has become important to its functioning. Case studies to help students comprehend the principles and exercises to critically assess newspaper reporting are included in the section on how the media sets the agenda. Another NCERT textbook, Abhivyakti aur Madhyam, which was introduced at the senior secondary level, is about media writing, according to her. She adds that a video series on "why media literacy" is in the works to help schools and policymakers understand the notion. **(NCERT, Annual Report 2009-10).**

3 Days training programs have been organized by CIET and NCERT to give training to teachers, educators and instructors on Media Studies. **(NCERT, Annual Report 2009-10).**

- **CBSE:**

The Central Board of Secondary Education has partnered with Facebook to run the Digital

Safety and Online Well-Being and Augmented Reality curriculum with collaboration on Facebook for the students of secondary school. This collaboration is led by Facebook for Education, a global program by Facebook that aims to prepare students for the future of work while also providing a safe online learning environment.

Initiatives in schools to conduct workshops and seminars to make students digitally literate and media educated as well. **(Srenger, M. 2018).**

- Internews, in collaboration with BBC News World Service and DataLEADS, has organized a combined media literacy project for students in grades 9-12 in 2021. **(Internews, 2021).**

OBSERVATIONS:-

- People are spending more time and money on social media. It shows that the medium is growing day by day. It is important to understand why this phenomenon has overwhelmed the other medium of information.

- The goal of media literacy education is to teach youngsters about various media sources, topics, and how to interpret and analyze messages. With billions of bytes of data streaming in from all directions on the world wide web, it is vital to authenticate the content and the origin of media messages to establish media literacy.

- It is being observed that youth spend more than two hours per day on the internet. As internet penetration and high-speed broadbands improve, time spent on the internet is likely to increase as users and online content availability expand.

- To educate Indian youth and students precisely on media literacy, the government should sponsor workshops and training programmes at the school and college levels, supplemented with online consumer awareness campaigns.

- Four PhD dissertations and a number of other papers have been written about media literacy in India. Moving from media literacy to "digital literacy" is currently being attempted, however the emphasis remains on skill acquisition rather than critical thinking.

- Critical media literacy, as an optimistic idea in such a convergence culture, reduces the reader-text conflict. Critical media literacy as a teaching technique is used in media education to further this process. This type of instruction does not make students cynical about media; rather, it raises knowledge of how media works to produce meaning.

- Media education should teach students to recognise a variety of pleasures in reading media texts while taking into account the socioeconomic context of any ideological or aesthetical criticisms.

- In India, the government and other institutional bodies like CBSE, NCERT, UGC, AICTE need to pay emphasis on media literacy and make it a significant part of curriculum.

CONCLUSION:-

The necessity for people to obtain news and information, as well as amusement and socialization, led to the creation of mass media. The media, on the other hand, does not always reflect reality, and its content is not always thorough, accurate, or neutral. Because government laws and regulations, as well as changing media content, are ineffective strategies for monitoring media consumption, and because reducing adolescent exposure to the media is not always practical, parents are concerned about their children's media use, because children use the media mostly at home. As a result, when directing children's media consumption, parents' roles as well as their perceptions should be considered. The Government of India is in a critical stage regarding the media literacy of the students, and needs to frame strategies, policies, and framework to educate students from the primary level. Training to teachers, educators and professionals should also be imparted so that they can cultivate the same in the students.

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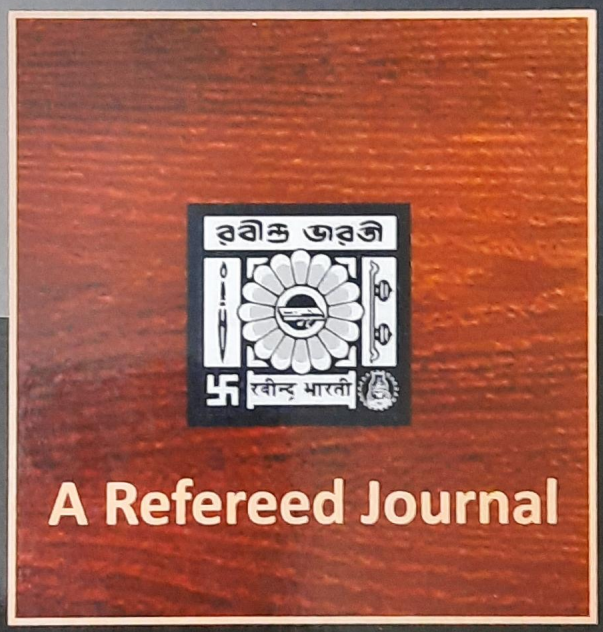

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CONTENTS

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COOPERATION AND COORDINATION PROTOCOLS IN CROSS-BORDER INSOLVENCY

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Abstract
Disputes involving multinational corporations' jurisdictional conflicts are rapidly rising. This article examines the modern solutions to multinational cross-border insolvency conflicts employed by courts and practitioners before focusing primarily on the recent invention and usage of case-specific cross-border judicial agreements, or "Protocols," to address such conflicts. This also examines how such Protocols are utilized by courts and practitioners to reduce jurisdictional issues in order to best meet a basic goal of most nations' insolvency laws: maximizing of economic return for the benefit of all parties involved.

Key Words: Cross-Border, Insolvency, Proceedings, Cooperation and Coordination Protocols.

Introduction

It is self-evident that as the global economy evolves, company failures with global consequences will become more common. Such failures will increasingly result in insolvency proceedings and/or collection litigation involving the same debtor in numerous jurisdictions. Such a slew of processes will invariably result in practical and legal squabbles.[1] This article examines the modern solutions to such conflicts employed by courts and practitioners before focusing primarily on the recent invention and usage of case-specific cross-border judicial agreements, or "Protocols," to address such conflicts. The essay examines how such Protocols are utilized by courts and practitioners to reduce jurisdictional issues in order to best meet a basic goal of most nations' insolvency laws: maximizing of economic return for the benefit of all parties involved.

The Requirement of Modern Multinational Insolvency Proceedings

With the advent of modem technology, multinational corporations with extensive global connections have proliferated. As a result, many insolvency proceedings may be initiated, with no single set of actions predominating. Indeed, it is possible that each of the proceedings is necessary and must be held in each of the applicable forums. In this circumstance, an alternate mechanism must be adopted to avoid jurisdictional dispute between several courts and to bridge the gaps between the legal forums. A definitive treaty would be an ideal mechanism in terms of simplicity. However, there are few such international insolvency treaties, and the United States is not a party to any of them[2]. In the absence of a formal treaty, practitioners and courts have established what basically case-specific private international insolvency treaties are. These systems for coordinating transnational proceedings have been dubbed "Cross-Border Insolvency Cooperation Protocols," or "Protocols."[3]

To date, the Protocols that have been implemented have been affected by both considerations of universality and certain territorial limits. They aim, first and foremost, to facilitate efficient global coordination and settlement of various insolvency procedures. At the same time, they protect fundamental, local rights that are relevant to each of the legal forums concerned. Protocols, for example, have enabled for coordinated, global asset identification, collection, and distribution procedures for the

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"CONTROL, PREVENTION AND INVESTIGATION OF THE CORPORATE FRAUDS IN INDIA UNDER COMPANIES ACT, 2013: WITH CRITICAL STUDY OF RELEVANT LAWS AND REGULATIONS"

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The advantages of Decriminalizing the offences like ease of doing business and increase of investment but it also leads to increase the number of frauds cases, as decriminalization of offence gives flexibility to do business without the strict criminal provisions, as the increase or decrease in penalties or decriminalization is not sufficient to control and prevent frauds. The present Legal framework to stop corporate frauds is insufficient and the Amendment of Decriminalizing of offence is not a good step to stop corporate frauds.

INTRODUCTION

In India, corporate fraud is a major problem. It is not new Phenomena. It is prevalent in existence in many form, size and shapes. The integrity of financial reports has been compromised by an increasing number of frauds, which have resulted in significant economic losses and eroded investor faith in the utility and dependability of financial statements.

Recent times, it has grown exponentially. Hence, any type of fraud emerged will responsible for the collapse of supportive financial systems and investments. The impact may be moderate or high in risk. Fraud is an illegal act or omission within and related persons of the company, for financial or personal gain. "Fraud in the context of the operations of the company is defined as any conduct, omissions, falsification of information, or misuse of power committed by any individual or other person with the intent to defraud, gain an unfair advantage over, or undermine the company's or its investors' interests, creditors, or any other individual, regardless of whether there has been any unjust gain or loss"[1]. The situation is even worse in developing countries like India, where 80% of respondents indicated their company has been a victim of fraud[2].

"Corporate fraud refers to operations carried out by a person or a firm in an untrustworthy or illegal manner with the intent of gaining an advantage for the perpetrator. Corporate fraudulent practices differ from other types of fraud in that they are more advanced and have a greater financial effect on the business, other personnel, and outside parties, and they go beyond an employee's defined function." It is required to control and take prevention measures for frauds in corporate. We have many provisions to regulate frauds but states required more strict liability, penalty, and provisions to stop big scam, so that public money can be saved.

[1] Section 447(1),companies Act,2013(18 of 2013)

[2]See the Article, India amongst worst in corporate fraud, shows survey by Arun Kumar, Available at: https://www.businesstoday.in/latest/corporate/story/india-among-worst-in-corporate-fraud-bribery-corruption-shows-survey-55630-2015-11-26 (visited on 12, December, 2020).

Comparison between Companies Act, 1956 and the Revised Act, 2013.

In numerous parts of the Companies Act of 1956, fraud is punished[3]. But it does not contain definition of fraud, charge, essentials of fraud, one person Company and many more provision. And on the other side Companies Act, 2013 provides clear and broadened provision related to fraud and its punishment. The main difference between the Act of 2013 and the Companies Act of 1956 is that the punishment for fraud under the new Act is the same for all incidents of 'fraud,' unlike the Companies Act of 1956, which has varying punishments for different types of fraud. The new Act, on the other hand, provides for harsher penalties where the fraud is perpetrated in the public interest. In that situation, the minimum sentence is 3 years (rather than 6 months), with a maximum sentence of 10 years. More provisions like Reporting of fraud in companies Act, 2013 is good but the issues are related to implementation and follow up these provisions by the companies and some more strict provisions are required to safeguard the interest of public and related persons with the affairs of company.

Decriminalization of offences under Companies Act, 2013.

The Companies (Amendment) Act of 2019 states that 16 of the 81 compoundable offences have been turned to civil defaults. However, following the implementation of the Companies. (Amendment) Act 2019, the legislature adopted the Companies (Amendment) Bill 2020, which decriminalized other provisions. The Companies Amendment Bill 2020 intends to remove nine non-compliance offences from the National Company Law Tribunal's jurisdiction. And decriminalizing the offence by the following measures like Removing the penalty of imprisonment and reclassifying the offence as a civil wrong Fine levels are being reconsidered, and instances are being referred to an in-house adjudication procedure are done by this Act.

Decriminalization is a forward step to increase investment and ease of doing business but if we see the increasing number of corporate frauds in India, it may be giving flexibility, and access to the person of fraudulent nature, who do not care about the penalties and fine. So the amendment to decriminalization of offence should be strictly checked and Regulate by the government. According to a study of 218 organizations conducted by inspection company Deloitte, in India around half of the appellant were unaware of the lawful protections given to whistle-blowers or individuals, who provide information about an individual and organization suspected of engaging in illegal or immoral behavior. According to the study, more than half of respondents were unsure how their disputes would be handled, two-thirds worried absence of confidentiality in complaint handling, and one-third were concerned about who receives and processes complaints.[4]

Above given is a single issue related to Corporate Governance, which shows a good control, Prevention and Regulation is required to stop corporate frauds. And the numbers of problems are increasing due to frauds. Hence any type of corporate frauds are happened anywhere in the world has an impact on the supportive financial systems and investors. All of these types of fraud result in significant losses, asset depletion, and, most importantly, the potential for the business to be crippled. The causes of corporate fraud are multi-layered and include both external and internal influences. A strict legal framework will become necessary to safeguard the interest of the both investors in financial markets and as well as for

[3] C. Dalal, *Novel and Conventional Methods of Audit, Investigation and Fraud Detection,* (Wolters. Kluwer, Mumbai, 4th edn., 2015).

[4]Available at: https://economictimes.indiatimes.com/industry-services/consultancy-/-audit/whistle-blowers-unsure-about.available-legal-protection-deloitte.survey/articles.how/76720883.cms (visited on 08/10/2021).

the promoters of the business operations to work under atmosphere of fearlessly in the society. Despite the fact that India has a well-established legislative control system in addition to prevent the occurrence or re-ocurrence of corporate frauds in the country. The Satyam scandal, 2G Spectrum scam, Harshad Mehta stock scam, City bank fraud, IPL Scam, Sahara Scam etc. When we examine the aforementioned cases, we first consider who is liable for the frauds and come to the conclusion that everyone from the Board of Directors, CEO, CFO, Senior Management, and Operational Management is deeply engaged and accountable.[5]

Our system is required to do more work to regulate, control, and prevent the companies and their investors from fraud .Corporate wrongdoers will try to take advantages from the liberal provisions like Decriminalization of offence, reducing penalties and removing criminal penalties for some offences. So we need to improve our legal framework to stop and prevent fraud. Provisions should be provided for the complete security and safety to public money and in the interest of public. Improved judicial administration and courts are the need of the hour. Organizations can significantly reduce fraud risks by implementing anti-fraud precautions such as personnel background checks, an efficient and well-understood whistle-blowing[6] system, a well-tested fraud risk monitoring system, a fraud risk assessment system, and coordinated and timely investigations and corrective actions. Proper functioning of serious frauds investigation office (SFIO) is mandatory. Strong and strict compliances by the companies, has to be made to control the Fraud, involving the manipulation of the accounts and records. Security Exchange Board of India (SEBI) as a regulating authority has to be stricter to prevent capital market. Proper market vigilance has to be followed by the SEBI.

In this new era, the technology is growing very fast, and the methods to frauds are also increasing, so the policies, provisions should be very Strict for this. The potential risks of business operations are growing by the day, due to the technological improvements, particularly the widespread use of information technology at all levels of corporate operations. Also, Business operations face additional obstacles as a result of the liberal economic environment. The significance of effective lawful control component isn't just the satisfaction of targets of the law yet additionally adds to the smooth development of corporate which will lead towards the financial advancement of the cutting edge social framework. Therefore the more efficient legal control mechanism is necessary to control and prevent the emergence of the frauds, because to safeguard the financial health of the organization as it leads to economic growth of the country.

Arguments for and against decriminalizing corporate offences

To begin with, it has been argued that in a country like India, there are a large number of companies of all sizes and practices. Depending on their size and financial status, monetary fines imposed on these companies would have varying effects. Second, the authority to punish or impose fines would be moved from the courts to civil servants or members of the political community. Finally, there is a chance that businesses may purposefully break the law because the loss experienced as a result of the application of penalties may be insignificant compared to the benefits acquired through such violations.

[5] Asish k Bhattacharyya, *Corporate Financial Reporting and Analysis*,(PHI Learning,2nd edn.,2019).
[6] Ibid.

Conclusion and Suggestions

As Information Technology (IT) is growing very fast, frauds are increasing day by day in a new face of using application, software, networking and much latest computer technology, which gives huge threat to the organization. Amendment in companies Act, 2013 to Decriminalization of offences can give negative impact also may be rise in the corporate fraud. It will become a big problem. With the liberal policies and Regulation, risk of frauds is going up also. Usually the first and main problem of companies is to control the Fraud that is involving the manipulation of the accounts and records. Secondly Frauds done by internal members that is employees involving the theft, unsuitable or embezzlement of companies' funds in the form of cash or its other assets. Personnel background screening, business parties and third party compliance, an efficient and a well proved fraud risk management system, a fraud risk assessment system, and coordinated and timely investigations and corrective actions are all anti-fraud measures that can significantly reduce fraud risks.

Decriminalization of offence can give terrible impact, it could have is that it could inspire the organizations to take a much less vigilant method and now no longer supply due regard to the significance of those compliances. If this occurs and the subculture of defaulting in appreciate of those compliances is fostered, the legislative reason at the back of this invoice will fail.

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संस्कृत साहित्य में जल के प्रति संचेतना

मिथिलेश कुमार पाण्डेय[*]

ऋग्वेद के मंत्रों में जल को माता के समान पूज्य माना गया है। लौकिक संस्कृत साहित्य में भी जल की ब्रह्मा, विष्णु और महेश के रूप में उपासना की गई है। जल साक्षात् 'ब्रह्म' है। संस्कृत साहित्य में जल ऐसा जीवन धारक तत्व है जिसके बिना अन्न का एक दाना भी उत्पन्न नहीं हो सकता– **"जलं हि प्राणिनः प्राणाः जलं सस्यस्य जीवनम्। न जलेन विना लोके सस्यबीजं प्रजायते।।"**[(1)]

जब से मनुष्य का इस धरती पर पदार्पण हुआ है जल ही उसके भरण–पोषण और आर्थिक प्रगति का अनिवार्य तत्त्व रहा है। विश्व की तमाम प्राचीन सभ्यताएं चाहे वह नील घाटी की सभ्यता हो या सिन्धु–सरस्वती या गंगा–यमुना की घाटी की सभ्यता, सभी सभ्यताएं नदियों के तटों पर ही विकसित हुई हैं। जहां तक भारतीय सभ्यता का सम्बन्ध है, वैदिक काल से ही इसे नदीमातृक संस्कृति के रूप में जाना जाता है जहां जल की मातृभाव से पूजा की जाती रही है। जल को मात्र एक प्राकृतिक संसाधन मानना वस्तुतः एक आधुनिक उपभोक्तावादी सोच है जिसके कारण जल अपव्यय, जल प्रदूषण और जल के व्यापारीकरण जैसी पर्यावरण विरोधी गतिविधियों को प्रोत्साहन मिलता है और जलसंकट की गंभीर समस्याएं पैदा होती हैं।'ग्लोबल वार्मिंग' के कारण भी जलसंकट की समस्या गहराई है।

आधुनिक विज्ञान और प्रौद्योगिकी के पास 'ग्लोबल वार्मिंग' के कारण उत्पन्न जल संकट का कोई समाधान नहीं है। केवल प्राकृतिक जल संसाधनों के संरक्षण और संवर्धन द्वारा ही इस संकट का निवारण किया जा सकता है। भारत मूलतः एक कृषि प्रधान देश होने के कारण भी जलविज्ञान का पुरस्कर्ता देश रहा है। पिछले आठ हजार वर्षों से भारत पर्यावरण संरक्षणॉ जल संग्रहण तथा जल प्रबन्धन से सम्बन्धित वैज्ञानिक तकनीकों के द्वारा अपनी जल संकट की समस्याओं को सुलझाता आया है। पुरातत्त्व और अभिलेखों के ऐतिहासिक साक्ष्यों से यह पुष्टि होती है कि 'वाटर हारवेस्टिंग' प्रणाली वैदिक काल से लेकर आधुनिक काल तक ग्रामदृनगर व्यवस्था और कृषि व्यवस्था की मूल आधारशिला रही है और इन्हीं परंपरागत 'वाटर हारवेस्टिंग' तकनीकों से इस देश का प्रत्येक गांव और शहर जल की दृष्टि से स्वयं में आत्मनिर्भर रहा है।

ब्रिटिश काल में अंग्रेज प्रशासकों द्वारा बड़े बड़े डैमों की योजनाएं बनाकर राष्ट्रीय जल प्रबन्धन के केन्द्रीकरण का जो प्रयास किया गया था उससे परम्परागत जलविज्ञान की धाराएं लुप्त होती गईं। ब्रिटिश साम्राज्यवादी प्रशासकों ने युद्धों के लिए धन इकट्ठा करने तथा औद्योगिकी के निर्माण हेतु भारत के वनों की जो अन्धाधुंध कटाई की उससे भी भारत के परम्परागत जलविज्ञान को भारी क्षति पहुंची तथा परम्परागत जलस्रोत सूखते गए। सबसे बड़ी विडंबना यह है कि हमारे देश में जो भी सरकारें चुनकर आई चाहे वह किसी भी दल की रही हों उन्होंने आजादी के इन 70 सालों में अंग्रेजों की विरासत में मिली साम्राज्यवादी और उपभोक्तावादी सोच के फलस्वरूप शोषणपरक केन्द्रीकृत जलनीतियों को ही अपनाया है। किसी भी राज्य सरकार ने परंपरागत जलविज्ञान और खेतीबाड़ी, सिंचाई आदि की दृष्टि से राज्य को आत्मनिर्भर बनाने वाली जल नीतियों और कृषि नीतियों को कभी लागू नहीं किया। हालांकि इस दिशा में हिमाचल प्रदेश की सराहना करनी होगी कि इस पहाड़ी राज्य ने विभिन्न परंपरागत जल परियोजनाओं को अपना कर अपने राज्य को जल की दृष्टि से आत्मनिर्भर बनाने में अच्छी सफलता प्राप्त की है।अन्य राज्यों की सरकारें भी यदि जनता की भागीदारी से ग्रामों और शहरों को आत्मनिर्भर बनाने की जल योजनाएं बनाती और वर्षा जल और भूजल संरक्षण के लिए परंपरागत जलाशयों के पुनर्निर्माण तथा 'वाटर हार्वेस्टिंग' जैसी योजनाओं को प्रोत्साहित करती तो आज देश के सामने जल संकट की ऐसी भीषण समस्या उपस्थित न होती।

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Mithilesh Kumar Pandey

भारतीय चिन्तक वैदिक काल से लेकर आधुनिक काल तक जल को पवित्र एवं दिव्य आस्थाभाव से देखते आए हैं। वैदिक साहित्य में जल देवता सम्बन्धी मंत्र इसके प्रमाण हैं। ऋग्वेद के मंत्रों में यह प्रार्थना की गई है कि ये मातृतुल्य नदियां लोगों को मधु और घृत के समान पुष्टिवर्धक जल प्रदान करें–

"सरस्वती सरयुः सिन्धुरुर्मिभिर्महो महीरवसाना यन्तु वक्षणीः।
देवीरापो मातरः सूदमित्न्वो घृत्वत्पयो मधुमन्नो अर्चत।।"[2] – ऋ., 10.64.9

ऋग्वेद के 'आपो देवता' सूक्त में जल को माता की संज्ञा दी गई है। क्योंकि जल से ही सम्पूर्ण ब्रह्माण्ड की सृष्टि हुई है तथा इसी जल के प्राकृतिक संरक्षण, संवर्धन और नियंत्रण द्वारा इस पृथ्वी का पर्यावरण संतुलित रहता है –

"ऋषे जनित्रीर्भुवनस्य पत्नीरपो वन्दस्व सवृधः सयोनीः।"[3] – ऋ., 10.30.9

जल संसार के सभी प्राणियों का वैसे ही पालन–पोषण करता है जैसे माता अपने बच्चों का दुग्धपान द्वारा पालन–पोषण करती है–

"यो वः शिवतमो रसस्तस्य भाजयतेह नः। उशतीरिव मातरः।।"[4] – ऋ., 10.9.2

जल के प्रति आस्था भाव का परिणाम है कि संस्कृत वाङ्मय के विभिन्न ग्रन्थों में वापी, कूप, तडाग आदि जलाशयों को धार्मिक दृष्टि से पुण्यदायी माना गया है–

"वापीकूपतडागानि देवतायतनानि च। अन्नप्रदानमारामाः पूतधर्मश्च मुक्तिदम्।।"[5]
– अग्निपुराण, 209.2

'प्रासादमण्डन' नामक वास्तुशास्त्र के ग्रन्थ में कहा गया है कि जो व्यक्ति जीव जन्तुओं और वृक्ष वनस्पतियों की जीवन रक्षा के लिए जलाशय का निर्माण करता है या दान स्वरूप देता है तो उसे इस लोक और परलोक में सुख की प्राप्ति होती है –

"जीवनं वृक्षजन्तूनां करोति य जलाश्रयम्। दत्ते वा लेभेत्सौख्यमुर्व्यां स्वर्गे च मानवः।।"[6]
– प्रासादमण्डन, 8.95

वाल्मीकि रामायण में राज्य की ओर से सिंचाई व्यवस्था को सुचारु बनाने तथा जल प्रबन्धन को जन–जन तक पहुंचाने के लिए नदियों के तटों पर बांध बनाना और जल के बिखरे हुए स्रोतों को संचयित करने का उल्लेख आया है –

"बबन्धुर्बन्धनीयांश्च क्षोद्यान् संचुक्षुदुस्तथा। अचिरेण तु कालेन परिवाहान् बहूदकान्।।"[7]
– वा. रामायण, 2.80.10–11

रामायण में ही निर्जल प्रदेशों में नाना प्रकार के जलाशयों जैसे कुओं, बावड़ियों आदि के निर्माण द्वारा जलसंचयन को विशेष रूप से प्रोत्साहित किया गया है –

"निर्जलेषु च देशेषु खानयामासुरुत्तमान्। उदपानान् बहुविधान् वेदिकापरिमण्डितान्।।"[8]
वा. रामायण, 2.80.12

इस प्रकार हम देख सकते है की कैसे भारतीय संस्कृति में और खासकर संस्कृत साहित्य में जल के प्रति समझ तथा जागरूकता पहले से ही विद्यमान थी, जिसका प्रमाण हमे वेद, रामायण आदि संस्कृत साहित्य के ग्रंथों में स्पष्ट रूप से मिलता है।

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वेदों में वर्णित रोग तथा उसके उपचार

मिथिलेश कुमार पाण्डेय *

सृष्टि के उत्पन्न होने के पूर्व ही सृष्टिकर्ता ने प्राणियों के जीवन की रक्षा - व्यवस्था के लिए वेदों में आयुर्वेद के सिद्धांतो का प्रतिपादन कर दिया था । सृष्टि के आदि काल से ही रोगों के प्रतिकार का प्रयत्न शुरू हो गया था । रोगों को दूर कर जीवन को स्वस्थ , निरोग तथा दीर्घ बनाना ही वेद तथा उसकी ही शाखा आयुर्वेद का मुख्य लक्ष्य हैं । गोपथ-ब्राह्मण में भेषज को अथर्व कहा गया हैं - **" येअथर्वाणस्तत भेषजं "** ।[(1)] जो अथर्वा हैं , वह भेषज(प्रतिषेध) हैं । थवती को अर्थ होता हैं गति और उसका जो प्रतिषेध करे , वह अथर्वा हैं । औषधि बढ़ते हुए रोग को रोकती हैं इसलिए उसे विद्वानों ने अथर्वा कहा हैं और यही अथर्वा अथर्ववेद में प्रतिपादित हैं सम्भवतः इसलिए उसका नाम अथर्ववेद हैं । चरक संहिंता में सभी प्रकार के राग - द्वेष से मुक्त होकर भेषज (नैष्ठिकी चिकित्सा) के बारे में बताया गया हैं --

विपापं विरजः शान्तं परमक्षरमव्ययम् ।
अमृतं ब्रह्म निर्वाणं पर्यायैः शान्तिरुच्यते ॥[(2)]

रोग के भेद मुख्यतः शारीरिक और मानसिक दो आधार पर कर सकते हैं ।रोग को मानव शरीर पर हमेशा नकारात्मक असर पड़ता हैं ,क्योंकि यह सत्य हैं की जिस प्रकार लगातार निर्बाध गति से बाह रहे जल को कोई अवरोध उत्पन्न हो जाये तो उसकी स्थिति में परिवर्तन दिखेगा ठीक इसी प्रकार सामान्य एवं सुव्यवस्थित रूप से जीवन व्यतीत कर रहे व्यक्ति के शरीर में जब रोग प्रवेश कर जाता हैं तो उसका जीवन अनियमित और अव्यवस्थित हो जाता है । उसकी कार्यक्षमता का ह्रास तथा कभी कभी अस्वाभाविक व्यवहार भी करने लगता है |इस प्रकार अन्य कई सामान्य परिणाम लगातार देखने को मिलता है।

वेदों में वर्णित रोगों तथा उनके उपाय निम्नलिखित है –

❖ **कुष्ठ रोग (Leprosy)**

वेदो में कुष्ठ रोग का लक्षण शरीर के विरुप होने तथा शरीर में श्वेत दाग का होना बताया गया हैं। अथर्वेद में किलास तथा पलित दो प्रकार के कुष्ठ रोग का वर्णन मिलता हैं -

किलासं च पलितं च निरीटो नाशया पृषत ।
आ त्वा स्वो विशतां वर्णः परा शुक्लानि पातय ॥[(3)]

कुष्ठ रोग के लिए औषधि के रूप में रामा , कृष्ण और असिक्नी औषधियों का उल्लेख किया गया हैं । इन औषधियों में त्वचा का प्राकृतिक रंग लाने की क्षमता मानी गयी है । कृष्ण नमक औषधि वस्तुतः पीपल औषधि ही है उसमे कुष्ठ रोग को दूर करने की क्षमता है ।

नक्तञ्जातस्योषधे रामे कृष्णे असिक्न च ।
इदं रजनी रजय किलासं पलितं च यत ॥[(4)]

❖ **यक्ष्मा (Tuberculosis)**

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Mithilesh Kumar Pandey

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भारतीय वैदिक शिक्षा

मिथिलेश कुमार पाण्डेय *

भारतीय वैदिक ज्ञान, सर्वतोमुखी, सम्पूर्ण तथा आदर्श है। मनुष्य के लिए जितनी भी आवश्यक सर्वांगीण विकास तथा अधिकाधिक सफलता के लिए ज्ञान वेदो में सन्निहित है। एक योग्य अन्वेषक आकांक्षापूर्वक ज्ञान इनसे पूर्णरूप से प्राप्त कर सकता है। **'वेदो अखिलो धर्म मूलम्** 'अर्थात इस समस्त सृष्टि में वेदों को ही समस्त धर्मो का मूल मन गया है। सृष्टि के आदि में ऋषियों द्वारा वेद समस्त नैतिक मूल्यों का जन्मदाता है। भारतीय संस्कृति में वेद सनातन वर्णाश्रम धर्म के, मूल और सबसे प्राचीन ग्रन्थ हैं, जो ईश्वर की वाणी है। ये विश्व के उन प्राचीनतम धार्मिक ग्रंथों में हैं जिनके पवित्र मन्त्र आज भी बड़ी आस्था और श्रद्धा से पढ़े और सुने जाते हैं।

'वेद' शब्द संस्कृत भाषा के विद् शब्द से बना है। इस तरह वेद का शाब्दिक अर्थ 'ज्ञान के ग्रंथ' है। इसी धातु से 'विदित' (जाना हुआ), 'विद्या' (ज्ञान), 'विद्वान' (ज्ञानी) जैसे शब्द आए हैं। आज 'चतुर्वेद' के रूप में ज्ञात इन ग्रंथों का विवरण इस प्रकार है -

- **ऋग्वेद** - सबसे प्राचीन वेद - ज्ञान हेतु लगभग 10 हजार मंत्र। इसमें देवताओं के गुणों का वर्णन और प्रकाश के लिए मन्त्र हैं सभी छन्द रूप में।
- **सामवेद** - उपासना में गाने के लिये 1975 संगीतमय मंत्र।
- **यजुर्वेद** - इसमें कार्य (क्रिया) व यज्ञ (समर्पण) की प्रक्रिया के लिये 3750 गद्यात्मक मन्त्र हैं।
- **अथर्ववेद** - इसमें गुण, धर्म, आरोग्य, एवं यज्ञ के लिये 7260 मन्त्र हैं।

वेदों को ***अपौरुषेय*** (जिसे कोई व्यक्ति न कर सकता हो, यानि ईश्वर कृत) माना जाता है। यह ज्ञान विराटपुरुष से वा कारणब्रह्म से श्रुति परम्परा के माध्यम से सृष्टिकर्ता ब्रह्माजी ने प्राप्त किया माना जाता है। इन्हें ***श्रुति*** भी कहते हैं जिसका अर्थ है 'सुना हुआ ज्ञान'। अन्य हिन्दू ग्रंथों को ***स्मृति*** कहते हैं, यानि वेदज्ञ मनुष्यों की वेदानुगत बुद्धि या स्मृति पर आधारित ग्रन्थ। वेद के समग्र भाग को मन्त्र संहिता, ब्राह्मण, आरण्यक, उपनिषद के रुप में भी जाना जाता है। इनमे प्रयुक्त भाषा वैदिक संस्कृत कहलाती है जो लौकिक संस्कृत से कुछ अलग है। ऐतिहासिक रूप से प्राचीन भारत और हिन्द-आर्य जाति के बारे में वेदों को एक अच्छा सन्दर्भ श्रोत माना जाता है। संस्कृत भाषा के प्राचीन रूप को लेकर भी इनका साहित्यिक महत्व बना हुआ है।

वेदों को समझना प्राचीन काल में भारतीय और बाद में विश्व भर में एक वार्ता का विषय रहा है। इसको पढ़ाने के लिए छः उपांगों की व्यवस्था थी। शिक्षा, कल्प, निरुक्त, व्याकरण, छन्द और ज्योतिष के अध्ययन के बाद ही प्राचीन काल में वेदाध्ययन पूर्ण माना जाता था। प्राचीन काल के ब्रह्मा, वशिष्ठ, शक्ति, पराशर, वेदव्यास, जैमिनी, याज्ञवल्क्य, कात्यायन इत्यादि ऋषियों को वेदों के अच्छे ज्ञाता माना जाता है। मध्यकाल में रचित व्याख्याओं में सायण का रचा चतुर्वेदभाष्य "माधवीय वेदार्थदीपिका" बहुत मान्य है। यूरोप के विद्वानों का वेदों के बारे में मत हिन्द-आर्य जाति के इतिहास की जिज्ञासा से प्रेरित रही है। अतः वे इसमें लोगों, जगहों, पहाड़ों, नदियों के नाम ढूँढते रहते हैं - लेकिन ये भारतीय परंपरा और गुरुओं की शिक्षाओं से मेल नहीं खाता। अठारहवीं सदी उपरांत यूरोपियनों के वेदों और उपनिषदों में रूचि आने के बाद भी इनके अर्थों पर विद्वानों में असहमति बनी रही है।

वेदाङ्गों में शिक्षा को पवित्रतम साधन मानते हुए ज्ञान और शिक्षा की महिमा की वर्णित किया गया है।**" न हि ज्ञानेन सदृशं पवित्रमिह विद्यते"** कहकर गीता में ज्ञान को पवित्रतम घोषित करते हुए उसे निःश्रेयस प्राप्ति का मार्ग बताया गया है ।

प्राचीन भारतीय काल में अध्ययन अध्यापन के प्रधान केंद्र गुरुकुल हुआ करते थे, जहाँ दूर दूर से विद्यार्थी, अथवा सत्यान्वेषी परिव्राजक अपनी-अपनी शिक्षाओं को पूर्ण करने जाते थे। वे गुरुकुल छोटे अथवा बड़े सभी प्रकार के होते थे। परंतु उन सभी गुरुकुलों को न तो आधुनिक शब्दावली में विश्वविद्यालय ही कहा जा सकता है और न उन सबके प्रधान गुरुओं को कुलपति ही कहा जाता था। स्मृतिवचनों के अनुसार -

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* छात्र, संस्कृत विभाग, दिल्ली विश्वविद्यालय

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Mithilesh Kumar Pandey

Mithilesh Kumar Pandey

रंगमंच और नाट्यकला

मिथिलेश कुमार पाण्डेय *

मनुष्य अपने भावों को प्रकट करने के लिए तरह तरह के युक्तियों को अपनाता है किन्तु उनमें सबसे सरल और सशक्त माध्यम के रूप में जों हमारे समक्ष आता है वह है अभिनय। अभिनय एक ऐसा माध्यम है जिसके द्वारा हम किसी भी भाव या विचार को सरलता पूर्वक ग्रहण करने में अपने को समर्थ पाते हैं इसका मुख्य कारण यह हैं की अभिनयकला या नाट्यकला समस्त ललित कलाओ में सर्वोपरि हैं। शायद यही कारण हैं की अभिनय को नाट्य प्रयोग का निर्वहन करने वाले नट का व्यापार ही कहा जाता हैं –

''अभिनीयते इति अभिनयः''।[1]

आचार्य भरत ने नाट्यशास्त्र के प्रथम अध्याय में नाट्य को तीनों लोकों के विशाल भावों का अनुकीर्तन कहा है तथा इसे सार्ववणिक पञ्चम वेद बतलाया है। भरत के अनुसार, ऐसा कोई ज्ञान शिल्प, विद्या, योग एवं कर्म नहीं है जो नाटक में दिखाई न पड़े –

न तज्ज्ञानं न तच्छिल्पं न सा विद्या न सा कला।
न स योगो न तत्कर्म नाट्ये अस्मिन् यन्न दृष्यते।।[2]

संस्कृत नाट्य साहित्य का विकास क्रमशः वैदिककाल से ही प्रारंभ हो गया था। वेदों में ऐसे संकेत अवश्य मिलते हैं जिनसे वैदिककाल में नाटकों की स्थिति सिद्ध होती है।

- ऋग्वेद के सूक्तों में सोमविक्रय के समय होने वाले अभिनय का पता चलता है। महाव्रत के अवसर पर कुमारियाँ नृत्य गान के साथ अग्नि के चारों ओर परिक्रमा करती थी।
- शुक्ल यजुर्वेद की वाजसनेयी संहिता के तीसवें अध्याय की छठी कण्डिका में ''शैलूष'' शब्द आया है, जिसका अर्थ है– अभिनेता। कहा जाता है कि एक सूत को नृत्य के लिए और शैलूष को गाने के लिये नियुक्त किया जाना चाहिये।
- सामवेद की ऋचाएँ रागबद्ध हैं ही, जिससे ज्ञात होता है कि वैदिक युग में संगीत पूर्ण विकसित अवस्था में था। संगीत के अलावा नृत्य तथा वाद्य के भी संकेत प्राप्त होते हैं।

इससे यह सिद्ध होता है कि वैदिक युग में वे सभी उपादान प्रचुर मात्रा में पाये जाते थे जो नाटक के विकास के लिए अपेक्षित हैं।

वेदो के पश्चात रामायण एवं महाभारत में भी नाटक के संकेत प्राप्त होते हैं।

- महाभारत में ''रामायण नाटक'' तथा ''कौबेर रंगाभिसार'' नामक नाटको के नाम आये हैं। महाभारत के विराट पर्व में रंगशाला तथा नट का प्रयोग है।
- रामायण में भी ''नट'', ''नाटक'', ''रंग'' तथा "नर्तक" का अनेक स्थानों पर उल्लेख प्राप्त होता है।
- पाणिनि ने भी 'अष्टाध्यायी'' में 'पाराशर्य शिलालिभ्याम् भिक्षुनटसूत्रयोः' द्वारा नाटकों की पूर्व रचना का आभास दिया है।

अभिनयकला विविध रूपो में अभिधेयत्व को प्राप्त होती हैं। इसके अन्तर्गत आंगिक, वाचिक, सात्विक एवं आहार्य अभिनय आता हैं। नाट्याभिनय में नट अभ्यास के बल से चरित्र विशेष को यथार्थ रूप में दर्शक एवं समाज के समक्ष प्रस्तुत करता हैं। अभिनय अर्थात् चरित्र की दक्षता के कारण ही अभिनेता अपने और दूसरे की भावना से हीन होकर सर्वग्राह्य हो जाता हैं। अभिनेता अभिनय के माध्यम से जिस भी चरित्र को करता हैं वह चरित्र पौराणिक, ऐतिहासिक, सामाजिक तथा कल्पना पर आधारित भी हो सकता हैं। अपने उत्कर्ष अभिनय द्वारा अभिनेता दर्शक एवं श्रोता से चारित्रिक साम्यता को स्थापित कर लेता हैं।

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Mithilesh Kumar Pandey

अभिनय अधिकांशतः लोकधर्मी माने गए हैं क्योंकि उनमें प्रायः लोकव्यवहार का मंचन होता हैं। नाट्य का उद्येश्य आचार्य भरत ने सुख व दुःख से व्याप्त जगत में नाट्यानंद रूपी लोक का सृजन करना बतलाया हैं –

दुःखार्तानां श्रमार्तानां शोकार्तानां तपस्विनाम्।
भिश्रामजननं लोके नाट्यमेतद् भविष्यति।।[3]

महाकवि कालिदास पांचवी शताब्दी के राजा विक्रमादित्य के दरबार के नवरत्नों में से एक थे। वे संस्कृत नाटककारों में सववश्रेष्ठ तथा सुप्रसिद्ध हैं। महाकवि कालिदास के नाटक मालविकाग्निमित्र, विक्रमोर्यवशीय तथा अभिज्ञानशाकुन्तल हैं। अभिज्ञानशाकुन्तल केवल कालिदास की ही नही अपितु समस्त संस्कृत साहित्य की सर्वोत्कृष्ट रचना हैं और इसे समस्त संसार में प्रदर्शित किया गया हैं। विगत 200 वर्षो से भारत की प्रान्तीय भाषाओं में अनुदित होकर हजारों बार रंगमंच पर खेला गया हैं। 1989 में सर विलियम जोंस ने अभिज्ञानशाकुन्तल नाटक को अग्रेजी में अनुदित करके पहली बार यूरोप को संस्कृत नाटक की झलक दिखलाई। इतना ही नही प्रसिद्ध जर्मन कवि और नाटककार गेटे अभिज्ञानशाकुन्तल से इतना प्रभावित हुआ की उसने अपने नाटक 'फाउस्ट' का प्रारम्भ कालिदास के नाटक के समान किया और गेटे ने लिखा की –

"Wouldst thou the young year's blossomsAnd the fruits of its decline,AndAll by which the soul is charmed, enraptured, feasted, fed, Wouldst thou the Earth And Heaven itself in one sole name combine, I name thee, O Sakuntala, And All At once is said."[4]

अर्थात् ''यदि तुम युवावस्था के फूल, प्रौढावस्था के फल और अन्य ऐसी सामग्रीयां एक ही स्थान पर खोजना चाहते हो तथा जिनसे आत्मा प्रभावित होता हो, तृप्त होता हो और शांति पाता हो,अर्थात् यदि तुम स्वर्ग और मर्त्यलोक को एक ही स्थान पर देखना चाहते हो तो मेरे मुख से सहसा एक ही नाम निकल पड़ता है – अभिज्ञानशाकुन्तल, महान कवि कालिदास की एक अमर रचना!''

संस्कृत नाटकों में प्रकृति के साथ घनिष्ठ सम्बन्ध दृष्टिगत होता है। अन्तः प्रकृति एवं बाह्य प्रकृति का इन नाटकों में सुन्दर समन्वय किया गया है। अन्तः प्रकृति की सूक्ष्म एवं सुकुमार भावनाओं के चित्रण के लिए बाह्य प्रकृति चित्रफलक का कार्य करती है। प्रकृति का मानवीकरण भी संस्कृत रुपकों की अपनी विशेषता रही है। इनमें मानव का प्रकृति के साथ घनिष्ठ सम्बन्ध दृष्टगोचर होता है। कालिदास के ''अभिज्ञानशाकुन्तलम्'' में शकुन्तला की विदाई के समय प्राकृतिक उपादानों की स्थिति का सजीव तथा कारुणिक वर्णन ह्रदय को सहज भावाभिभूत करने वाला है दृ

'उद्गलित दर्भकवला मृग्यः, परित्यक्तनर्तना मयूराः
अपसृत पाण्डुपत्रा मुन्चन्त्यश्रूणीव लताः।।[5]

वैश्वीकरण एवों तकनीकीकरण के युग में आधुनिक रंगमंच अभिनय के माध्यम से स्थानीय एवं आंचलिक सामाजिक समस्याओं को उजागर करने के लिए एक सशक्त माध्यम बन गया हैं जिसके फलस्वरूप आज अनेक प्रकार के प्रयोगात्मक अभिनय और रंगमंच का प्रचलन दिखाई दे रहा हैं।दर्शक को मात्र एक अनुभव चाहिए, बच्चे की तरह जो घोडे पर सवार होना चाहता हैं। दर्शक भी एक ऐसा बच्चा हैं लजसक रंगमंच एक वाहन के रूप में चाहिए जिससे उसे लगे की वह कही ले जाया जा रहा हैं– किसी लक्ष्य की ओर किसी दिशा की तरफ। हमको आज ऐसा नाटक या रंगमंच चाहिए जो दर्शक की ओर समर्पित और संबोधित हो।

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वेंदो में नारियों की भूमिका

मिथिलेश कुमार पाण्डेय[*]

भारतीय समाज में स्त्री को त्याग और तपस्या का प्रतीक माना गया है। भारतीय समाज में स्त्री का क्या महत्व है, इसका अनुमान मनुस्मृति के इस वचन से लगाया जा सकता है–

"यत्र नार्यस्तु पूज्यन्ते रमन्ते तत्र देवताः"।[(1)]

अर्थात् जहाँ पर स्त्रियों की पूजा होती है वहाँ देवता आदि निवास करते है। वैदिक समाज के समाजशास्त्रियों के अनुसार स्त्रियाँ निंदा अथवा अपमान का सूचक नहीं है बल्कि वह आदर एवं सम्मान की अधिकारी है। जिस कुल में स्त्रियाँ कष्ट भोगती हैं, वह कुल शीघ्र ही नष्ट हो जाता है और जहाँ स्त्रियाँ प्रसन्न रहती है वह कुल सदैव फलता फूलता और समृद्ध रहता है–

शोचन्ति जामयो यत्र विनश्यत्याशु तत्कुलम् ।
न शोचन्ति तु यत्रैता वर्धते तद्धि सर्वदा।।[(2)]

वैदिक संस्कृति के अनुसार नारी समाज की आधारशिला है और वह जिस प्रकार से कन्या, पत्नी तथा माता के रूप में अपने अपने कर्तव्यों की भूमिका का निर्वहन करती हैं, उसी कर्तव्यों के आधार पर ही किसी समाज की उन्नति या अवनति होती है। इसलिए उस राष्ट्र या देश को चाहिए की उन नारियों के प्रति अपने सकारात्मक जिम्मेदारियों को समझे तथा उन्हें उनके उत्तरदायित्व तक पहुचने और प्रतिनिधित्व के अवसर को प्राप्त करने के लिए सहयोग करें तथा उनके लिए सकारात्मक प्रक्रिया को सुनिश्चित करें।

वैदिक साहित्य के अध्ययन से यह स्पष्ट तौर पर पता चलता है की उस समय का सामाजिक जीवन बहुत ही वैज्ञानिक और सुव्यवस्थित था क्योंकि इस बात से हम कतई भी मना नहीं कर रहे की उस समय में पुरुषों की प्रधानता थी, फिर भी उस समाज में नारियों को सम्मानित तथा योग्य स्थान प्राप्त था। किसी राष्ट्र एवम् समाज की स्तिथि इस प्रकार देखा जा सकता है की वहाँ की नारियों की दशा या स्तिथि क्या और कैसी है। वैदिक साहित्य (ऋग्वेद आदि) को पढने तथा अनुशीलन करने के बाद यह पता चलता है की उस समाज में समानता तथा स्वतंत्रता के प्रति दृष्टिकोण की भावना जागृत तथा उत्साहपूर्ण थी और नारियों को प्रत्येक स्तर पर सम्मान की दृष्टि से देखा जाता था तथा उनकी बात को सुना जाता था। घर के कार्यों से लेकर कृषि से सम्बन्धित सभी कार्य तथा यज्ञ आदि क्रिया–कलापों से लेकर शिक्षा ग्रहण करने तक के सभी कार्यों से नारियाँ अछूती नही थी अपितु उनका योगदान और सहभागिता पुरुषों की ही भांति ही थी। वैदिक साहित्य में तो कहीं पुत्री के रूप में तो कहीं पत्नी के रूप में तो कहीं माता के रूप में उनके योगदान और वास्तविक भूमिका का वर्णन स्पष्ट रूप से देखने और समझने को मिलता है।

आज जो नारी की स्थिति है वह समय, काल व परिस्थितियों के कारण परिवर्तित है परंतु नारी की यह स्थिति न तो सदा से है और न ही शास्वत है।

"त्वं स्वाहा त्वं स्वधा त्वं हि वष्टकारः स्वरात्मिका।
सुधा त्वं अक्षरे नित्ये तृधा मात्रात्मिका स्थिता।"[(3)]

इस श्लोक के द्वारा ब्रम्हा जी देवी स्तुति आरंभ करते हैं। विद्वानों का मानना है कि वैदिक काल के आरंभ से पहले समाज मातृसत्तात्मक था जिसमें स्त्री श्रेष्ठ और उच्च भूमिका में थी। उस युग में स्त्रियों की शिक्षा–दीक्षा के साथ साथ अध्ययन–अध्यापन की भी समुचित व्यवस्था थी। घर–परिवार, सभाओं तथा युद्ध में भी उनकी समान भागेदारी थी। नारी को सभी क्षेत्र तथा दिशाओं में पूर्णरूप से उन्नति करने की स्वतंत्रता थी, इसीलिए उस काल में नारी की प्रतिभा तथा ज्ञान अपूर्व और अद्भुत था। उस काल में नारी के अंदर विचारशक्ति व आत्मबल के साथ उसके व्यवहार में शालीनता, विनम्रता

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थी तथा प्रभावशाली व्यक्तित्व भी था। परिवार व समाज में नारी का स्थान पुरुषों के समान अथवा कुछ स्थानों में पुरुष से भी श्रेष्ठ था तथा देवी स्वरूप को कई स्थानों पर पुरुष देवताओं से ज्यादा शक्तिशाली दिखाया गया था। स्त्री घर का प्रबंधन व नियमन करती थी। पतिव्रता स्त्री का देवी तुल्य सम्मान था। कन्यादान के समय माता की उपस्थिति अनिवार्य मानी जाती थी। वैदिक युग स्त्री व पुरुष दोनों को ही इच्छानुसार विवाह की स्वतन्त्रता थी। स्त्रियां इच्छा अनुरूप अपना जीवन बिना विवाह किए शिक्षा में व्यतीत कर सकती थीं। वैदिक काल में ही स्त्री की शक्ति रूप में स्थापना हुई और वह शक्ति रूप में पूज्यनीय बनी स्त्री को धन, शौर्य और ज्ञान की अधिष्ठात्री बताया गया है।

भारत की नारियाँ प्राचीन समय से ही उच्च नही अपितु उच्चतम शिक्षा को ग्रहण करने वाली रही हैं। अथर्ववेद के अनुसार बालकों के भांति बालिकाओं के लिए भी शिक्षा को ग्रहण करना अत्यंत आवश्यक बताया गया है और बालिकाएँ ब्रह्मचारी का पालन करते हुए अलग अलग विद्याओं में पारंगत हुआ करती थी। आध्यात्मिक ज्ञान के क्षेत्र में भगिनी, अपर्णा, एकपर्णा, मैना, समति आदि कन्याओं का उल्लेख प्राप्त होता है और शायद यही कारण रहा है की उन्हें विदुषी कहा जाता रहा हैं। इन विदुषी नारियों में घोषा, लोपामुद्रा, मैत्रेयी, सुलभा और गार्गी आदि अन्य कई उदहारण स्वरुप हैं। ऋग्वेद के दशम मण्डल में घोषा का वर्णन स्पष्ट रूप में प्राप्त होता है। अपाला और रोमशा के साथ सूर्य पुत्री सूर्य ने मंत्रों की रचना किया। ऋग्वेद में ऋषि अगस्त्य और उनकी धर्मपत्नी ऋषिका लोपामुद्रा के समुद्र भांति अगाध ज्ञान का वर्णन हमें स्पष्ट रूप से प्राप्त होता है। इसी प्रकार ऋषिका गार्गी का वर्णन प्राप्त होता है की जब रजा जनक अपने राज्य में यज्ञ का आयोजन करवाते है तो उसमे ऋषिका गार्गी भी उपस्थित होती है और वे याज्ञवल्क्य ऋषि के साथ संवाद करती है, जिससे उनके अगाध विद्वता का परिचय हमे प्राप्त होता है।

उन दिनों नारियां जो अध्यापिकाओं के रूप में शिक्षण देती थी उन्हें उपाध्याया के नाम से अभिहित किया जाता था। व्याकरण–आचार्य पाणिनि ने भी उपाध्याया एवं स्त्री पद वाली स्त्रियों पर प्रकाश डाला है। उनके अनुसार छात्र तथा छात्राएँ एक साथ शिक्षा ग्रहण करते थें

इतिहास को देखने के बाद यह पता चलता है कि हमारा वैदिक इतिहास किस प्रकार नारियों के प्रति सजग एवं जागरूक था और उस समय किस प्रकार नारियों का प्रतिनिधित्व शिक्षा के साथ–साथ अन्य कई मत्वपूर्ण स्थानों पर पुरुष की भांति था। आज देश के पुनरुथान के समय में पुनः उसी स्वर्णिम इतिहास को एक बार फिर दोहराए जाने की आवश्यकता है ताकि नारी जागृति तथा उनके प्रतिनिधित्व की लहर 21वीं सदी में सकारात्मक रूप ले तथा समाज में उनका एक विशिष्ठ सम्मानित स्थान हो।

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Mithilesh Kumar Pandey

ज्ञान-विज्ञान विमुक्तये

2016 – 17

रंगमंच एवं नाट्यकला : आधुनिक परिप्रेक्ष्य में

THEATRE AND DRAMATURGY IN MODERN PERSPECTIVE

प्रधान संपादक
डॉ. अनुला मौर्य

संपादक
डॉ. देशराज

संस्कृत विभाग

कालिन्दी महाविद्यालय

दिल्ली विश्वविद्यालय

Mithilesh Kumar Pandey

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Editor

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Contents

Understanding Hollywood Period Films W.R.T Cultivation Theory

Monika Sharma

There are numerous intersecting points between cinema and history. It occurs at a point or junction focusing upon two points where the history has been made and where it's been perceived, as in what present audience perceives out of a particular film. At some instances cinema has been called as an agent of history. In the beginning, it was considered as a tool to measure scientific progress. The trend of making historical films has already begun a long way back such as in England the filmmakers have shown Queen Elizabeth with her empire, in France they were based on the productions of Bourgeoisie such as various institutions, means of transportation: train. At that time fictional films were used as a tool of propaganda and as a result of which the leaders of the society started using it in the same manner.

Over 1200 films were released during the time period from 1950 to 1959. All the films made during the fifties have generated a big challenge that how to do justice with the original history and according to the statistics the production of these movies involved over 300 directors, 400 producers, more than 500 scriptwriters and numerous actors, dancers, designers. Filmmakers have utilized all the possible material and the practice of reconstructing the sets has got evolved. The story which a movie has shown and the recreation of events somewhere or the other have reinforced the way how the same events of history are been portrayed in another film. This has given birth to new and wide variety of narrative techniques which were further used by various filmmakers to produce period films. Later on, various filmmakers started using different stories from the past to reconstruct them and present them to the audiences. A wide range of films was made such as Titanic, Cleopatra, Alexander, the Patriot, Gladiator, Chicago etc.

Titanic was a movie which was one of the biggest hits of the year 1997 and has collected the highest gross collection. It was directed by James Cameron, Leonardo DiCaprio, and Kate Winslet. The movie was based on the sinking of a huge ship named "Titanic'. It was applauded for the picturization and was also nominated in 14 categories out of which it has won Oscar for the best picture and best director awards category. It has also won 11 Academy awards along with many other awards. On the other hand, according to Jennifer Rosenberg, there are some facts which are still unknown to the audience and the film has got failed to represent and showcase. These are lifeboat drill was got canceled, The Titanic had its own newspaper, lifeboats which were known to save people's lives, were not launched off and also were not filled to their capacity, boats were closer which were meant for rescue.

Another Hollywood period film was Elizabeth, released in the year 1998 and was directed by ShekharKapur. This film has got great critical acclaim and has won many awards like academy award, American society of cinematographers for best cinematography, best picture and best director by Toronto film critics association and best performance by an actress by the golden globe. This film was based on the conflicts happening at the times when Elizabeth has become the Queen of England, between the ruling Protestants and Catholics and who were out to regain control. This film was nominated for 7 categories but has won only one and that was for best makeup. Gladiator, a movie by Ridley Scott in the year 2000 was the biggest hit of the year. It is a story of a Roman soldier who later on becomes a slave and after training rose to challenge the empire. It has won 5 Oscars and great fame.

Troy is another movie which came in 2004 by Wolfgang Petersen, starring Brad Pitt, Eric Bana, and Orlando Bloom. It was nominated for Oscars and was worldwide hit commercially and was critically acclaimed.

According to Ranciere, whatever is being represented filmicly in period films is an aspect of the historical past, the possibility emerges for viewers to engage deeply and critically, and quite possibly to embrace new political commitments, both in past and in future. As the society is getting evolved and the invasion of so many new things like technological advancements, one should understand the fact that with the changing society the thinking and academic level of historians are also getting changed day by day. So it's not necessary to represent the history through a transparent frame, as in receptive techniques of people vary from one to another and so filmmaker is allowed to portray the history according to his interpretation. At this instance, the term 'Narrative Construction' comes into the frame.

Historical films are considered as an influential source to depict historical events as they have ever happened. Many times audiences of such films link themselves with the characters been portrayed in them and start feeling that they have a stake in events depicted. Usage of voice overs in period films has helped filmmakers a lot to make it commercially viable. But foreign writers, on the other hand, do not rely on such films to gather information and most of the times they use to ignore this genre as according to them the period filmmakers do not take the history serious enough. All the possible techniques like editing, inserting music, voice over are into the period films have made them more popular and commercially hit worldwide. It can be easily understood from here that period films do not comprise of history only, rather it is a package of songs, melodrama, narrations etc. Some movies were based on various fights been happened between various kings and rulers, so the usage of weapons is another aspect of Hollywood period films. In the present day society, no one is that much familiar with the history such that he/she can actually represent the original history as it is. So, it's clear from the fact that with the changing norms and values of society, the definition of period films is also getting changes and the present filmmakers and historians have a belief that whatever period films showcases is something which is based on somebody's own understanding of that particular historical event.

"Historical films, both drama and documentary, derive their popularity from criteria they share with narrative history", asserted by Rosenstone.

"The past is a foreign country; they do things differently there".L.P.Hartley, the Go-Between (1953).

David Lowenthal, in his book titled, The Past is a Foreign Country, remarked that 'it is no longer the presence of the past that speaks to us, but its past'. This thin line distinction underlines the pleasure of the period film, in which 'the Past' resonates in the present through the visualization of past, and its intimate signs. The period film stages a return to a place and time whose codes may seem strange and, more often than not, irrelevant. However, period objects and practices are a source of continuing fascination, which accounts for the genre's enduring popularity. A period filmmaker tries to utilize each and every form of material available on the respective topic. Adaptation of various literary works into a fiction film is one of the key aspects of period films. Books and novels can be considered as the key contributors in making a period film. To analyze the content and credibility of period films knowledge of literary works of varying types of various time periods is very necessary, which then helps to compare the films based on them. Period film is nothing else than applying conventions of cinematography to conventions of history. Traditional scholarship on film adaptation has been caught in a

reductive opposition between the original and its illustration. The numerous discourses analysis which was done on fidelity has dominated the debates on around film adaptation since the beginning. In the present context, 'Fidelity' refers to the critical activity within a hierarchy of cultural values that assesses above all the adaptation degree of likeliness to the original.

The combination of photographs and texts presented to society especially by the media became a powerful tool for influencing opinion and thereby both history and historiography. The trend of making period films has begun with the period film named Pride and Prejudice (Joe Wright, 2005). It was a mainstream production with 'classic' literary credentials. In this Austen's novel has become part of repetitive visual figures which; given a consistent identity through genre, function as a generative template for new films. The modern period film has changed unifying heritage label inadequately and has also changed the post phenomenon: post-national, post quality, post heritage and postmodern. The period film has increasingly followed the principles of sophistication in showcasing their films visually, but on the other hand, it is increasingly difficult to put down according to national traits of style and content. Its agenda also become diversified and even more dislocated.

The period film's iconographic obviousness and instant readability disguise the fact that the genre mobilizes an array of visual forms that have their own genealogy and are first are foremost self-referential. Here 'Realism', can be defined as, its own historical origins as one of the more philosophical regimes of writing through the evidence of the photographic 'having been there of things'. The period film's descriptive mode (identified by Higson as the spectacular 'Heritage Space', opposed to narrative space. The historical film thus articulates spectatorship as 'a kind of dialectic between a "realist" quest for the referential awareness of and pleasure in the artifice of the film.

According to Laura Bushell of BBC," it is a benchmark film for both Indian cinema and cinema grandeur in general; 'Mughal-e-Azam' is epic in every sense of the word."

In 1955 paullazarsfeld and elihukatz evolved two-step waft theory. In keeping with this concept, the media disseminates its data into wonderful degrees. The energy of media, therefore, is oblique and is reduced with the aid of the have an impact on of opinion leaders.

1. Opinion leaders (first hand receivers of media content)
2. Then those opinion leaders bypass on their interpretations to the audiences similarly to the real content material produced by media.

3. Here, term 'non-public affect' comes into the body, which intervenes between the media's direct message and audience's ultimate response to that message.
4. Opinion leaders play crucial position in getting human beings to alternate their attitudes and beliefs.

The identical concept can be carried out to the Hollywood additionally, as in filmmakers acts as opinion leaders, which transforms the literary works into a visual format. At the same time as making a movie sometimes, filmmakers use their personal attitudes along with the real paintings being available, which actually justifies the invasion of the time period 'non-public have an effect on'.

The book, 'Screen Adaptations' by Geoffrey Wagner, states three basic adaptations of cinema:

1. Commentary adaptation: It is a type in which originality is altered according to the purpose and intentions of the filmmaker.
2. Analogy adaptation: This type signifies an altogether different form of work which has a little similarity to the literature.
3. Transposition adaptation: This form assures that whatever the screen visions, all will be close to the literature.

Conclusion

Fulfillment of a period film doesn't depend upon the accurate representation of history; inside the current era, duration movies are made with a brand new trend of intentionally the use of anachronistic elements with the intention to make it movie more relevant to a modern target market. Equal is with movies like a Knight's Story, Marie Antoinette and Vanity Fair. Each the two former movies have modernized the periods they represent with the aid of placing rock tune into them. Conceitedness truthful, then again, attracts notably on the references to Bollywood to explore the giant impact of India on the British Empire at some stage in the 19th century.

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Editor

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Contents

Unaware or Smart Shoppers of Online Content

Monika Sharma

With the expanding use of PC innovation and the Web in instructional settings, online assets including electronic diaries are rapidly picking up grounds as an essential hotspot for references. Such online instructive interests can result in genuine outcomes if Clients don't appropriately credit the proprietors of protected innovation they use. The motive behind this online robbery and copyright infringement module was to increment the consciousness of online robbery and copyright infringement to eventually figure out the utilization of techniques to keep away from infringement for understudies.

New advancements make it simple for everyone to download and utilize innovative work, from numerous points of view, for example, motion pictures, music, articles, books, and workmanship. In any case, in a quick paced online culture, it's anything but difficult to disregard copyright law, which raises two most issues: written falsification and theft. Written falsification implies utilizing another person's thoughts or words without crediting the source and imagining they're your. Theft is the unapproved use, proliferation, or on the other hand sharing of copyrighted or protected material – ordinarily music, films, TV shows, and programming. Although a few youngsters may feel they reserve the privilege to take and utilize anything they find online without giving credit to its maker or paying for it when fundamental, the Internet is definitely not a free-for-all. Be that as it may, teenagers first should be instructed by the way, they can employ copyrighted work. For instance, realizing that they have to get consent previously utilizing copyrighted work, and figuring out how to appropriately refer to the work they use, are great initial steps to being deferential computerized makers and shoppers.

Literary theft and robbery are two extraordinary parts of copyright encroachment, and extensively we can characterize literary theft as the allocation of someone else words

or on the other hand thoughts without appropriate authorization or affirmation, while robbery alludes to the huge scale generation of entire books, regardless of whether in print or electronic structure, to substitute for genuine duplicates. Literary theft is a term with a long history, furthermore, it is as, yet the term of decision for contemporary revealing of copyright encroachment, as we have seen as of late in the Dan Brown situation where even the prominent papers have utilized the word 'literary theft' in their features as an insulting that they except to be generally comprehended. However 'copyright infringement' is a dangerous idea in copyright law, and legal counselors appear to need to avoid it.

On the off chance that you take a stab at discovering 'written falsification' in any of the driving reading material on protected innovation furthermore, copyright, you will find that it simply is not there. In the past decades, we experienced PC infections, interference of intensity, attacks of security, digital erotic entertainment, and numerous robberies.

Unoriginality includes duplicating material, either word from word or as a reword, from anything going from books, to web locales, course notes, oral or visual introductions, lab reports, PC assignments, or imaginative works. The cutting edge idea of literary theft as unethical and innovation as a perfect developed in Europe just in the eighteenth century. Presently we can check written falsification of research content, numerous devices are accessible on the web to check the inventiveness of research work. While a few actualities might be seen as normal information, the introduction of those actualities is viewed as the one of a kind work of a creator. Once more, when utilizing the language or expressions of another, you should appropriately recognize his or her work.

The present postmodern world, managed by electronic devises and broadband web has seen a change of home stimulation into another dimension of moment, quick and expansive accessibly of substance (for example films, music, recreations, books). All the while, the improvement of new conveyance channels occurred, enabling customers to stream any advanced substance continuously without the need to store such substance on hard drives (for example Compact discs, DVDs, PC and substance drives), inferable from quick infiltration of web around the world Unmistakably digitalisation influenced the manner by which numerous enterprises make and appropriate their substance .

The issue of piracy and plagiarism has been disturbing since inception and matter of scholarly trustworthiness inside advanced education has gotten impressive attention in the writing over ongoing years. Falsifying and robbery are steady, across the board, worldwide marvels that have tested chiefs and researchers for quite a while. The most recent gauge from the Worldwide Chamber of Commerce (ICC) demonstrates that the all-

out worldwide estimation of duplicating and robbery could achieve a stunning pinnacle of $1.7 trillion before the finish of 2015 (Economics 2011). Since trademarks have been utilized deceitfully to both mislead buyers and fulfill their optimistic, status-chasing buys, the simplicity with which electronic information can be duplicated and dispersed through the Internet has prompted a pestilence of robbery.

Duplicating and robbery hit a wide range of item classifications: extravagance merchandise, style merchandise (clothing and frill), CDs and DVDs, PC programming, cigarettes, valuable stones, toys, charge cards, auto and plane parts, accommodation merchandise (child recipes, cleanser, toothpaste, condoms, and so forth.), manures and pesticides, medicinal gadgets and pharmaceuticals, and so on. Unapproved items are normally conveyed through disconnected channels, for example, road merchants, bug markets or shopping centers. This conventional commercialization requires a physical vicinity between the dealer and the purchaser, it might be said restricting, at any rate physically, the uncontrolled spread of illegal merchandise. Be that as it may, the appearance of the Internet and of advanced innovations (shared P2P systems) has cultivated the online conveyance of fake products and the illicit sharing and downloading of substance merchandise, so to ten times the extents of the wonders.

Customers need to recognize the presence, the negative outcomes of and the dangers that the buy of a fake/pilfered great create for themselves and for society in general. Accordingly, specialists consider forging and theft as trying zones that should be additionally investigated so as to discover potential answers for such hurtful episodes. Among these works, the most tried item classifications are physical items (generally design, brilliant, extravagance merchandise; content items: CDs, DVDs, Software CDs) in addition to their computerized adaptations (online conveyance through P2P systems or unlawful downloading of substance, data products—music, motion pictures, programming). The aftereffect of every one of these commitments is a divided, various and frequently conflicting writing that does not have an intelligible fundamental structure. Thus, there is a need to combine the surviving information on duplicating and theft in request to encourage the comprehension of the wonders while additionally helping supervisors in their regular battles against them.

Theft and counterfeiting activities not just influence the private privileges of protected innovation holders and their attending monetary and moral interests, yet additionally hurt national economies and social structures. Subsequently, it is required to comprehend the entire trap of robbery and written falsification, so as to look for arrangement.

Counterfeiter copy content both deliberately and accidentally, so it is imperative to set up the stage and isolate the customers of substance admirably. Additionally, there is stern need to investigate the issue and actualize burning guidelines and guidelines, which are applicable in today's world.

It is very imperative to make a clear distinction between what is counterfeiting of content and how does, one can stay away from getting involved in legal activities. Users themselves do not have a concrete understanding of what could be the tentative outcomes of committing such acts.

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Contents

Credibility of Period Films: A Case Study of Jodha Akbar

Monika Sharma

A period film is a genre of films which attempts to showcase the happenings of a particular time period. These films have been given some kind of improvisation in terms of making it more entertaining and the directors have used and still use all the possible developments in filmmaking by costumes, set designs, VFXs etc. This provides an ability to replicate the history in a more entertaining manner. Nowadays techniques have also evolved, which plays a major role in making the film a big hit and audience friendly. All of these techniques from shooting till adding special effects allow the audience to have a joyful journey into that particular time period and on the other hand, it shows that the filmmaker has achieved his goal behind making such kind of films.

Now supposedly one film is a big hit, it does not mean that its facts are also been accepted from the whole audience. In last decade many period films have been produced in the Bollywood industry, like Asoka, Jodha-Akbar, Padmavat, Manikarnika etc. Via this paper, I would like to differentiate and bring some clarity on the debate of period films being credible.

Generally films are one of the tools of entertainment, people watch them to seek pleasure and gratify their needs. Films comes in a variety of bouquet, you get to see numerous genres and types of films. Period film is one of the genres, it has a rich history and numerous films have been made. Directors from all over the world have produced period films, but we will narrow down the horizon to Indian context only. Indian film industry is known across the globe as Bollywood. Period films can be categorized into two main subcategories. It can be either an attempt to realistically depict a historical event

or usage of real history as a backdrop to create new characters that in reality that have no historical basis. The first category can also be classified as Biopic and examples of these include movies like Gandhi, Padmavat, Manikarnika, Manto etc. The second type of period film gives birth to new characters, which tends to fit into a particular time period.

As an instance, hollywood has given a remarkable hit films which has used the emotional appeal and content of the actual ancient event of the sinking of large. Many other films which are not based totally on any unique ancient subject, in a while, which ends up in a film primarily based on the fictional paintings of authors like Jane Austen, William Thackeray, or Charles Dickens. A duration movie like sense and sensibility has depicted the term thoroughly wherein the author Jane Austen wrote however does no longer confer with "actual" ancient characters. Period films can also be listed as a exclusive subclass of diverse time durations showcased by using movies. Movies like chinese sword era movies, medieval movies, or movies representing the romantic generation may also all be subcategorized under the heading of period movies. A period film once in a while may even tend to attain in addition lower back in time, to prehistory to comprehend what life could have been like a number of the early human beings as in movies like extended family of the cave endure or Mel Gibson's Apocalypto.

Period films in itself have a unique place in all forms of major cinema be they historical, fantasy-mythology. India is full of history, legends, and myth. The trend of making period films has been started a long way back, out of which Kurosawa has made awesome films set in Japan. But he was not alone who has tried to recreate medieval Japan on a celluloid film. Many films have been made which became classics worldwide. The Samurai Trilogy is one of them.

The first-period film which has started the trend of making such films was Raja Harishchandra, in 1913 and it was the beginning of golden age of Period films. Another film was Dilip Kumar's Yahudi which has showcased romance between a Roman Prince and a Jew girl, played by MeenaKumari. It was set in Imperial Rome. As time was evolving, period films were also evolving and even up to 70's there were numerous moments which has proven the excellence of such films. Mughal-e-Azam, love story of a Mughal Prince, Salim, and a court dancer Anarkali, in spite of the great opposition from the great emperor. The outstanding music, performances of the actors and extremely lavished glamorous representation of characters has made it a great hit of that time. Taj Mahal and Pakeezah are two other movies of the 60s, which has continued the trend of making historical films. As Hindi cinema was evolving in terms of making such films the Regional cinema has

also started using the history and Indian Myths to make films. For example, Tamil cinema has made some great and memorable historical films such as Manohara. Later on many series, of historical dramas have also been made which were counted amongst the major hits in Tamil industry.

Some years later Indian cinema has started transforming in terms of showcasing romantic, fictional movies like the birth of Angry young man and other prominent Credits. But in recent years it started off with the invasion of a series of movies which were based on the times when India was under the influence of British Raj. Bhagat Singh and Hey Ram were some of them. But, Lagaan, on the other hand, had a predictable story with a very talented cast and excellent picturization.

The film is a period film or not is dependent on all the aspects like the costumes, music, sets. Many critics have said that whenever Hollywood Scriptwriters lack Scripts they opt for making Period films. Many have also felt that making a period film is a very tough job for both the filmmaker and the actors as the present actors are not familiar with the attributes of the past hence unable to imagine the expressions of that particular time period.

The trend of making such films is not a new concept; rather it has started since the India Cinema was born. Numerous well-known directors and filmmakers have started making films based on the reconstruction of historical events. India is considered to have a rich stock of stories related to histories and so later on, it has given the filmmakers a new concept to make films on. The trend of making period films in the Indian cinema has begun in the early 20th century out of which some has gained great popularity and been applauded for the work been done in such films.

Raja Harishchandra (1913) by Dhundiraj Govind Phalke also known as Dadasaheb Phalke, was one of the pioneers of the silent feature films in the history of Hindi cinema. The film was based on an epic of Mahabharata. It was a silent film and was remarked as the beginning of the 'golden age' of Indian period films. Another which came as a period film was Ardeshir Irani's Alam Ara in 1921. It was the first talkie of Hindi cinema industry. This was mainly fantasy with a king and was based on a play by Joseph David. In that era, the trend of a straight adaptation of events and other materials was so common and so the movie was also a representation of the drama. As the movie was the first talkie film, it was applauded by the audience as well.

The stories were now not constrained to India itself; as a substitute a film named Yahudi based on a love tale of a roman prince and Jew lady become made. It suggests

that filmmakers had been seeking to recreate each and every tale, Indian or overseas with a small pinch in their knowledge of the identical to make a period movie. Even up to Nineteen Seventies films were persisted to be made in large numbers and in the year 1960, Karimmudin Asif's Mughal-e-Azam has come. It became a large hit of that time and has some of the greatest abilties of that point together with the writers, transcribers, actors, singers and above all the director himself. This changed into the second out of three films been made on muslims at that point. If we have a look at its ancient accuracy then it became made with far greater interest to detail and accuracy then most different Indian 'historic'. The screenplay of the movie has routinely related the target market to the movies, such become a scene in which the map of india turned into proven and a voice over changed into performed; this has given spectators a feeling of watching 'voice of India'. Akbar was an extremely good king which has given the concept of 'the divine religion' and the identical historical accuracy is maintained in both the period movies showcasing Akbar, one is the Mughal-e-Azam itself and different is AshutoshGowarikar'sJodha-Akbar.

Asoka was another period film which showcases a skilled and great warrior, dreams of becoming a great king one day. It came in 2001, directed by Santosh Sivan. According to director's interview to BBC," he was a brave prince, an obedient son, a lover, a husband, a father, an ambitious king and most importantly, a man who won everything only to lose it in his search for eternal peace."

Shahrukh Khan, well-known actor of the Indian cinemas has played the role of a protagonist in Asoka because according to the director of the movie he was the only man who could portray the many transitions that the warrior king went through and could do justice to the role of great king Asoka.

But with the passage of time, the number of period films has also got increased such as Bhagat Singh, Hey Ram and some were based on Mahatma Gandhi and other national leaders. Lagaan was another movie which got so popular; it was a movie which seemed to have a British relevance, but in reality, it showcased one of the aspects to solve disputes between Indians and the Britishers with the help of a cricket match. For making o good period film the filmmaker needs to be an old fashioned storyteller at heart not like a person who build fantasized worlds in the minds of the audience.

Historical Accuracy

If one talk about the historical accuracy of a period film there are two terms which one should know before going to the conclusion. Mainly there are two terms "Historiophoty"

it is basically the representation of history according to one's thought and perception in the form of images and filmic discourse, another term is "Historiography" which deals with the representation of history in the form of verbal and written discourse. According to Robert Rosenstone, "Is it possible to reform and translate written account of history into an audio-visual program without losing a significant amount of actual content?"

According to a great saying, a picture speaks more than words, here, it means that visual representation of historical events is a better medium to convey messages rather than going through written histories. Same is true in the case of cinema as well but, it is not necessary that whatever cinema shows is the actual depiction of history. Many scholars have felt that whatever period films represent, can never be called as the actual history as it's not possible to showcase each and every aspect. So both forms of history have benefits of their own and can both can never be compared on the same grounds. Likewise, some information can only be represented by visual images and some can be understood only by reading the original literature.

Images can be considered as one of the aspects on which period films can be made, as in a verbal story and imagic story are two different things out of which images can be accepted as an authentic source as compared to the verbal narration of events. But Rosenstone, on the other hand, insists that there are some things which can be represented in films in a better way such as landscapes, emotions, dialects as compared to mere verbal account. Many of the films which were made in India had to face a lot of problems as in people have protested for the content been shown

In movies. One movie which has faced a lot of opposition from the audience is, AshutoshGowarikar'sJodha-Akbar. Some of the main points are:

1. The portrayal of ethnic Rajput people in the movie was criticized by members of the Rajput community as misleading, politically motivated historical revisionism that minimized Rajput history. However, the producer moved the Supreme Court by challenging it later; the Supreme Court of India lifted the ban on screening the film for now in Uttar Pradesh and some towns of Uttarakhand and Haryana. The court scrapped the Uttar Pradesh government ban as well as similar orders by authorities in Dehradun in Uttarakhand and in Ambala, Sonepat, and Rewari in Haryana.
2. During January 2008, one has witnessed the acts of breaking glass panes, disrupting the screening of film Jodha Akbar, as a part of protests by sections of Rajput and

Khsatriaya community against this film. They claim that this film insults their community honor! Some Governments banned this film, the ban which eventually was lifted by the courts.

3. The arguments of those opposing the film are on the overt ground that film is not historically accurate, according to them Jodha was Akbar's daughter in law, not his wife.
4. In communal view of society, the community honor is located in the bodies of women, 'our' women are to be protected from others and 'their' women are to be dishonored as a revenge of 'their' violating the honor of our women.
5. History is a vast ocean of events. History is an arena which has been interpreted by the elements according to their political agendas. In the film under discussion, it is sure that there was a matrimonial alliance between Mughal kings and Rajput princesses, it is sure that Akbar did have Rajput wife/wives. It is also sure that the interaction of Hindu Muslim, Mughal Rajput cultures peaked in the times of Akbar and did maintain its tempo later also irrespective of the ruling kings being fanatic or tolerant. As such this film comes as a refreshing interpretation, very much needed in current times.
6. History seems to be a multi-edged phenomenon. It has two different aspects as in on one hand events and on the other interpretations. Historian's job is to select which events should be shown in which manner. The issue is not that whether Jodha was wife or daughter in law of Akbar, the issue is in identity-based politics of current times, the marriage of a Hindu woman's marriage to a Muslim is not acceptable.

Conclusion

From the above mentioned points, now it is clear that recreation of historical events does not mean representation of characters and events in a folded manner, whatever a filmmaker decides to depict, it should be something which can be later on accepted by every type of audience. Thus, it's necessary that whatever a period film portrays, it should be cross-checked with Historians, so that their credibility could be maintained.

Ashutosh Gowarikar, in his movie Jodha Akbar, has used the phenomena of commentary adaptation where he has chosen the name, Jodha Bai, out of Harkha Bai and others as according to him audience knows the name Jodha. Santosh Sivan has used

analogy adaptation in his movie Asoka (2001), as in according to him the film was meant to entertain the audience. K.Asif has produced the Salim-Anarkali love story onto a celluloid film, Mughal-e-Azam (1960) and has utilized that transposition adaptation, in terms of depicting the actual reality. To check the credibility of a period film, critics play a very important role and audience considers being the one on whom, the whole fate of movie depends. If films don't have music, then it may tend to make audience bore, so period films have also started putting songs in between the sequences. Due to songs, many period films have gained huge popularity and has won numerous renowned film awards as well.

Filmmakers have had to go through the original history before making a film, but due to the demands of the present day audience, they incorporate some kind of masala to make it more entertaining. It results in making a historical film less credible in terms of its content and it is the reason why audience does not want themselves to rely on these films to understand history and consider it as a medium to authenticate facts and information.

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Contents

Changing Trends in Journalism

Monika Sharma

Liberalization is the relaxation in the policies and guidelines of the government in a democracy. A liberal society can function without a democracy but a democracy cannot channelize itself without liberalization. In due course of time, both liberalization and democratization have transformed journalism completely to what it was earlier (the only source of accurate/baked up news).

Trends in journalism have changed drastically. Earlier the people had access to limited newspapers and a few could afford radio. And they blindly trusted them to be the only source of news. But today when a person reads a newspaper he never thinks, "Is this what I meant to read, or was this story worthy enough to be a news?" Hardly anyone ponders upon the content of the news story. News of national importance is hardly given so much importance which it deserves, rather the news channels believe in increasing TRP's and hence they focus on sensational news giving it good 30 minutes time slot and they relegate the news related to bravery of soldiers or loss of lives, national festivals etc. For example, when some actress of the Bollywood industry gets married, then the only buzz in the news media is , will she change her surname or not, what has she worn at her wedding etc. Media covers such stories putting in to good amount of time and space to make it a cover story, neglecting other matters of national and social impetus.

Reporting today is, in a word, dynamic. Paper readership has gone down essentially as online uses of news-casting have turned into the standard. Broadcast reporting, while still pertinent, is currently grafted into recordings and connected to sites, for example, YouTube, internet based life outlets, for example, Facebook and Twitter and individual online journals. Numerous news organizations currently effectively endeavor to coordinate multimedia techniques, for example, video, audios or photographs into pretty much

every story. Notwithstanding these new techniques for media utilization, the capacity to produce and independently publish news is currently in the hands of anybody with a web association and a couple of fundamental apparatuses, making another power dynamic between conventional news sources and resident columnists. Radio news still lives on through projects, for example, NPR (National Public Radio), however now concentrates less on breaking news and more on examination and human intrigue content.

There has additionally been a changing pattern in the manner news is conveyed through the telecom houses. The news inclusion has changed from the already long stories to which were offered previously, to short and to the point reports. The news inclusion puts together more with respect to the image or film of the real occasion as opposed to a story by the writer about what occurred. The newspapers are additionally adjusting this pattern as they highlight more on the photos then the long articles recorded as a hard copy. This pattern has turned out to be well known as the watchers are really ready to get an unmistakable portrayal of the occasions that occurred. The news channels have likewise been associated with the ongoing pattern of bundling data. These days, the news fuses articles and inclusion that will engage the readers much as they give information. There is joining of news about the mainstream famous people, occasions and the side shows of get-togethers. This is significant in keeping the group of spectators engaged when viewing the news. In doing as such, news revealing in news coverage has turned into a method of excitement moreover. Analytical news-casting has turned out to be prominent in the present announcing enterprises.

The commencement of citizen journalism is another very prominent trend in journalism where the citizen cover the news story themselves or are eye witnesses to the incident, hence citizen journalism are more accurate and authentic. Indian Hindi news Channels in like AajTak. NDTV, IBN7, Star News all have access to citizen journalists. Online journalism is another commendable change in journalism which is most imperative aspect of journalism which provides minute to minute details and current status of news on the internet. Many TV channels own their websites which provide Live TV and all news stories well segregated in detail. For example Times group has a portal which owns newspapers, channels and blogs.

Blogs are another means of new age journalism which is all about maintaining an online diary about the events occurring and making news. They also account for feedback from the people which makes it a source of two way communication besides mass communication. Commonly, blogs are non-commercial. Numerous individuals simply

share their experience and information with their pursuers. A few bloggers post writings and recordings about their adventures, pastimes or interests. Others simply appreciate being in the spotlight and demonstrate their photographs, works of art, models, gems, vehicles or garments. Numerous individuals use writes as close to home journals. They expound on their regular day to day existence and ordinary occasions and issues. A large number of bloggers inform the crowd regarding their pets. As you see, non-business blogging is a particular leisure activity that causes individuals express something to the Internet people group, gain distinction and kill time.

Business web journals are totally extraordinary. The chief motivation behind business blogging is profiting. Almost every fruitful organization has its very own blog that publicizes its products and ventures. They educate the crowd about deals, unique offers, and spic and span items. Such sites publicize items in a particular and non-individual way. They pull in open consideration with amazing substance, photographs, and recordings. Surely, every blog is created by a strong group of journalists, advertisers, and architects who make straightforward yet exact writings and magnificent photographs. There are additionally autonomous bloggers who publicize different products and ventures and get cash from various organizations for this deliberate advancement.

Radio journalism is yet again a very leading and wanted (popular) stream in journalism where earlier the radio was only used for announcements or speeches but today it has better scripts, digital telecast, better coverage of latest news and maximum public interaction due to availability of radio and every user's smartphone. The vibe of promptness provoked another propensity for checking out the radio to discover what was happening on the planet, and the 1930s were set apart by enhancements in the creation of radio news. Releases were drafted in language that was less 'artistic' and rather increasingly fit to the ear. Magnetic – thus moment – recording innovation arrived, and the BBC step by step liberated itself from a portion of the confinements that the legislature and paper industry had forced.

When journalism started, the news stories were very few but elaborated and only the eminent leaders wrote or owned newspapers. But today there are news agencies like Reuters, PTI, etc. which provide news to all channels, newspapers, magazines, etc. to maintain the quality of news, but news is no more unique on each channel.Archives and e-papers have also become the highlights of journalism where websites display free access to newspapers having their own websites like TOI, The Hindu, DainikJagran etc. own archives.

Investigations and sting operations in journalism have also gained momentum because the viewers believe in evidence and eye witnesses with proofs. The news presently joins insightful documentaries with the writers going covert inside the enemy territories and giving selective reports. This new pattern in inclusion of the investigative journalism has truly helped in revealing and uncovering offenders in the general public. The writers these days are assuming an additionally including job in their reports and examinations. The writers are getting individual with their interviewees and this is significant in the credibility of the reports. This new pattern has empowered the watchers to get the chance to comprehend the news surprisingly better not at all like the days when they needed to depend on essentially what was being said on the news. It is viewed as that, a great writer will consistently be a decent columnist regardless of the substance of his report.

The technology whether in print or television have advanced with better printing techniques unlike telegraphs used in pre and post-independent era, and digital and satellite transmission of news with better audio/visual quality of news.

Press democracy and liberalization have made journalism more open to criticism and has led to mass of activating interests of people. Earlier people used to be passive users of media content but as the time has evolved, it has transformed them to active ones. Nowadays while consuming the online content or any form on news content, every individual maps and calculates the ratio of propaganda to truth in a story. However on the other hand, users who does not have any sort of access to any kind of medium, tend to believe the stories presented to them in platter.

In a vote based nation like India, while surrounding strategies, the necessities of the last and least special man ought to likewise be taken into thought. Disclosing to the general population why a choice was taken is similarly significant as taking a choice. On the off chance that we utilize the print media effectively and successfully we can achieve this two-way correspondence. Government and numerous different associations become insignificant and dictator in light of the fact that the principle office that ought to make and set up the two way correspondence conceivable – The Media – has not satisfied the objectives. There are events where they have acted as indicated by the interest of the occasions even at the expense of their own interests. Yet, cases are numerous that tell stories of absolute recklessness with respect to this media.

Trivialization of news is a typical practice with of papers to undermine the significance of news things as per their personal stakes. By giving trivialized version of an occurrence or truth the pursuer is prevented an unmistakable picture from claiming it. Serious issues

must be given due weightage and reality. It is an essential standard of media morals. From writing to show, news things must be treated with getting to be significance. Be that as it may, a few papers play down them or streamline them so as to defend egotistical thought processes of the media proprietors or to adjust to journalists intrigue. A few papers show checked bias for certain shades of assessment while choosing news and articles for their exceptional versions or material for publications to the interests of the general public. This inclination is exceptionally hindering.

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Deconstructing Farmer Protests in Delhi (2021) : Counter-Narratives and Misinformation on Social Media

Namit Vikram Singh • Surbhi Tandon

I. Introduction

The paper explores the debates revolving around "Farmers' Protests" post the approval of threefarm acts (1. Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020; 2. Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020; 3. Essential Commodities (Amendment) Act, 2020 by the Parliament of India in September 2020. Facebook, which acted as a forum for promotion and sensitization about the event, also experienced the emergence of different counter-narratives and its circulation on the platform citing the protest movements by the farmers as unconstitutional and against the welfare of the state. Most of the counter-narratives produced on Facebook projected the farmers' movement as an aggressive and radical protest against the government. Stories of policeclashes, public disturbance, etc., were propagated through social media platforms (Badola, 2021). An interesting observation to note in the case of India's ongoing Farmer Protests (2020-2021) is that Facebook has been one of the social media platforms instrumental in both propagating and countering fake news, misinformation about farm laws, and the protest movement. The official organizers of the movement have been overwhelmingly engaging on almost all social networking platforms and their IT Cell has been playing a significant role in dispelling misinformation, countering false narratives, and keeping a connection with the

individual protestors and their supporters alike (Ranjan, 2021). The paper emphasizes on the effectiveness of Facebook in terms of how it has helped in countering the stories of misinformation against the farmers' protest movement and what kind of counter-narrative it helped in shaping up against the actions of the state amongst the people in Delhi, India.

The case of farmers' protests in India post-independence can be traced from 1947 onwards. The expansion of farming lands and the beginning of land redistribution post-1947 witnessed a period of protest from the landed classes. This was further fueled by the adoption of the "Green Revolution" in 1967 for self-sufficiency in food grains. Unfortunately, the "Green Revolution" had a very concentrated impact on the Indian agriculture sector as most parts of Punjab and Haryana witnessed a high rate of agricultural growth due to high land fertility. 1991 was observed as a timeperiodthat ushered the growth of agricultural markets across India due to new economic policies of globalization, liberalization, and privatization. However, in the process of complete adoption of these policies, local traders and agricultural entrepreneurs failed to keep up with the growing competition and witnessed a decline in the agricultural markets. Further, in 2006, farmers in India protested over the slow growth of agricultural markets which failed to provide adequate demand for produce which resulted in corruption and illegal trading of commodities. In 2014 with the change in the political regime, a lot of promises were made for agricultural reforms but nothing substantial took place to boost agricultural markets (Kumar and Sethi, 2017). In 2020 with the recession in agricultural markets due to the Covid-19 pandemic, a lot of wholesale markets failed to provide the options for trade for the local farmers. The fear of declining demand followed by the passing of new farm laws fueled the farmers' protest movement across parts of Punjab, Haryana, and Delhi which further escalated to the western part of Uttar Pradesh. The protest movement was largely within the outskirts of Delhi covering the following borders namely:

(a) Dhansa
(b) Ghazipur
(c) Harevli
(d) Jharoda
(e) Mungeshpur
(f) PiauManiyari
(g) Singhu
(h) Tikri

The agricultural sector in India has always remained a sensitive political topic and there has been a discrepancy in terms of policy formulation and its incompatibility at ground level implementation which has resulted in farmers' protests across different timelines. However, the "Farmers' Protest (2020-21)" has been different and unique from the past events because of the manner in which social media has been utilized for developing different counter-narratives both supporting and criticizing the movement at its different stages (Kronstadt, 2021) (Kilgo and Harlow, 2021). The paper, therefore, is significant as it presents the arguments of both the counter-groups and the government on Facebook and how the platform has been helpful or challenging in handling the concerns of fake information and sensitizing the public about the social cause in Delhi, India.

II. Amendments in Farm Laws and Farmers' Dissent

The Indian agricultural sector has had different degrees of state (government) support in the form of agricultural policies for financial support, safety nets, subsidies and injections, and measures for adopting new technology and inputs. Farmers in India have been able to take advantage of both the government and the market support across different states. However, in 2020 the Indian agriculture sector experienced severe economic shocks created by the pandemic of Covid-19 in the form of declining market demand.Even the government support failed to provide a basic degree of sustenance to the farmers. This shock was further complemented by the amendments in the farm laws during the winter session of the Parliament in September 2020 (Curtis, 2021).

Three core laws namely 1. Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020; 2. Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020 and 3. Essential Commodities (Amendment) Act, 2020 were introduced as ordinances during June 2020 and in the winter session, they were passed as official acts through voting. One of the primary concerns that emerged from these amendments amongst the farmers was the government's inclination towards privatizing the agricultural sector and exploiting farmers for agricultural produce. They also felt that the

government's inclination towards further corporatization of the agricultural sector may lead to an increased control for big corporate players in influencing the agriculture produce and pricing (Curtis, 2021).

The very first act, namely, "The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020" eliminated the option of Agriculture Produce Market Committees (APMCs). The role of such committees was to ensure that there are no extreme price fluctuations regarding agriculture produce in a regulated market. Further, if any farmer wishes to sell the produce outside to any private trader, he/she will have to pay a tax. Before the agricultural laws were amended, most of the agricultural produce was bought and sold primarily in the APMCs. These bodies were regulated by the state government. It required a license for traders to purchase agricultural produce from the APMCs. It was a regulated market-like setup where farmers could bring their produce for sale. As for the farmers who could not afford transportation of their produce, they would sell their commodities to any private trader at market price. APMCs had an advantage in ensuring price protection to the farmers which acted as a safety net in the case of financial shocks. However, the government over a period of time felt that APMCs have begun to operateas monopolies and have started promoting corruption within the regulated market.The government felt that there was a dire need for a policy revision to address the issue (Lerche, 2021).

The government argued that "Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020" will provide a barrier-free trade in agricultural produce outside the boundaries of an APMC and will not imposetaxation on any farmer who wishes to sell the produce outside the state-regulated market at a fair price. However, the farmers in parts of Punjab and Haryana argued that the act will be advantageous for the rich and big farmers who will have more choices in selling to private traders. Further, for small and medium farmers, they will have to depend entirely on the market price for the sale and purchase of the produce which can be subjected to financial shocks.

The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020, was another amendment that focused on the legal agreement between the farmer and the business owner under contract farming. The agreement outlined the condition for production of farm products and the delivery of the produce as per the buyer's quality standards.The act ensured that the buyer cannot change any condition after the contractual agreement with the farmer in order to limit the scope for exploitation by the buyer. The timeperiod of the contract can vary from 1 year to maximum of 5 years with a clear reference of guaranteed price in the contract. Further, a body comprising the Sub-Divisional Magistrate and the Appellate Authority (Collector or Additional Collector) will handle the matters of dispute regarding such agreements within 30 days.

Lastly, the Essential Commodities (Amendment) Act, 2020 emphasized on the control over production, supply, and distribution of certain food commodities. The central government may regulate or prohibit the production, supply, distribution, trade, and commerce of food items including cereals, pulses, potatoes, onions, edible oilseeds, and oils, only under extraordinary circumstances such as (i) war, (ii) famine, (iii) extraordinary price rise and (iv) natural calamity of grave nature The central government argued that through this act they can even include new commodities when its need arises. The act also highlighted the imposition of any stock limit on agricultural produce based on price rise in the market. This condition on regulating the agricultural produce by the state did not exist earlier and farmers felt that their independence to carry out their agricultural operations may get compromised through the government's predominance over agriculture markets.

The Indian farmers' dissent towards the above-mentioned farm laws was primarily seen as an outcome of fear that the removal of APMCs may also lead to the removal of minimum support prices which was earlier being provided to them. No private trader will be willing to purchase the produce at a minimum support price thereby creating scope for monopoly in the agricultural markets. They further argued that 80% of farmers in our countries were small farmers. They have very limited landholdings and in case of any financial conflicts with the private players, they will not be able to challenge them in courts due to

financial limitations. Farmers also demanded that a law needs to be put in place that can ensure guaranteed payments from the buyers through intermediaries.

They also protested as the amendments in the agricultural policy specified that no individual can file a case regarding the law's specification against either the Central/State government or any State/Central government officers, thereby compromising on accountability in the case of challenges in implementation. They argued that the amendments take away their fundamental right to approach the courts.

As a result, the protest movement began taking shape in August 2020, and by September 2020 onwards different farm unions mobilized for a peaceful yet stern non-cooperation movement across Delhi and its neighbouring states. The highlighting aspect of this movement was howsocial media platforms, especially Facebook, were used for creating narratives and counter-narratives about the farmers' protest and the claims by the government of India.

III. Digital Narratives on Farmers' Protests in Delhi

The given section explores various counter-narratives that emerged on Facebook regarding "Farmers' Protest Movement 2020" around the borders of Delhi and its neighbouring states and how these narratives were challenged by the Farmers' Protest Group and what kind of outlook it shaped both towards the government and the movement. The facts, as presented below through content and discourse analysis of Farmers' Protest Group on Facebook and that of different users, reflect the continuous tussle between the two factions, namely the protestors and the users supporting the government's initiatives. The data also indicates the efforts that went through in attempting to validate misinformation and how the protest group was able to counter most of the false narratives for a healthy public forum and dialogue with the public.

Table 1
List of False Narratives and its Counter Arguments on Facebook (September-November 2021)

S. No.	Date of Facebook Live	Name of the Leader	Misinformation Debunked/Counter Narrative Set	Like	Views	Comments
1.	15th November 2021	Harish Hoon	Farmers are still awaiting the sugarcane payments even after one year in Uttar Pradesh. The Ruling Party had promised the implementation of the Sugarcane Control Order which requires payment to Sugarcane farmers within 14 days of sale. Farmer unions will protest against government inaction in all districts of Uttar Pradesh	1.7K	16K	148

2.	15th Novembe 2021	Rakesh Tikait	Farm Leader Rakesh Tikait local leaders in Karnal district where the government is planning to sell a land allotted to Mandi and the Agro Mall built on the same land to private players. The Agro Mall caters to farmers of Uttar Pradesh, Rajasthan, and Haryana for selling their produce. The leader refers to Land Acquisition Act which states that if the land is acquired from the farmers for five years after the acquisition, then it needs to be returned to the original farmers who parted away from their lands for development purposes.	8.4K	73K	666

3.	14th November 2021	Manjit Singh Rai	Explaining the modalities and logistics regarding the planned Sansad March on 29th November 2021. He explained that 500 farmers in their tractors will march to Parliament of India in Delhi from two protest sites after due process of verification. Parliament's Winter Session will begin on 29th November 2021.	5.1K	34K	399
4.	13th November 2021	HarinderLakhowal	Invitation to farmers to join Lucknow Mahapanchayat scheduled on 22nd November 2021 in Lucknow to seek justice for the victims of Lakhimpur Khiri Violence. Lucknow is the capital of poll-bound state Uttar Pradesh.	838	5.2K	44
5.	13th November 2021	Harish Hoon	Providing information regarding Tractor March to Parliament on 29th November 2021.	529	3.6K	21

6.	12th November 2021	Abhimanyu Kohad	Shared the willingness of Samyukta Kisan Morcha to take up questions raised by the citizens. But, also asked them to share suggestions and constructive criticism that could be taken up for discussion in the meeting of SKM. He urged people not to find faults just because they have a different view and ideology than the farmers. He said SKM has the responsibility for the rollback of the farm laws and ensuring that all farmers reach their homes safely after the movement is over. He referred to media reports regarding the declining popularity graph of the Prime Minister. He emphasized that the movement has enhanced women's political participation especially in Haryana which is considered a patriarchal society. He said that women's participation in the movement is more than men in Haryana. He also said that farm protests have changed the political culture as the protesting parties did not allow a single political leader to be on the stage and address protesting citizens from the KM stage. He also updated the condition of a farmer who was seriously injured during a scuffle at a political rally. He also clarified regarding the PAYTM number issued to get contributions for the medical assistance to be provided to the injured farmers. He said there only a single person's number was issued whose credentials were verified and local committee members could give an account of the money received and spent that was collected for the medical help of the injured farmer.	6.3K	50K	1.1K

7.	12th November 2021	Rakesh Tikait	Some elements want to discredit the movement. Thus, farmers present at the protest sites need to be alert and vigilant. They need to guard the sites like they guard their farms. He said that protestors need to prepare themselves for the upcoming winters and we need to mend out torn tents and arrange for warm clothing and beddings. He said that farmers are strong on tractors but not on Twitter. He suggested getting 2-3 boys from each village/district who understand social media dynamics or have an IT background to counter-narratives on social media. He emphasized that social media narratives are important because there is surveillance on both camera (referring to Broadcast Media) and pe (referring to Print Media).	1.8K	10K	129

8.	7th November 2021	Harish Hoon	Violence was unleashed on Farmers in Hansi, Haryana when they were peacefully protesting against the leadership of the ruling party and FIRs being filed on the farmers themselves. No FIRs were being filed on the Member of Parliament who unleashed the violence on farmers.	954	6.1K	34
9.	6th November 2021	Manjit Singh Rai	Rumours regarding the Roads opening at Tikri Borders. They emphasized that Roads were blocked by Government and not the farmers.	4.5K	50K	326
10.	3rd November 2021	Harish Hoon	Dispelled the rumours that farmers have left the protest sites. Emphasized that Non-Violence remains the strength of the movement and farmers will abide by its principles.	928	5.9K	71

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			There have been constant attacks on the movement by the mainstream media. He asked citizens to remain cautious regarding the rumours. He said do not believe on any development or rumours until you get a statement or press conference from SKM. He asked the supporters not to panic.			
11.	31st October 2021	Manjit Singh Rai	Rumours regarding meeting with India's National Security Adviser Ajit Doval The final agreement with Central Government is already done but Samyukta Kisan Morcha waiting for the correct time to announce it. Farmers will celebrate Diwali at home as the decision regarding farm laws will happen by them.	3.4K	45K	524

July-December 2021
ISSN 2278-4632

12.	31st October 2021	Harish Hoon	Dispersal of Compensation to the Sugarcane Farmers of Uttar Pradesh.	923	7K	53
13.	30th October 2021	Abhimanyu	Regarding the barricading of the protests site and closing of borders causing inconvenience to the local population. He debunked by saying that volunteers were posted to aid the traffic and there are no jams at the protest site.	19K	280 K	2.9K
14.	30th October 2021	Suresh Koth	Farmers have stopped border sites Captain Amrinder Singh is negotiating and part of the Samyukta Kisan Morcha. A Committee will be formed for looking into Farmers' demand regarding Minimum Support Price (MSP).	3.9K	40K	476

ISSN 2278-4632 July-December 2021

15.	29th October 2021	Dr. Darshan Pal	Regarding some anti-social elements trying to enter the protest site and police lathi charge on farmers.	2K	12K	133
16.	28th October 2021	Harish Hoon	Regarding some anti-social elements trying to enter the protest site police lathi charge on farmers.	844	6.5K	46
17.	20th October 2021	Abhimanyu Kohad	Heavy Deployment of Protest Site and government trying to remove farmers from the site.	70K	115K	1.9K
18.	17th October 2021	Jagjit Singh	Cautions against believing those rumours Dallewal that want to divide the movement on religious basis and fake news spread in newspapers.	2K	15K	426
19.	13th October2021	Balbir Singh Rajewal	Change in the date of the burning of the effigy of some political leaders on Dussehra as some editorials in the newspapers have tried to make it a point to malign Hindu-Sikh harmony prevalent in the movement.	8K	91K	1K

July-December 2021 ISSN 2278-4632 Juni Khyat 207

20.	10th October 2021	Ravi Azad	Clarifies the road blockages. They strongly propose that they are a movement and not a political party.	7.2K	75K	1.2K
21.	9th October 2021	Sanjay Khareta (A Local from Singhu Border)	Farmers have not stopped roads. Counter Narrative : Local Farmer are supporting the movement.	2.7K	22K	275
22.	7th October 2021	Dr. Darshan Pal	Negotiations with the Government on Lakhimpur Violence were done by a panel/committee of Sanjyukta Kisan Morcha rather than a single popular farm leader Rakesh Tikait in consultation with the family of the deceased.	7K	219K	792
23.	1st October 2021	Abhimanyu Kohad	Counter Narrative: Regarding the MSP of two crops – Bajra and Rice. The constant change in specifications and dates of government procurement.	3.5K	38K	352

24.	27th September 2021	Manjit Singh Rai	The success of Bharat Bandh called by Sanjukta Kisan Morcha was successful in 22 states and remained peaceful.	816	10K	3.4K
25.	24th September 2021	Manjit Singh Rai	Countering Media narrative that the movement does not have strength.	586	5.7K	59
26.	21st September 2021	Balkaran Singh Brar	Explaining the initial stand of opposition political parties of Punjab towards Farm Laws and how they changed their stands post the movement.	500	3.1K	66
27.	19th September 2021	Professor Kartar Sartaj Singh	Explaining how the movement is related to all as it would impact food inflation and citizens' purchasing power. Cautions against Propaganda.	720	4.9K	109

28.	19th September 2021	Abhimanyu Kohad	Emphasis on the need to keep Bharat Bandh called by farmers on September 27 peaceful. Counter Narrative to the Government's stand that private players would enhance Farm Income, he explains the conditions of Apple growers of Himachal Pradesh who sell their apples to big corporates and how their prices were reduced for 2021 despite double-digit inflation in the country. Brings NSO data issued by Government itself to showcase the increased rural indebtedness for agriculture-related households between 2012-2021	7.7K	73K	886
29.	18th September 2021	Kulwant Singh Sandhu	Administration in the name of the Supreme Court of India is asking to vacate the roads; however, the court	730	5K	69

30.	17th September 2021	Manjeet Singh Rai	has issued no such orders. Even the women who filed Public Interest Litigation related to the inconvenience caused to locals near protest sites did not appear in the court hearing. Explained how opposition parties had similar laws planned in their election manifestos of yesteryears.	Counter-Narrative: On behalf of Sanjukta Kisan Morcha they showcased solidarity and support to Actor Sonu Sood who faced Income Tax Raids. He has done extensive work for social welfare during COVID 19 Crisis. SKM believes that anyone attempting to do public welfare faces such actions from the government as some farmer groups and supporters have faced similar consequences for supporting farm agitations.	1K	5.9 K	121

The table above is a record of the various discourses that emerged on the official page of "Kisan Ekta Morcha" the farmers' protest group on Facebookand how they tackled falsenarratives through the use of visualmedia in the form of "live feeds" or video records to showcase the actual events occurring during the protest movement.

Image I : Kisan Ekta Morcha Page

Source : shorturl.at/itzB0

Image II : Kisan Ekta Morcha

Source : shorturl.at/itzB0

The page, created in December 2020 on Facebook, was not being effectively operated due toa lack of knowledge as to how to utilize the platform and ignorance towards the counter-narratives being shaped on social media against their protest movement. However, when the protestors realized the impact that social media narratives were creating against their offline protest movement, they began utilizing the platform to present facts and countering the false narratives that were circulating on Facebook. The page saw momentum in information flow and active engagement with different users from January 2021 onwards and the timeline of September 2021 to November 2021 reflects how the series of events by the protestors were projected to the public through social media. The given timeline is also important as it witnesses a lot of false and counter-narratives aimed at breaking the sustainability of the movement. It also includes facts presented by "Kisan Ekta Morcha" on their social media account as to how they were sustaining the movement through cultural activities and mobilizing the support of the public through the presentation of correct information.

A. Breaking the Myth of the Movement being Radical and Violent in Nature

The leaders of the protest movement on 12th November 2021

Source : shorturl.at/itzB0

released a live video feed to the supporters and other users on Facebookover the falsenarrative that had shaped claiming the movement to be violent and radical. The video feed cautioned the users about the presence of anti-social elements entering the protest sites and causing harm to the participating public. Rakesh Tikait, one of the leaders of the movement,stated thatfarmers need to be on their guard and remain vigilant at the protest site regarding any malicious group entering the protest sites. He further said that protesting farmers need to guard these sites similarly as they guard their farmlands.Abhimanyu Kohad on 20thOctober 2021, dispelled the rumours being spread that there was a heavy police deployment due to protestors being violent and aggressive towards the police and damaging public property. Dr. Darshan Pal on 29thOctober 2021 debunked the misinformation that some anti-social elements had entered the site and police had to resort to the use of batons on farmers to control them.

B. Breaking the Myth of Farmers Accepting Corporatization of Agriculture Markets

Source : shorturl.at/itzB0

Abhimanyu Kohad through Facebook Live on 19thSeptember 2021explained the perils of the corporatization of the agriculture sector through the example of apple farmers in Himachal Pradesh. He argued that big corporates have beenpaying lowprices for apple

acquisition in comparison with APMCs. He substantiated his views with NSO Data (National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India) on rural indebtedness between 2012-2021.Rakesh Tikaitthrough Facebook Live on 15thNovember 2021 reached Karnal District, Haryana, and stood outside a*Mandi* (State-Sponsored Market) which was supposed to be sold to private contractors. He spoke that farmers have not agreed to the corporatization of agriculture markets and no negotiations have taken place between the government and the protestors as it was claimed on Facebook. Further issues were raised regarding the shortage of DAP(Di Ammonium Phosphate) and farmers being forced to purchase Sulphur along with DAPby private contractors in the states of Haryana, Punjab, and Rajasthan. Harish Hoonraised the concerns of Uttar Pradesh Farmers who had not received the payments for Sugarcane last year in two of his Facebook Live sessions dated 31stOctober 2021 and 15thNovember 2021 which according to the law was supposed to be done within 14 days of the sale (Sugarcane Control Order).

C. Breaking the Myth of Revival of Khalistani Movement through Farmers' Protest

The protest movement was discredited on Facebook by government supporters that it was reviving the Khalistani Movement (Reference to Militant Groups of Punjab in the 1980s seeking a separate state from India), the protestors being anti-nationalists and gaining financial support from Pakistan.

Others called the movement as a movement of large farmers and middlemen (*Artiyas*) from North Indian states protesting to secure their financial aids given by the government. The protestleader Rakesh Tikaiton Facebook on 12thNovember 2021 expressed that the movement is strong offline but not strong enough on Twitter and other social media platforms referring to the misinformation and fake news spread against the movement. He requested the youth to kindly aid them in understanding the dynamics of social media and to counter the propaganda being created against them. Farmer leader Harish Hoon (on 3rd November 2021) pointed out that the allegations and accusations created on Facebook are entirely false and the movement is a people's movement that is focused on highlighting people's grievances with the implementation of new farm laws. He rejected the claim that the movement was an act of sedition against the country or was harbouringanti-state ideology amongst the protesting farmers. Farmer leader Manjit Singh Rai dispelled the information that the movement was losing the strength of its supporters at the protest sites on Facebook Live (24thSeptember 2021) on the basis of the movement being seditious.

D. Breaking the Myth of Farmers and Government Negotiations for Ending the Movement

Source: shorturl.at/itzB0

The leaders of the Farmers' Protest Movement continuously rejected the false claims since January 2021 that farmers and government negotiations had taken place for a rollback of the three farm laws. Manjit Singh Rai through Facebook Live (31st October 2021) aggressively debunked such fake claims that had emerged on Facebook. He further pointed out that no negotiations had taken place between the leaders of the movement and India's National Security Advisor Mr. Ajit Doval. He also clarified that no agreement was made between the stakeholders. Dr. Darshan Pal emphasized that the movement was a unity of 32 independent farmers' groups that comprised the Samyukta Kisan Morcha rather than personality cults of certain charismatic and media-savvy leaders and this united front was responsible for compensating the families of the deceased farmers involved in the Lakhimpur Kheri violence in Delhi on 3rd October 2021.

E. Breaking the Myth of Farmers Restricting Movement of Vehicles and Barricading State-Borders Around Delhi

A lot of false narratives have been circulating on Facebook claiming that the protestors had blocked the movement of vehicles and barricaded the state borders causing inconvenience to the commuters. Even a Public Interest Litigation (PIL)was filed in the Supreme Court of India regarding the road blockage caused by the farm protest. In the span of two months, the farmer leaders have been continuously using Facebook to clarify their standpoint on the issue. Manjit Singh Rai on 6thNovember 2021 pointed out that roads were blocked by the Government and its agencies rather than the protestors. He emphasized that Police had barricaded the protest sites which had resulted in the closing of roads and borders. Abhimanyu Kohadon 30thOctober 2021mentioned that volunteers belonging to Samyukta Kisan Morcha were aiding the commuters and ensuring that there were no traffic jams on the roads and highways near theprotest sites. He also emphasized that the local population was supporting the movement and farmer protests were not causing any inconvenience to the nearby residents. Protestleader Kulwant Singh Sandhu dispelled the myth that the Supreme Court had issued any orders regarding the vacating of protest sites. He said that the administration was trying to remove them in the name of false orders of the Supreme Court. He even clarified that the women who had filed the PIL in the court did not appear in the hearing of the court on his Facebook Live session on18thSeptember 2021.

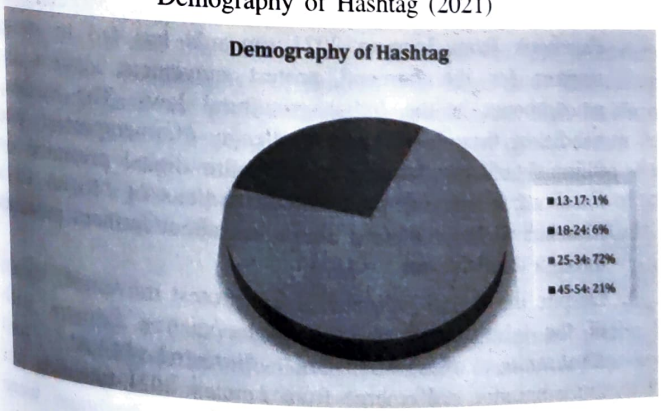
Table 2 :

List of Popular Hashtags on Farmers Protest (2021)

S. No	Popular Hashtags	Posts
1.	#standwithfarmerschallenge	881000
2.	#FarmersProtest	455000
3.	#kisanektazindabad	111000
4.	#resignmodi	93000
5.	#isupportfarmers	70000
6.	#rakeshtikait	36000
7.	#SpeakUpForFarmers	33000
8.	#kisanektamorcha	21000
9.	#FarmersProtestDelhi2020	16000
10.	#kisankhalistan	12000
11.	#arrestrakeshtikait	12000
12.	#Missingindira	8000
13.	#khalistanterrorists	4000
14.	#ModiPlanningFarmerGenocide	2500

Figure 3 :

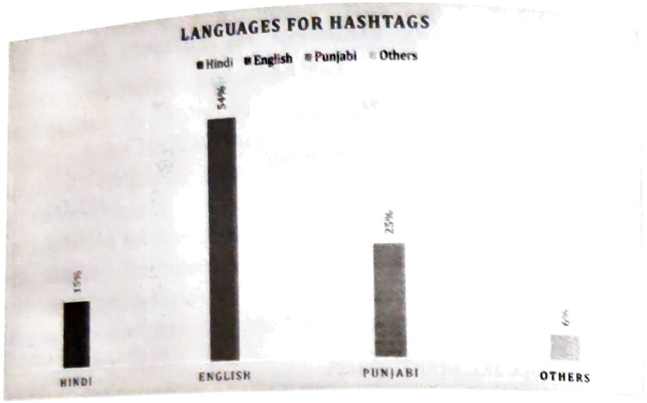
Demography of Hashtag (2021)



Source:shorturl.at/yFUZ7

Figure 4

Language for Hashtags



Source:shorturl.at/yFUZ7

The above data indicates the following facts:

1. The majority of participation on Facebook regarding the "Farmers' Protest Movement (2020-21)" was by the Indian youth within the age bracket of 25 to 34 years. Most of the communication regarding the farmers' protests was conveyed in English and then in Punjabi to cater to both local and international audiences.
2. The rising digital presence of "Kisan Ekta Morcha" on Facebook from January 2021 onwards has led to rising support for the farmers' protest movement against the amendments in the Indianagricultural laws. The hashtag handle of #standwithfarmerschallenge, #farmersprotest, and #kisanektazindabad had the maximum digital presence on Facebook which complements the actions of "Kisan Ekta Morcha" in bursting false narratives about farmers protests through their live feed videos.
3. Despite the digital presence of the protest movement, some of the false narratives such as associating farmers with *Khalistanis*, #kisankhalistan, #arrestrakeshtikait, and #missingindira did emerge from January 2021 onwards but due to the government's intervention, the hashtags were restricted for a specific period of time which led to a decline in its digital presence. The interesting fact to highlight here is that most of the government supporters on Facebook linked Indian farmers with *Khalistani*terrorists and used #missingindira extensively (Related to Late PM Ms. Indira Gandhi and her approach in curbing *Khalistani* Movement in India in the 1980s) to express the need for a radical step in curbing the protest movement and attempting to give validation to the false narratives that the movement was an act of seditionthrough Facebook. To counter the false narratives, the protest group used #Modi Planning Farmer Genocide to express the harsh approach of the government in subduing the movement but the hashtag was severely regulated leading to its low digital presence. The government also regulated the hashtag #shoot which was used to justify that shooting the farmers would be the best possible intervention in curbing the protest movement. The hashtag was later removed completely from Facebook to project that the government was concerned about the farmers.

IV. Conclusion

From the above-mentioned facts, it can be found that Facebook was extensively used as a forum for validating different narratives which included both factual and fake information. The digital presence of the farmers' movement was helpful in terms of sensitizing the people through facts and mobilizing the public for support. However, due to the high rate of transfer of information on Facebook and the creation of false narratives, the protesters' group faced the challenge of dealing with large data. The factors which benefited the protestors on Facebook were high levels of transparency in presenting facts and allowing a public forum for accountability and verification of information. Thus,it can be seen that a high degree of participation was observed in the favour of the farmers on Facebook through the presentation of verifiable facts.

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Revisiting the Knowledge Gap Theory: Dynamism and Risks of AI in Adaptive Learning

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Scholars have argued that the digital means of providing inter-disciplinary professional programs can not only help in aiding the demographic dividend in India but can also help in proper monitoring and motivation of the learners to complete the programs which they have enrolled in digitally thereby, reducing the knowledge gap within society. Despite the possibilities of a high dropout rate, adaptive learning methods on digital platforms can be seen as potential game-changers due to their ability to personalize learning. For a digital sound platform to promote adaptive learning in India, there is a need to adopt a sound digital learning model that can help the learners by providing academic aid and also motivating them to develop an inter-disciplinary aptitude for greater industrial integration. Adaptive learning with the integration of artificial intelligence can be seen as a necessary and crucial step towards effective learning. The paper focuses on analyzing some of the key e-content and e-learning platforms such as e-PG *Pathshala*, UGC-SWAYAM, mooKIT (Open-source MOOC Management Software), IITBX, ApnaCourse, etc. to understand their e-learning model and to identify the parameters which are indicative of adaptive learning and what more can be integrated to ensure that the learners are equipped with complete understanding of inductive, deductive and discovery-based learning. The idea of integrating AI in the learning model is a positive step towards adaptive forms of learning. However, the challenge of noise in the information can create extreme situations of incorrect assessment of student's performance, followed by the challenges of dealing with the emotional reactions during the student's progress. It is also imperative to understand as to how the AI-driven model can be integrated to the discussion forum of such platforms where a dynamic form of continuous communication can be achieved with the students through AI and how it can help in better assisting them and guiding them in the course of their performance.

Keywords: Artificial intelligence, adaptive learning, Knowledge Gap theory, e-PG *Pathshala*, UGC-SWAYAM MOOCs.

The Knowledge Gap theory is a communication theory that was proposed in the 1970s by Philip J. Tichenor, George A. Donohue, and Clarice N. Olien (Donohue, Olien, and Tichenor, 1970, pp. 159-170). This theory primarily focused on the information gap that existed within society. The theory proposed that "as the infusion of mass media information into a social system increases, the higher socio-economic status segments tend to acquire this information faster than lower socio-economic status population segments. Hence the gap in knowledge between the two tends to increase rather than decrease." (Communication Theory, 2019). The theory was seen as pivotal in the context of any society because media gradually began to be identified as an information source that had the power to influence knowledge creation and opinion formation. Unfortunately, the demerit of media as a form of technology was that it was, to a greater extent, determined by the socio-economic capital of an individual.

Historically, it was the stratum of the population well off in terms of socio-economic capital that had access to media technologies first. It would come later on trickle down to the rest of the sections of the society. As a result, the early adopters had a comparative advantage over others in terms of access to information. This gap within society was expected to expand with time as with the advancement in media technologies, the access being costly would become concentrated to the creamy layer, and the rest of the population will have to wait till the time the technology became competitive in terms of cost. Also, at the same time, in this gestation period of waiting, the state of technology would not remain constant and evolve into a newer and more advanced form. As a result, it was observed that the gap would continue to grow within society. Even in terms of information services, there would be an economic challenge as the technology would remain to be inaccessible to everyone within society, and providing cost-effective information services on the available technological platforms would not prove fruitful in the long run (Atkin, Fu, & Jeffers, 2017).

This theory was seen relevant for most of the developing societies such as India because, in India, there is a wide disparity between the rich and the poor, which has also affected the domain of media technology and its access. The Knowledge Gap theory is considered to be crucial because there is a process of rapid digitization of information that has taken place in India in the 21st century. This process has resulted in providing different degrees of choices for knowledge creation among the population. However, the demerit of this process is the fact that due to the rapidly growing freedom of choice in the contemporary information environment, there may emerge an increasingly differential distribution of knowledge between various socio-economic groups. This may create adverse societal implications in the long-run. The primary focus of the policy-makers then comes down to ensuring that the levels of knowledge formation amongst the demographic dividend of the country remain fair. However, in the case of India, with the already existing structural imbalances and unequal distribution of media technologies, it has contributed to the rising gap of knowledge amongst the different strata of the population (Sheikh, 2017).

For instance, in the case of levels of literacy in India, the Census Data of 2011 indicated that the total levels of literacy in India were 778,454,120[1] (approximately 74% of the total population). Despite the rise in the levels of literacy, the numbers did not show significant development in the domain of girl-child literacy, which was relatively low in comparison with boys. The census data supports the above argument that the levels of literacy amongst the women population increased by only 43% in comparison to men, which was approximately 60% (Census of India, 2011).

Even the male-female gap in terms of effective literacy rate did not come down drastically. It was 17% in 2011 in comparison with 22% in 2001. The decline was not very considerable despite the growth in the overall economy in India. Even by looking at the state-wise increase in the levels of literacy, states like Kerala, Lakshadweep, Mizoram, Goa, Daman, and Diu, etc., had a remarkable growth rate (Census of India, 2011). However, states identified as socio-economically backward such as Bihar, Chattisgarh, Jharkhand, Madhya Pradesh, etc. witnessed a minor rise in the levels of literacy. Still, comparing the statistics in terms of their decadal difference, the figures were not very promising (Census of India, 2011).

Comparing these figures with the growth in the levels of per-capita income, it can be seen that from the period of 2014 to 2017, per-capita income had increased by a mere percentage of 0.77% (Ministry of Statistics and Programme Implementation, 2017). In addition to that, the growth of higher education in India has been slow. For instance, there are a total of 25,951 colleges[2], out of which only 28% have been recognized (OECD Economic Survey, 2011). The total youth population of India, which accounts for 242 million (2017),

the number of recognized colleges lack the sufficient capacity to absorb them for higher education. There is a major challenge in terms of providing the youth with a basic set of skills essential to overcome the issues of unemployment and poverty (UGC Report, 2017).

The current statistics of the Ministry of Human Resource Development, Govt of India, has pointed out that more than 8,00,000 students (2018-19) have enrolled in higher education. Even the Gross Enrollment Ratio (GER) has increased from 25.8% (2016-17) to 26.3% (2018-19). Despite the increase in the number of colleges to 49,964 (2018-19)[3], the problem of recognized institutions still exists, thereby making the process of absorbing the young population for higher education a challenge (Livemint, 2019).

Apart from that, the major concern in terms of higher education that is present is the lack of proper industry-academia linkage. The courses that are running in most of the institutions have not been upgraded with the changing market requirements. The course curricula are incompatible with the industrial requirements. In addition to that, there is limited scope at the institution level for garnering value-addition skills, which can be industry oriented. There are also major challenges in terms of infrastructure. Most of the universities and institutions operating at central or state levels are dependent upon the University Grants Commission for grants and aids for any form of infrastructure-based development.

On the other hand, the colleges and institutions which are self-funded have an exorbitant fee structure that limits the admission of the students, and at the same time, due to its revenue model being profit-based, the scope for quality education becomes limited in the long run. Also, both at the primary level as well as at the level of higher education, there is a lot of political interference in terms of revising the course curricula either in terms of the subject matter or reference material, etc. This has created frequent imbalances in the system, thereby making the delivery of effective programs a challenge. There also exist challenges in terms of research and innovation at institutional levels. Except for a few engineering and management institutions such as IITs and IIMs, the degree of research and innovation is inadequate and lacks the scope for future utilization. The engagement is highly linear and faces challenges in terms of reliability and validity. Also, due to this issue, there exist challenges in terms of acquiring government-based research grants and fellowships. Most of the Indian institutions and universities lack quality publication of research papers which can help in developing an international recognition. This, too, complements the problem of acquiring funds for research and innovation. Further analysis it is noticed that:

(i) There are issues regarding the management of resources as in most of the state universities, there exists a financial crunch as the number of grants received by them is not optimal. Almost 65% of the grants provided by the UGC are gone into central universities, whereas state universities and affiliated colleges are only able to get the remaining 35%. Although alternative channels for funds have been explored, still in most of the state universities, they have not shaped up to the desired degree.

(ii) The other alarming concern in the case of higher education is the fact that the student-teacher ratio in most of the universities and institutions, both central and state are unbalanced. According to UGC, there are more than 16,699 posts vacant[4] in different central and state universities were 5,925 (35%) professor posts; 2,183 (46%) associate professor posts; and 2,459 (26%) assistant professor posts remain to be vacant (UGC Standing Committee Report, 2017). It is further complicated with the issues in accountability in teacher appointments and the performance of the subject matter experts in the long run. At present, there are no proper mechanisms for ensuring the accountability and performance of professors in universities and colleges. The process

of student feedback and improving teaching pedagogy is not taken very seriously rather as a formality.

(iii) In addition to that, most universities also face a challenge in terms of maintaining quality ranking in the long run. With the issues in quality assurance, institutions and universities avoid taking long terms strategies that can ensure quality education. They tend to adopt short term strategies that can help in gaining optimal ranking (Sheikh, 2017).

With the existence of such complex structural problems existing in the higher education system in India, the government has begun to explore alternative venues that can help in leap-frogging the structural imbalances and help in providing a vast array of professional courses which can help in strengthening industry-academia linkages.

Learning to E-Learning

Digital technologies post-globalization have brought about a change in the process of learning through the convergence of time and space. The learner is no longer required to exist in a defined structural space to develop professional learning that gradually translates into knowledge. In India, most of the open and distance form of learning was based on the model of the UK open university system. This process amplified with the emergence of privatization and growth in digital media. This allowed for the development of programs and courses which were diverse, inter-disciplinary, and based on the principle of 4 As (Anyone, Anyway, Anywhere, and Anytime). It was observed that with the growth in the professional sectors, there was a demand for services with distinct specializations, be it technological service, mobile service, visualization, etc. It was further observed that the skill development avenues for value addition could not be expected out of every state or central university and institution. It cannot be provided immediately. There was a need for a model that can help in filling this skill and learning gap (Imran, 2012).

It was also observed that with the development of ICT and its applications, the traditional methods acquisition, organization, and access of information had transformed. It was witnessed in most of the developed societies where the employment market constituted different types of information related activities along with a combination of traditional and technological skills. This led to a greater emphasis on content development and management, which could be delivered through digital media.

The notion of e-learning came into light in India post-1999. It was seen as a means for providing choice based courses to the students for value addition. It initially began at school level in the form of smart classes where standard course curricula of primary education were being complemented with additional information in the form of visuals. It later on, from 2000 onwards began to trickle down to business and professional sectors where e-learning was utilized for cost-effectively training the employees. This approach helped in revolutionizing the process of "learning at the doorstep" (Kawatra, 2006).

The focus on transcending from the paradigm of learning to e-learning was primarily done to ensure that there is a plurality in terms of access and affordability, followed by the provision of quality courses. In 2002, a committee was set up to look into the shaping of UGC-INFONET (2004). It was also focused on introducing the idea of e-learning. UGC-INFONET focussed on providing access to scholarly literature available over the Internet in all areas of learning to the university sector in India. UGC planned to link all Indian universities and research and development institutes together with a strong intranet network, which will ensure smooth and quick dissemination of information and would be a major leap towards educational development in the country (Kawatra, 2006).

In addition to that, another project that took shape in terms of delivery of online programs in the field of sciences and other related professional courses was the National Programme on Technology Enhanced Learning (NPTEL). It was funded by the Ministry of Human Resource Development. The idea was first conceived in 1999. It was focused on linking multimedia and web-based technologies to enhance the learning of basic sciences and engineering concepts. The platform was launched in 2006. The process involved making video lectures and broadcasting it through the *Eklavya* channel and also to develop a repository of online learning material through the NPTEL website. NPTEL has more than 300 courses running digitally and has been undertaken by partner institutions such as IITs, IISC, etc. The primary focus has been in terms of designing and promoting e-learning courses in professional fields and competing with international standards (Kawatra, 2006). Even the Government of India has developed a project on making library access in a digitized format, i.e., "National Digital Library," providing free access to various e-books and reference materials across different disciplines which can be used by professional institutions as reference for open-education courses and programs. However, e-learning in India is still gradually expanding as it is undergoing different degrees of experimentation. In India, there still exists a greater reliance on the traditional forms of teaching. It is changing but slowly. As a result, the shift towards e-learning is slow. The Government of India has begun to explore different avenues through which professional courses can be provided effectively through digital media. There has been the entry of private players as well in the form of Udemy, Unacademy, etc. which are providing professional courses in the form of e-learning. There are, however, certain design and structural challenges that can be seen to slow the process of transcendence from the traditional form of teaching to digital form of teaching. As a result, the degree of expansion in India in comparison with the global figures is not very significant (Imran, 2012).

E-Learning Platforms and Engagement: Contrast and Comparison

There is a slow growth towards the adoption of different e-learning platforms. However, the central question that remains to be explored is the fact that can such e-learning platforms help in addressing the problem of a knowledge gap in Indian society? The answer to this question is yes, but it is not linear. The approach to addressing this concern has to be dynamic. In India, in terms of digital engagement, there are certain parameters such as access to smartphones, which has reached a favorable figure of 800 million (2019) (Statista, 2019). Out of this figure, six hundred thirty million users belong to the category of youth. Four hundred fifty million users out of the total figure are utilizing the Internet for information access through smartphones. Post-globalization with the rise in the levels of competition, smartphones have become easily accessible to the different strata of the population. Thus what can be observed here is the fact that if there exist multiple platforms based on e-learning and providing professional courses in a customized manner, then the issue of knowledge gap can be addressed to some extent (Atkin, Fu, & Jeffers, 2017). However, what matters is how the platform has been set up and what all options of customization it is offering, which can provide an easy mode of learning cost-effectively. There exists criticism in terms of how technology may create alternative degrees of knowledge, but also, at the same time, arguments exist that through the exposure to professional information, knowledge can be created, which can provide value addition in different fields. Even the problem of socio-economic capital can be leap-frogged with access to cost-effective media technologies and digital learning platforms (Atkin, Fu, & Jeffers, 2017).

The other central questions regarding e-learning platforms are to understand which type of e-learning model will suit best for Indian conditions and how they can be implemented effectively? It is important to understand that the AI-driven model is where the data through effective storage and efficient processing can provide predictions through neural net algorithms and data-centric techniques to understand the levels of understanding of different students and predict the future course of engagement for them in a far more personalized manner. However, for this to effectively take place, there is a growing reliance on quality data where the AI is initially data-driven in comparison with model-driven as developing a model again is dependent on quality data. As a result, if the existing platforms of e-learning do not provide a sufficient channel to utilize the data through the back-end, the AI-driven model will see a finite set of operations that are minimalistic.

There is no denying in the fact that a complete AI-driven model is a pending future in terms of e-learning, and researchers have already begun to work and employ artificial intelligence technologies to develop more functional web-based learning systems. However, not only do the existing data sets require extensive processing for minimizing the degree of noise, but the technology is also expensive and requires extensive individualization strategies to operate effectively. In addition to that, there is also a need to ensure that the process of learning is adaptive (Hwang & Tsai, 2008).

Most of the e-learning platforms that are based on the principle of open-education resources (OERs) utilizes the Sharable Content Object Reference Model (SCORM). It is the most common occurring model which is based on content sharing and performance assessment, which can be customized. However, the issues emerge when it comes to providing a highly flexible and adaptive mode of learning. SCORM faces certain limitations in terms of providing a dynamic platform. For instance, e-PG *Pathshala* was launched in 2015 by the Ministry of Human Resource Development, Govt of India, and was supervised by UGC-INFLIBNET. It was an e-learning platform that was launched under NME-ICT. The platform provided access to more than 63 subjects, which included both inter-disciplinary and disciplinary courses (UGC, 2019). The platform provided access to learning material both in text and video format, along with self-evaluation assignments. The platform was entirely based on OER and Creative Commons. The only demerit of the platform was that it was not dynamic in terms of providing time-to-time feedback to the learners and nor could it be made adaptive. The programs offered followed a uniform standard and did not have the provision of the certificate of completion. The platform was based on the SCORM model and was very linear in terms of engagement. The platform was designed primarily to provide access to reference material, which was developed by the subject matter experts from all over India in various disciplines and that too free of cost. However, because of the linear engagement and lack of venues for adaptive learning, the platform had limited traffic of users and learners (Hwang & Tsai, 2008).

The other model is the Modular Adaptive Learning System (MALS). This model of learning provides different e-learning programs to be constructed in an individualized and intelligent manner. It is based on an algorithm which enables an object-oriented course framework. Here the learners are subjected to a specific learning object which is supplemented with the course content followed by assessments. Incase if the learning object fails to be achieved, then a new set of learning objects is formed, followed by course material and assessments. This process continues until all the learning objects have been fulfilled. The advantage of having this particular model is that it provides ample scope for an adaptive mode of learning where the programs can be personalized as per the learner's requirements (Hwang & Tsai, 2008).

In addition to that, there are other models, such as the "Wrap Around Model" and "Integrated Model." The former model is linear and involves using existing materials that are available and fixed. It also does not provide a dynamic way of conducting assessments. *e-PG Pathshala* also incorporates elements of this model. The Integrated Model offers a more fluid and dynamic form of engagement. It is largely determined by the individual and group activities in the course.

The challenge that emerges here is that most of the government-run platforms on e-learning are based on open source applications such as Google Course Builder. The application, despite being effective and simple in terms of operations, lacks the dynamic attributes which can enable an adaptive form of learning (Chauhan, 2017). By adaptive, it implies how the process of learning can dynamically change with the change in the learning objectives. This may be seen in terms of language, learning objectives, assessments, etc. UGC-SWAYAM MOOCs is based on Google Course Builder and provides access to more than 100 professional and inter-disciplinary courses spread across different academic sessions. The programs are designed in a standard manner, which includes four quadrants, namely the e-content, video, self-assessment assignments, and learn-more. These quadrants can be accessed as the learner progresses. However, the progression is time-bound and not determined based on learners' achievements and objectives. In addition to that, in case if the learning objective has not been fulfilled, the course designer has to manually calibrate the programs within a given period to provide some degree of adaptive learning. This can be a challenge if the number of learners enrolling for the course is in great numbers. In addition to that, the course does not provide the scope for changing the language at any point in time. It depends entirely on the course designer. Even the format is uniform across every module. Further, the model of evaluation is static. The assessment can be provided through different means such as objective multiple-choice based or subjective writing etc. However, each value has to be defined manually. It cannot be set up automatically in an algorithm, which can make the process of assessment far more effective. As a result, the biggest challenge that can be seen here is in sustaining the learners until the end of the program. The majority of learners tend to leave in the middle of the program. Even NPTEL and CEC follow a similar platform for course delivery (Chauhan, 2017).

In comparison with the above platform, IIMBX provides a far greater engagement when it comes to providing access to professional courses through MOOCs. It is based on the platform, Open edX, which is a similar platform used by MIT for providing MOOCs courses. It offers a range of customization features such as course content, course schedule, and grading policy. The advantage which IIMBx provides in comparison with other government operated open-source e-learning platforms is that there is a progression level that provides the learner to constantly be in touch with his or her levels of progression through the feature of "Insight." This feature, in the case of UGC-MOOCs, is entirely dependent upon the discussion forums, which are again driven by the course designer or coordinator. The nature of engagement on IIMBx is dynamic in the sense that there is an integration of both visuals and text. In addition to that, every unit involves a practical example and assessment methods where the learner can test his/her learnings so far. Even the level of progression for the learner is tuned to his/her pace. The discussion forum is personalized for every course and learner. The discussion posts can also be filtered concerning the topic in discussion to the learner who has raised valuable points during the process. Even the interface for access is simple in terms of engagement (Chauhan, 2017).

The similar is the case of *ApnaCourse*, where more than 100 programs are accessible in the domains of finance and business management to law and designing, etc. The platform is not based on the open-source model yet provides the scope for personalized

learning. The course designed on the platform undergoes different stages of quality checks before it is made accessible to the users. Even this platform provides a simple interface in terms of access to course material, videos, and assessment based assignments, which vary depending upon the learning objectives. The advantage of this platform is that it allows the learner to preview the course curriculum as well as the course structure followed by reviews and feedback from the past learners. This helps in developing a sense of trust and reliability on the platform. The learner can engage in conversation with the subject matter expert, which can be either based on the forum or real-time (Chakravarty & Kaur, 2016).

The advantage that can be seen in all of the e-learning mentioned above platforms is the fact that they provide some degree of cloud-based learning where the learner can access the course anywhere and at any time. However, the challenge that exists in terms of incorporating the process of gamification, which in the case of most of the government-run open-source e-learning platforms lack. On the other hand, private-run e-learning platforms such as Edtech and Next Education, etc. are based on experiential learning techniques and incorporate artificial intelligence for providing personalized learning to the learners. This mode of engagement follows the AI-driven model and is highly dynamic. It enables the learners to engage with the learning problems and constructing meanings. Because of this personalized form of dynamic engagement, the level of dropout rate is less in comparison with government based e-learning platforms (Chakravarty & Kaur, 2016).

Notes

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CONTENTS

Analysis of the Policy Debates around Concentration in Newspaper Industry in India: Insights of 1st Press Commission Report (1954)

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Namit Vikram Singh

Abstract

Concentration in media is not a new emerging problem but an existing problem which has very much impacted India as well. By concentration we mean creation of conglomerate, merging of industries where the control is confined to few hands. In newspaper industry, concentration means few owners being able to grasp control over more than one newspaper firm which lead to the shift in power to few hands rather than being dispersed in a democratic fashion. However, the question that arises is as to why concentration is bad and why should it be a concern? One positive argument around concentration of newspaper industry can be that it leads to an improvement in efficiency. But on the other hand with the shrinking of power to few hands and declining competition, it can prove to be a major threat. Newspaper industry, being a non-democratic organized force having the ability to in uence politics, public discourse and culture, can pose severe issues to democracy if it possesses immense market power. Concentration in newspaper can not only restrict the multiplicity of viewpoints in a democratic society but can also create issues of dominant language, plurality, in informing the citizenry and most importantly a source of generating profits through newspapers by covering those facts which have a higher sale value. The paper will focus on the understanding the notion of concentration arising in the policy debates and re ective in the 1st Press Commission Report. The paper also intends to look into the different kinds of concentration that have been witnessed in the

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In the case of competition as discussed earlier, there exist monopolies which though are not affecting the freedom of choice for the reader but are leading to concentration in terms of ownership and language. The Commission recommends that the Pres Registrar should keep a close check on the circulation of newspaper and brig up the issue of creation of monopoly in any particular area or language. It should ensure that any kind of undesirable practice to eliminate competition should be dealt with. The Commission points out that the Press Council should draw public attention making the people realize the risks of monopoly. They should diversify their readership stimulating rival papers to boost competition.

If there involved any kind of external pressure on the newspaper firms for instance from the advertisers which would affect the news content , the Commission recommends to reporting of such instances to the Press Council. It holds that choice of publishing of the advertisements should be in the hands of the editor only. Lastly, in the case of editorial comment, the Commission recommends the Indian language newspapers not to follow the model of English papers and also include columns to address the issues on local and state matters as well.

Conclusion

Thus what is evident from all the facts explained above is that the problem of concentration despite the various measures of newsprint allocation or import quota or price-page quota, did not help much in bringing about uniformity. The policy reforms that were tried to be implemented to address the concerns in 1950's in turn resulted in the change in the concentration rather than its eradication. Also the changing patterns of concentration be it ownership or geographical concentration etc. led to a situation which made it critical for the policies to undergo revision. It was so as due to the existing settings, the trends of newspaper concentration also began to undergo a change which could not be directly addressed by the given set of policies in the 1950's.

Ultimately, it can be understood that the recommendations and the approach to addressing concentration did not bring about much of change as it was expected to. Like in the case of advertisements, the small newspapers increased in numbers but the share of ads they were getting remained the same. As a result, it is important to highlight that concentration had very much become a part of newspaper industry and could not be removed that easily with the proposed strategies during the 1950's.

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The International Journal of Communication Development is a new journal devoted to the analysis of communication, mass media and development in a global context in both Indian and international perspective. Authors are encouraged to submit high quality, original works which have not appeared, nor are under consideration, in other journals.

The International Journal of Communication Development examines the way in which similarities and differences open up scope for discussion, research and application in the field of communication, mass media and development. This journal seeks innovative articles, utilizing critical and empirical approaches regarding global communication including, but not limited to, systems, structures, processes, practices and cultures. These articles could deal with content, as well as its production, consumption and effects, all of which are situated within inter- and trans-national, cross-cultural, inter-disciplinary and especially comparative perspectives.

Culture Centric Citizenship and Marginality

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Dr. Durgesh Tripathi, Assistant Professor, USMC, GGS IP University, Delhi

Abstract

The paper focuses on the aspect of understanding cultural marginality and the different debates revolving around the issue. In light of that, the focus is towards analyzing how the issues of cultural marginality are being addressed in the context of citizenship. The attempt is to explore the idea about cultural citizenship that delves into the question of cultural marginality. The issues of marginality are deep rooted and very much present in the social, economic and political spheres of the society. However, the rise of identity consciousness among distinct groups within the Indian society has led to the emergence of cultural front as a pivotal domain of attention. The assimilation of different cultural forms and the conflicts arising between the dominant and the vernacular cultural forms has developed areas of concern which have become organic to the issue of citizenship. As a result, it becomes pivotal to understand the overall impact it has on the society on the basis of the concerned issues.

Introduction

The paper is focused on understanding the concept of cultural marginality and the different debates revolving around the very issue. In light of that, the focus is also towards analyzing how the issues of cultural marginality are being addressed in the context of citizenship. The attempt is to explore the idea about cultural citizenship that delves into the question of cultural marginality. The issues of marginality are deep rooted and very much present in the social, economic and political spheres of the society. However, the rise of identity consciousness among distinct groups within the Indian society has led to the emergence of cultural front as a pivotal domain of attention. The assimilation of different cultural forms and the conflicts arising between the dominant and the vernacular cultural forms has developed areas of concern which have become organic to the issue of citizenship.

The cultural aspect of marginality was rarely given relevance earlier. Issues of cultural discrimination and alienation etc, were mostly associated with the social aspect of marginality rather than having an independent dimension of understanding. Gradually, it became evident that the cultural aspect could no longer be sidelined and would have to be critically analyzed, as an independent layer of marginality which is multi-fold. Cultural marginality is responsible for generating a feeling of deprivation within the individual which impacts his cognitive ability of locating his identity in a situation of cultural clash between the dominant and vernacular cultural forms. This very feeling is also responsible for impacting his social, economic and political role within the society. Such issues of marginality are evidently present in the urbanized settlements due to the process of cross-cultural exchange. It is important to dwell upon the cultural factors of marginality as these elements also reinforce themselves in the social space and affect other aspects of the society namely social, political and economic. These issues can no longer be understood or analyzed in the form of sub-set rather it is necessary to critically engage them in a separate, individual space and then try to thread the linkages it has with other domains. It is also imperative to understand that such issues of marginality do not remain largely confined to the minorities but rather affects each and every individual in the society. Therefore, the concern emerges as to how the marginality created within the cultural space can be solved or addressed from the viewpoint of citizenship.

The notion of citizenship has not been uniform; rather it has been changing with time. However, scholars like Toby Miller (2001) have argued that since citizenship is multifaceted and its different layers namely social, economic and political can be easily distinguished and defined. He, therefore, asserts to the importance of cultural layer of citizenship which should also be identified independently. He dwells into the notion of cultural citizenship and explains its focus on maintenance and development of the cultural lineage through customs, language and positive acknowledgement of difference in and by the mainstream. To him, the cultural citizenship is essential in safeguarding the cultural rights of the individuals and providing greater scope for engagement by protecting the citizen's access to his socio-cultural heritage. Cultural citizenship will be essential in understanding the problem of cultural marginality and how to approach to the solution rationally. It is because neither political nor social notions of citizenship are able to capture the idea and scope of cultural marginality and the dignity. As a result, the reliance on there on cultural citizenship is greater.

Understanding Marginality and Citizenship

The concept of marginality was first coined by Robert Park in 1928. The very concept has had a historical significance in terms of evolving the sociological thinking. The term marginality may have ambiguous implications but Robert Park has tried to explain it from the perspective of marginal man. He questioned as to who is a marginal man? How can one be identified as marginal? Marginality is generally seen as a situation rooted in socio-cultural, political and economic spheres of the society where disadvantaged people struggle to gain access (societal and spatial) to resources and full participation in social life. In other words, marginalised people might be socially, economically, politically and legally ignored, excluded or neglected, and are therefore, vulnerable to livelihood change (Gurung and Kollmair, 2005, p10). Specifically, it can be understood as *"the temporary state of having been put aside of living in relative isolation, at the edge of a system (cultural, social, political or economic) ... in mind, when one excludes certain domains or phenomena from one's thinking because they do not correspond to the mainstream philosophy"* (Gurung and Kollmair, 2005, p10). It is interesting to note that marginality is closely associated to the psychological attributes of an individual i.e., the fear or threat of being sidelined or excluded which can gradually manifest a form in any existing sphere of the society. Also degree of marginality cannot be exactly identified numerically as such a complexity can exist within a community which may be high or low in number. Confining the issue of marginality to a specific domain would be ethically wrong as marginality is deep-rooted and multi-dimensional. It may have different forms existing within the society but these very forms will do share a common overlapping ground.

Gurung and Kollmair (2005) in their work "Marginality: Concepts and their Limitations" have largely identified marginality into two broad categories of spatial and societal marginality. Societal marginality is largely incepted and reflected by the unpleasant social conditions of people. The very conditions can be in the form of poor livelihood options like lack of resources, skills and opportunities, poor to no participation in public decision-making process, lower sense of community and poor self-esteem. People within this category are the ones who are usually discriminated against, stigmatized and ignored or suppressed on the basis of race, gender, age, culture, religion, ethnicity, occupation, education and economy.

Spatial marginality, on the other hand, revolves around the issue of geographical remoteness of an area from major community habitats. Here the scale seems to be the important factor for consideration. Marginality here can be expressed in terms of exclusion from a wider established societal base due to incompatibility with the pre-laid conditions of entry. The individual here may

properly address the identity issue of different groups involved in the process of cultural assimilation (Munir, 2013, p 19).

Conclusion

It can be well understood that the issue of cultural marginalization has risen gradually with the change in the structure of society and cannot be sidelined over other societal issues. It is, therefore, essential to critically understand the roots of its cause and taking active steps in curbing its spread. Cultural citizenship does possess the potential of addressing this contemporary issue, however, it should be able to highlight responsibility, the acknowledgement of difference, inclusion in policymaking and increased interaction in the community with the aim of building participatory public life. It should propagate solidarity among the citizens through various plans and programs where citizens come together and learn about the advantages of having a cosmopolitan society. The collective learning has to be based on equity and equal rights. Spaces for socialization have to be promoted and conditions for social and cultural integration need to take into account the different demands and different contexts. Cultural citizenship should have the capacity to properly challenge the hegemony of the state at different spheres. Cultural citizenship should not be conformed with to some form of shape, but rather it should inform the inquires of the citizens to empower them to challenge the structures of power and find agencies within the cultural practices. Cultural citizenship can only then become an important means of cognitive transformation of self and others and hence contribute towards reducing the xenophobia in society by giving voice to personal identities, rather than unifying groups into collectivities i.e, to empower the minorities and immigrants through their own self-understanding and sense of belonging and identity (Munir, 2013, p 21).

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INDEX

Culture, Communications, and Propaganda Model: An Opinion

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The articles "Culture, Communications, and Political Economy" by Peter Golding & Graham Murdock and the "Propaganda Model" by Edward Herman and Noam Chomasky address the common concern of how media as a tool for informative purpose is being mostly used for the fulfillment of private gains. Their critique is embedded into the perspectives of political economy of propaganda which demonstrates the interface between the state, media and public.

In the "Propaganda Model", Herman & Chomsky highlight the importance of mass media as a system for communicating messages and symbols to the general populace. They highlight how media controlled by few, projects a deceptive portrayal as a spokesman for free speech and general community interest which entirely, it is not. The control on ownership of media in few hands and the industry tiered, where the top tier deciding the rules of the game is clearly highlighted in the article. Also the focus is shown towards understanding the propaganda model and the consequences it has on the society. Herman and Chomsky have also paid attention towards highlighting the essential ingredients of the propaganda model, e.g., concentrated ownership, advertising as primary source, flak, media and government relation (information) etc.

On the other hand, the paper by Golding and Murdock explains the relation between public communications systems and the cultural industries and how they are integrated into the general industrial structure. They bring about the distinctions of critical political economy and its focus on the interplay between the symbolic and the economic dimensions of public communications. They, through their article project how different ways of financing and organizing cultural production have traceable consequences for the range of discourses and the representations in the public domain and for the audiences to access them.

I found the argument raised by Herman and Chomsky in their paper to be absolutely valid. Their notion of propaganda that is projection of information which is false, twisted or exaggerated to receive support from the people for specific purposes, in their paper by the government and the dominant private interests holds true in most of the media- government relations. Their emphasis on the issue of concentration in the ownership of media where the big firms control the production and circulation of information, as well as focus their attention towards the facts having an economic value, can very much help in providing a strong basis for propaganda. These players being dominant in the media market can easily control the decisions of the small independent firms which can shrink the window for diverse views even further.

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Index

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Contents

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Review

Metal/Metalloid-Based Nanomaterials for Plant Abiotic Stress Tolerance: An Overview of the Mechanisms

Mohammad Sarraf [1,†], Kanchan Vishwakarma [2,†], Vinod Kumar [3], Namira Arif [4], Susmita Das [5], Riya Johnson [6], Edappayil Janeeshma [6], Jos T. Puthur [6], Sasan Aliniaeifard [7], Devendra Kumar Chauhan [4], Masayuki Fujita [8,*] and Mirza Hasanuzzaman [9,*]

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Abstract: In agriculture, abiotic stress is one of the critical issues impacting the crop productivity and yield. Such stress factors lead to the generation of reactive oxygen species, membrane damage, and other plant metabolic activities. To neutralize the harmful effects of abiotic stress, several strategies have been employed that include the utilization of nanomaterials. Nanomaterials are now gaining attention worldwide to protect plant growth against abiotic stresses such as drought, salinity, heavy metals, extreme temperatures, flooding, etc. However, their behavior is significantly impacted by the dose in which they are being used in agriculture. Furthermore, the action of nanomaterials in plants under various stresses still require understanding. Hence, with this background, the present review envisages to highlight beneficial role of nanomaterials in plants, their mode of action, and their mechanism in overcoming various abiotic stresses. It also emphasizes upon antioxidant activities of different nanomaterials and their dose-dependent variability in plants' growth under stress. Nevertheless, limitations of using nanomaterials in agriculture are also presented in this review.

Keywords: abiotic stress; plant stress tolerance; metalloids; metalloid nanoparticle; antioxidant enzymes; antioxidant defense; ascorbate peroxidase; glutathione reductase; reactive oxygen species

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1. Introduction

The upcoming challenges of rise in global population, decreasing arable lands, and escalating threats posed by climate change exert pressure on the need for developing new techniques and methods to increase yield potential during stressful conditions. Stressful conditions for plants arise from numerous biotic and abiotic factors, which impart stresses such as drought, salinity, temperature, and heavy metal leading to substantial modifications in plants. Thus, improving stress tolerance in crops is a major target of research to fulfill

the food demand of growing populations. Over the last several decades, tremendous efforts are being taken to improve the agricultural yields through extensive application of chemicals that have long-lasting and profound effects on the environment and human health. Therefore, to feed the world population without damaging the environment, the application of novel technology is necessary.

Nanotechnology is a novel approach towards the improvement in the agricultural sector as it puts forth new ways to impart tolerance against various stresses and enhances the productivity [1]. Nanoparticles (NPs) are molecules with dimensions of 100 nm, diverse physicochemical properties, higher reactivity, and biochemical activity which depends on their high surface energy and the high surface-to-volume ratio [2]. Plants have the ability to synthesize NPs which are natural agents used for improving the morphology of the plants without imparting any negative effects [3]. In the current situation, NPs have the potentiality to boost plant morphogenesis, used as herbicides, nanopesticides, and nanofertilizers, etc., that can proficiently release their content in required amounts to target cellular organelles in plants. Still, certain potentials of NPs are not revealed due to a lack of mechanisms that are not cleared or nor yet studied.

Different types of NPs are developed such as those containing inorganic nonmetallic NPs, carbon-based NPs, metallic NPs, and organic polymeric materials based on the application and usage [4]. Effective nutrient supply requires specific nanofertilizers or nanoencapsulated nutrients that could act as an efficient tool towards sustainable mode of agricultural practices. These nanofertilizers would be an alternative to chemical fertilizers that, in turn, improve efficiency of resource utilization, reduce soil toxicity, and thus, usage of nanofertilizers will assist to diminish such problems [5]. Plants are sessile so they have to face extreme environmental stress conditions, such as salinity, drought, high and low temperatures, heavy metals, flooding, high and low light intensities, ultraviolet (UV), and others. The extreme environmental conditions induces bursts of reactive oxygen species (ROS) which causes macromolecules and membrane degradation, prompts cell toxicity, and diminishes the plant growth. Antioxidant machinery through enzymatic and non-enzymatic systems scavenges ROS to alleviate oxidative stress. Against various abiotic stress, NPs take part in the growth and development of plants followed by providing protection to plants [6]. NPs have the capability to modify those genes (and their expressions) that are involved in cell biosynthesis and organization, electron transport, and energy transport during stress responses [2]. From different experiments, it was concluded that NPs play a very important role in improvement of crop plants, but understanding of the appropriate mechanism [1,7–10] and the way of interaction of NPs with plants at different levels is still required at an early stage. Current review focuses on the concept, types, mode of metal/metalloid nanoparticles together with physiological impact of metalloid NPs on plants, their effect on growth and overcoming abiotic stress, and the underlying mechanisms.

2. Concepts and Types of Nanoparticles

The use of NPs has a novel approach, which allows a better understanding of interconnection of science and technology, and opens up new interventions in the field of biotechnology and agriculture [11]. Particles having dimensions between 1–100 nm are considered as NPs; they have high surface vitality and large surface to volume ratio that increases their reactivity [12]. Besides having small dimensions and high reactivity, each NP contains its unique physical and chemical properties. They are composed of three layers: the outer layer known as surface layer, middle layer known as shell layer, and the inner layer is called core layer. The shell layer is found chemically different from core layer [13]. In the present scenario, which depicts indulging of various materials and novel techniques to create a boom in agricultural crops and in improving crop quality, the application of NPs in the agriculture field shows potential results through increasing plant growth and production, as different NPs are applied through various methods, for instance, as herbicides, nanopesticides, nanofertilizers, etc. [14]. The major difference

between mode of action of other elements and NPs in plants is that NPs are effectively released in required amounts and reach the targeted cellular organelles [12]. Although, despite having numerous initial studies on potential application of nanomaterials to attain the objective of flourishing agriculture, there is still a need to unfold their unique mode of action in plant system, which helps to boost the agriculture production one level up [15].

NPs have different sources of origin, namely natural, incidental, and engineered [16]. Natural occurrence of NPs is from volcanic eruptions, dust storms, mineral complexes, forest fire, photochemical reactions, etc. Incidental origin of NPs occurs through human interventional activities, such as exhaust from metallurgic activities, coal combustion, and industries [16]. Whereas, engineered NPs are generally classified into carbon-based NPs, metal-based NPs, metal magnetic NPs, dendrimers, and composite NPs. Metal and metal oxide-based NPs from the past several decades are comprehensively studied in agriculture field for the improvement of crop productivity, and increasing the plant resilience and tolerance under abiotic stress conditions [17]. Metal-based NPs include nanomaterials of gold (Au), silver (Ag), copper (Cu), aluminum (Al), and iron (Fe). Additionally, their oxides, such as titanium dioxide (TiO_2), cerium oxide (CeO_2), iron oxide (FeO), aluminum oxide (Al_2O_3), and zinc oxide (ZnO) are also gaining so much attention of scientists worldwide to tackle adverse environmental conditions [18–20]. The different types of nanoparticles are given in Table 1.

Table 1. Categories and types of nanoparticles.

Categories of Nanoparticles	Types of Nanoparticles	References
Metal-based NPs	Gold, copper, aluminum, iron, silver, platinum, palladium	[21,22]
Metalloids NPs	Selenium, silicon, boron, arsenic, tellurium	[23,24]
Metal magnetic NPs	Cobalt, manganese, nickel, iron	[25,26]
Metal-oxide NPs	Titanium dioxide, cerium oxide, iron oxide, aluminium oxide, zinc oxide, copper oxide	[27,28]
Dendrimers	Hybrid, tecto, micellar, chiral, liquid crystalline, triazine	[29,30]
Carbon-based NPs	Carbon nanotubes, carbon nanohorn, nanodiamond, fullerene, graphite, graphene, graphene oxide, carbon dot	[31,32]

3. Synthesis of Metal and Metalloid Nanoparticles

The synthesis of metal and metalloid NPs is a promising part of nanotechnology, which offers solutions for wide areas including agriculture [33]. Engineered NPs have distinctive electrical, mechanical, physiochemical, optical, and imaging properties that can be controlled during synthesis process [34]. The difference between metal/metalloid NPs and their bulk material occurs on the basis of size, shape, and surface characteristics, such as presence of coatings, copious reactive sites, and mobility regulated by their aggregation state [35] that further depends on their pH, temperature, ionic strength, and concentration [36]. So far, a number of methods have been developed for controlled synthesis of NPs. Generally, there are two main approaches such as: (i) bottom-up approach and (ii) top-down approach [37]. These are further classified under many subclasses developed on the basis of operation, reaction condition, and adopted protocols.

Top-down pathway includes synthesis by gradual size reduction, which is achieved via various physical and chemical methods [38]. In general, it operates when particles are larger than nano-sized particles [34]. Whereas, in bottom-up means of synthesis, NPs are produced from atoms and molecules that include reduction/oxidation as core reaction [39]. This pathway is followed when metal particles are already smaller than nano-sized molecules. During synthesis, NPs aggregate through the action of reducing agents which also act as anti-agglomerating agents [34]. Plant extracts and chemicals act as

reducing agents, as they contain alkaloids, terpenoids, flavonoids, phenols, carbohydrates, anthraquinones, and proteins, etc., which reduce the size of metal ions into NPs and stabilize the resultant NPs [40].

Moreover, bottom-up approach follows the involvement of biogenic substances. Biological agents required for the synthesis are bacteria, yeast, algae, cyanobacteria, fungi, flagella, viruses, plants, and even human cells [41]. For the reducing agent, microorganism and plant extracts are used [42]. Biological synthesis is more feasible, cost-effective, ecologically-friendly, and less toxic to the environment [41], due to their distinct optical, chemical, photoelectrochemical, and electronic properties [43]. A wide range of physical, chemical, and biological methods including environment-friendly green synthesis of NPs are developed and applied in various disciplines. The size of NPs can be manipulated by controlling various parameters such as pH, temperature, concentration, and exposure time to substrate [34]. For instance, a method was developed to manipulate the shape and size of AuNPs extracellularly produced by microorganisms through shifting the key growth parameters [43]. Some study shows that AuNPs' synthesis occurs by using the plants rich in tannic acid, whereas to synthesize AgNPs, chemicals like trisodium citrate can be used as important catalysts [44,45]. The overview of nanoparticles' synthesis is illustrated in Figure 1.

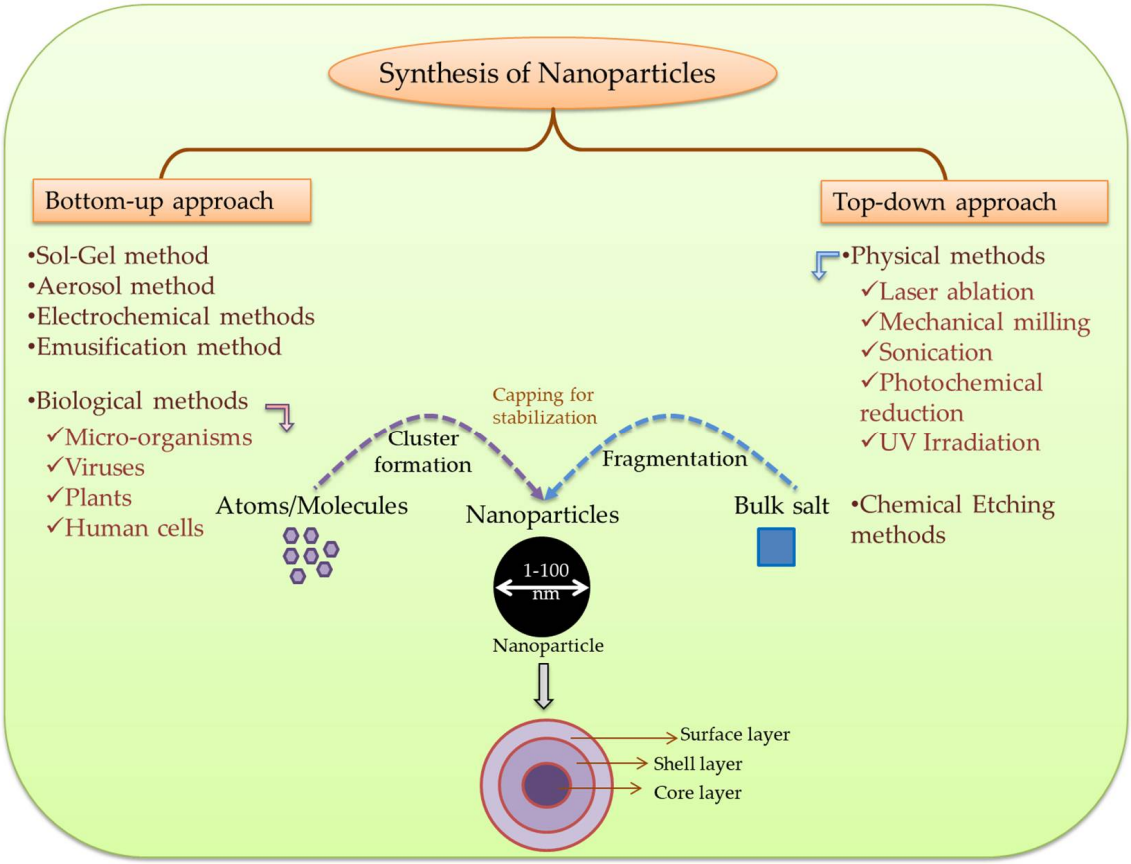

Figure 1. An overview of nanoparticles' synthesis.

4. Mode of Action of Nanoparticles in Plants

Several hypotheses have been made from the studies that were conducted to know the exact NPs' mode of action (Figure 2). Certain studies showed that NPs which mediated growth of plants depends upon the concentration of NPs utilized; this can be toxic to plant growth at higher concentrations [46–48] or it can be beneficial when given in relevant concentrations [49,50]. Entry of NPs into the cells happens either by penetration or by transportation via particular channels located in the cellular membrane. NPs might

function as stress signaling molecules which, in turn, cause induction in the expression of various genes involved in stressed condition. This includes the induction of expression of regulatory factors thus resulting in activation of defense system, and finally, exhibiting stress tolerance. Besides an acceptable level, NPs can maintain ROS at considerable level to induce ROS signaling network hence activating defense system of plant under stress conditions. Ruotolo et al. [51] performed meta-analysis of proteomics and transcriptomics studies where the response of different plant species to metal-based NPs was compared. It was found that common NPs which induced responses to stress include root architecture modification, antioxidant mechanism activation, and involvement of specific signaling pathway of phytohormones, although the effects were influenced by NPs' nature and their duration of exposure [51,52]. For example, after exposure to NPs, the root architecture modification could be due to the downregulation of genes involved in trichoblast differentiation. This is the area from where the emergence of root hairs occurs hence trichoblasts come under specialized epidermal cells. Further, genes responsive to indole acetic acid (IAA) and ethylene (ET) were shown as the positive regulators of development of root hairs [51]. NPs' treatment frequently alters biological pathways involved in defense mechanisms [51]. NPs' treatment also upregulates genes that encode for proteins which play a primary role in ROS balance like NADPH oxidase, GST, superoxide dismutase (SOD), and peroxidases (POX) [51].

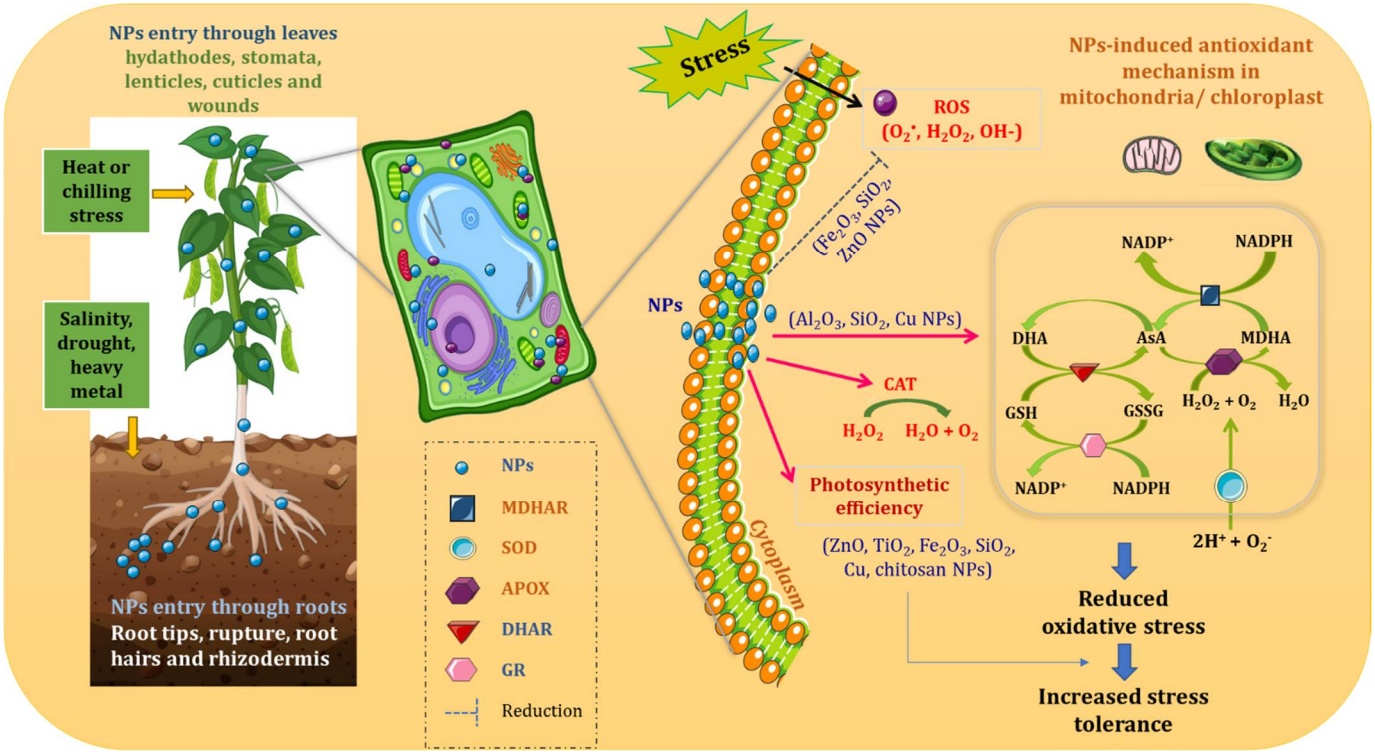

Figure 2. Antioxidative mechanism of action of nanoparticles in plants under abiotic stress (NPs: nanoparticles; MDHAR: monodehydroascorbate reductase; SOD: superoxide dismutase; APOX: ascorbate peroxidase; DHAR: dehydroascorbate reductase; GR: glutathione reductase; ROS: reactive oxygen species).

The genes responsible for activation of antioxidant enzymes are upregulated by NPs [53]. Laware and Raskar [53] carried out an experiment to determine the effects of TiO_2 NPs on onion seedlings, and from the results, they suggested that the activity of SOD enzyme was elevated by TiO_2 NPs where the enzyme's activity was further enhanced when the concentration of NPs was increased. However, only at low concentration of TiO_2 NPs, there was an improvement in seedling growth and seed germination in onion which was suppressed at high concentration of TiO_2 NPs [53]. One study showed an enhancement

of seed germination and growth in *Glycine max* seeds when exposed to TiO_2 and SiO_2 NPs [54].

The studies also reported that NPs can be recognized by calcium-binding protein (CaBP) complex or as signaling molecules in the cytoplasm. Once NPs enter plant cells, NP-specific proteins are recognized which then triggers the downstream expression of stress-related genes [9,55]. As a result, a cascade of signaling pathways is induced intracellularly, and associated genes are upregulated whose expressions lead to plant's increased tolerance responses to adverse environmental conditions. When *Arabidopsis thaliana* was exposed to salinity and drought conditions or treated with ABA, responsive to desiccation (RD20) gene expression was induced which harbors a specific conservative region for binding of calcium ion (EF-hand) [56]. In a study, increase in the expression of RD20A, particularly in Co and Fe NPs-supplemented plants, supported the hypothesis that NPs take part in induction of Ca^{2+}-binding protein expression [55]. Besides that, NPs are also thought to impart a vital role in scavenging ROS by inducing the activities of antioxidant enzymes. Recently, very strong evidence was provided by Sun et al. [57] which shows that the expression of Cu/Zn SOD, Fe/Mn SOD, catalase (CAT), and ascorbate peroxidase (APX) was notably enhanced in plants that were treated with ZnO NPs under drought.

Various transcriptomics and proteomics studies have been carried out to assess plant and nanomaterial association [10]. Results from transcriptomics studies showed the effects of ($\leq$50 nm size) Cu-based NPs which modulate the genes responsive to oxidative stress, brassinosteroid biosynthesis, and root formation [58]. Metabolomics studies on 40 nm sized Cu NPs in cucumber (*Cucumis sativus*) showed increase in secondary metabolite (such as acetyl glucosamine, phenyl lactate, 4-aminobutyrate) accumulation involved in cell signaling and defense responses, and decrease in metabolites of flavonoid and fatty acid synthesis, as well as riboflavin and amino acid metabolism [59]. Moreover, TiO_2 NPs-treated tobacco plants had a significant elevation in transcript levels of miR399 and miR395 in transcriptome analysis, both of which are involved in regulation of adaptive responses of plant to nutrient stress, thus suggesting the fact that these miRNAs in tobacco plants have a significant role in responding to TiO_2 NPs [60]. When the seedlings of *A. thaliana* were exposed to carbon nanodots of 3 nm, root elongation happened in a dose-dependent manner; transcriptomics analysis revealed that the genes involved in cellular response to phosphate starvation, UDP-glycosyltransferase activity, and stimulus response were upregulated whereas those which took part in chloroplast structure and function were downregulated [61]. Results from metabolomics study suggested the occurrence of defense response activation due to the augmentation of cell wall's carbohydrate components.

Metal/Metalloid-Based Nanoparticles for Enhancing Plant Antioxidant Defense

Antioxidant defense system of plants comprise of various enzymes like CAT, APX, dehydroascorbate reductase (DHAR), guaiacol peroxidase (GPX), glutathione reductase (GR), and SOD and low molecular weight antioxidant compounds such as glutathione and ascorbate (Figure 2) [62,63]. It has been confirmed that enzyme-like activities are possessed by various NPs where $nCeO_2$, nFe_3O_4, nCo_3O_4 NPs imitate CAT; $nCeO_2$, nFe_3O_4, nCo_3O_4, $nMnO_2$, nCuO, and nAu mimic peroxidase; $nCeO_2$, nPt, and fullerene mimic SOD activity [62]. With all this information in hand, still, efficient techniques are required to detect enzymes mimicking activities of NPs when supplemented to the whole plant.

Maghemite γ-Fe_2O_3 nanomaterials (NMs) and magnetite Fe_3O_4 NMs are the most common forms among ferromagnetic FeO NMs [64–66]. It was first unveiled by Gao et al. [67] that Fe_3O_4 NPs have POD-like activity and the results showed that with decreasing Fe_3O_4 NPs particle size, the catalytic activity would be significantly increased [67,68]. In Fe_3O_4 NPs, the Fe is present in either ferrous (Fe^{2+}) or in ferric (Fe^{3+}) form where the POD-like activity is higher when NPs are in ferrous Fe^{2+} form [67]. Chen et al. [64] proved ferromagnetic FeO NPs can also act like CAT enzyme thus owning dual enzyme-like activity property. At an acidic pH of 4.8, hydrogen peroxide is catalyzed by ferromagnetic FeO NPs forming $^{\bullet}OH$ thus exhibiting POD-like activity, whereas at neutral conditions ferromagnetic

FeONPs exhibit CAT-like activity, decomposing hydrogen peroxide to H_2O and O_2. Side-by-side comparison of catalytic performance was done on two types of FeO ferromagnetic NPs on the basis of surface charge and similarity in sizes. From the results, it was known that POD-like activity was possessed by Fe_3O_4 NPs than γ-Fe_2O_3 NPs [64]. From all these, it can be concluded that ferromagnetic FeO NMs can perform multifunctional activities by combining enzyme-like and magnetic properties. In a study, doping γ-Fe_2O_3 NPs with yttrium has decreased the amount of H_2O_2 by 45% and peroxidation of membrane lipid by 28% in the leaves of *B. napus*, leading to alleviation of drought stress impacts on plant [69]. When maize grown in calcareous soil was foliar-sprayed with Fe_3O_4 NPs, scavenging of H_2O_2 was enhanced, and the rate of peroxidation of membrane lipid was brought down in comparison to the control [70]. Similarly, Fe_3O_4 NPs have been used to protect cadmium toxicity in tomato plants by reducing oxidative stress level [71]. Using all these results, it can be confirmed that γ-Fe_2O_3 and Fe_3O_4 NPs protect plants from environmental stresses. In addition to that, Li et al. [72] carried out an experiment in seedlings of *Citrus maxima* to compare γ-Fe_2O_3 and Fe_3O_4 NPs. It was found that Fe_3O_4 NPs have more antioxidant capacity than the γ-Fe_2O_3 NPs.

CeO_2 NMs are considered as the initial NMs, which have SOD-like activities exceeding the catalytic activity of native SOD [73]. The preliminary mechanism to possess enzyme-like activity is to have the ability to switch between two valence states (Ce^{3+} and Ce^{4+}) with a significant level of oxygen vacancy on its surface [74]. CeO_2 NMs retains longer when the cycling is between two oxidation states (Ce^{3+} and Ce^{4+}) and remains uninterrupted with Ce^{3+} being continuously regenerated. Various studies have been carried out in the past to determine the multifunctional enzyme activity (SOD and CAT) of CeO_2 nanozymes [73,75,76]. As a thumb rule, CeO_2 NMs function as SOD-like when the ratio of Ce^{3+}/Ce^{4+} is high and CAT-like when the ratio is low [77]. Under alkaline or neutral conditions, CeO_2 NMs exhibit CAT-/SOD-like property whereas under acidic conditions OXD-/SOD-like property is exhibited by CeO_2 NMs [76]. It is henceforth clear that $O_2^{\bullet -}$ and H_2O_2 can be scavenged by CeO_2 NMs due to their ability to mimic ROS scavenging enzymes. Recently CeO_2 NMs have attracted attention to scavenge ROS in plants under environmental stresses. The coating of anionic poly (acrylic acid) on CeO_2 NPs (10nm) with low (35%) ratio of Ce^{3+}/Ce^{4+} has been reported to scavenge ROS by 52% in the *A. thaliana* leaves subjected to abiotic stress [78]. Sorghum leaves under drought stress have been compared by spraying water (control) and CeO_2 NPs to leaves, and it was observed that leaves sprayed with CeO_2 NPs had decreased $O_2^{\bullet -}$ content by 41% and H_2O_2 content by 36% as compared to control [79]. In cotton roots, efficient reduction in accumulation of ROS by 46% has been observed when seeds were primed with poly (acrylic acid)-coated CeO_2 NPs under salinity stress [80]. The results of transcriptomic analysis showed that tolerance to saline conditions had improved when seed priming with CeO_2 NMs had been carried out which induced changes in expressions of gene family coding for antioxidant enzymes [80]. Thus, it is clear from previous studies that CeO_2 NMs have dual roles of scavenging ROS and are an inducer of antioxidant enzymes.

Cobalt oxide (Co_3O_4) NPs have dual intrinsic POD-like and CAT-like enzyme activities [81]. Transfer of electrons between H_2O_2 and the substrates potentially offer Co_3O_4 NPs the ability to function like POD. Although Co_3O_4 NPs have dual intrinsic enzyme-like activities, its ability to function as CAT-like is weaker than that of its ability to function like POD. However, the CAT-like activity can be modified by changing the pH to neutral or to basic from acidic conditions [82]. Jahani et al. [83] did a field work of spraying Co_3O_4 NPs at different concentrations, where the foliar spray of these NPs at a concentration <100 mg L^{-1} induced growth of plant and did not cause production of ROS; however, at >250 mg L^{-1} concentration of Co_3O_4 NPs, ROS generation was induced and negatively affected growth and photosynthetic activity. It is still a mystery that the plant growth inducing effect of Co_3O_4 NMs is because of its ability to act enzyme-like or due to some other unknown function. Future research must be carried out to understand the association between Co_3O_4 NMs and plants under environmental stress.

Manganese NMs such as Mn_3O_4, MnO, and MnO_2 have the ability to eliminate high amounts of ROS and also possess enzyme-like activities [84–86]. From the study of Ragg et al. [84], it is known that SOD-like activities are exhibited by MnO NPs where the enzyme-like activity is surprisingly greater as compared to native Mn-SOD. However, apart from SOD, multiple other enzyme activities have been mimicked by MnO_2 such as OXD, POD, and CAT [85]. A very satisfying ROS scavenging efficacy was exhibited by Mn_3O_4 NPs where $^{\bullet}OH$ was removed [86]. The fast redox exchange between two oxidative states of Mn (Mn^{2+} and Mn^{3+}) is crucial for the intrinsic multifunctional enzyme-like activity of Mn_3O_4 NMs [87]. H_2O_2 and $O_2^{\bullet-}$ couple show a high degree of affinity for H_2O_2 and $O_2^{\bullet-}$ than any other transition metal couples. It was also found that Mn_3O_4 NPs' ability to eliminate ROS was way superior to that of CeO_2 NPs [86]. Hence manganese oxide-based NMs can be used as a promising therapeutic tool for treating ROS-mediated diseases [86–88]. Taking into account the abovementioned observations, more relevant studies regarding the catalytic and antioxidant activities of Mn_3O_4 NMs are needed in the coming future.

There are some other NPs that can be beneficial at low concentrations but toxic when supplied at higher concentrations. Zinc oxide (ZnO) NPs have been used in plants to overcome Zn deficiency and abiotic stresses. When ZnO NPs with the size of 90 ± 10 nm applied at varying concentration between 400–3200 mg Zn kg^{-1}, levels of superoxide (O_2^-) radical were found to be elevated and a significant raise in SOD activity at a maximum dose was documented in maize [89]. On treating *Gossypium hirsutum* with ZnO NPs, enhanced POX and SOD activities with a subsequent drop in lipid peroxidation was reported [90]. ZnO NPs come in various shapes and sizes like spherical (38 nm), floral (59 nm), rod-like (>500 nm), and also Zn^{2+} ions; out of all these, the most protective form was found to be spherical ZnO NPs of size 38 nm which elicited the greatest oxidative stress responses (SOD, POX, MDA, CAT, H_2O_2 synthesis) in soybean [91].

The pretreatment by TiO_2, ZnO NPs resulted in obvious increase in GPX and SOD activity which also improved the tolerance against heat stress, further lowering the levels of H_2O_2 and causing membrane stabilization (1.5 times) [92]. Gene expression analyses on *A. thaliana* exposed to ZnO NPs showed 660 up- and 826 downregulated genes [93]; further analyses on roots exposed to TiO_2 NPs and fullerene soot (FS) NPs revealed 80 up- and 74 downregulated genes and 232 up- and 189 downregulated genes, respectively (expression difference > 2-fold).

Enhanced activities of APX, GPX, CAT, and GR were noticed when seedlings of *Brassica juncea* were treated with gold nanoparticles (GNPs) which also resulted in proline and H_2O_2 accumulation in an amount greater than usual in plants treated with GNPs which kept on increasing with increase in concentration of GNPs [94].

Extensive research is still being carried out to understand the interactions between plants and metallic oxide nanomaterials (NMs) [95,96]. Few metal-oxide NMs such as CeO_2NMs, MnO_2 NMs, cobalt oxide (Co_3O_4) NMs, and ferromagnetic FeO are available in mixed valence state and hence have the ability to function as nanozymes for scavenging free radicals [65,96,97].

5. Application of Metal and Metalloid Nanoparticles for Improving Abiotic Stress Tolerance

Abiotic stresses are major problems for agriculture productivity and extension. They include drought, salinity, alkalinity, submergence, mineral and metal toxicity/deficiencies, and many others that reduce crop growth and productivity. Plants adapt and mitigate abiotic stresses by alterations in morphological, physiological, biochemical, and molecular levels to combat various stresses. Researchers have revealed that NPs help plants to overcome abiotic stresses by their concentration-dependent impact on plant growth and development [98]. The effect of abiotic stresses and the ways by which NPs combat abiotic stress and impart tolerance is depicted in Table 2. Recapitulation of the possible interaction

between NPs and plant metabolisms is essential to explore the novel insights in the field of plants' stress tolerance.

Table 2. Positive effect of various types of nanoparticles on some plant species under different abiotic stress conditions.

Plant Species	NPs	Concentration of NPs	Type of Stress	Response	References
Mentha piperita L.	Fe_2O_3	0, 10, 20, and 30 µm	Salinity	Decreased accumulation of proline and ROS	[99]
Capsicum annum L.	MnNPs	0.1, 0.5, and 1 mg L^{-1}	Salinity	Redistributed manganese, sodium, potassium, and calcium content in shoot and root	[100]
Solanum lycopersicum	CuNPs	50, 100, and 150 mg L^{-1}	Salinity	Increases lycopene, carotenoid, and SOD activity	[101]
Triticum aestivum	AgNPs	1 mg L^{-1}	Salinity	Increased IBA, NAA, and BAP accumulation	[102]
Lupinus termis	ZnO	20–60 mg L^{-1}	Salinity	Modulate growth, photosynthesis, and antioxidant responses	[19]
Zea mays L.	CuNP	3.33, 4.44 and 5.55 mg L^{-1}	Drought	Higher biomass grain yield	[103]
Fragaria×ananassa Duch	Fe_3O_4	0.8 ppm	Drought	Improved morphological and growth parameters	[104]
Glycine max	CeO	0, 10, 100 and 500 mg kg^{-1}	Salinity	Higher photosynthetic rate, RuBisCo carboxylase, and water use efficiency	[105]
Gossypium hirsutum L.	Graphene	200 µg ml^{-1}	Drought	Increased fiber biomass	[106]
Triticum aestivum L.	TiO_2	0.01–0.03%	Drought	Higher amount of gluten and starch	[107]
Sorghum bicolor L.	SeNP	10 mg L^{-1}	Heat	Improved integrity in thylakoid and photosynthetic apparatus	[79]
Lycopersicum esculentum	SeNP	4–12 µM	Low and high temperature	Better morphological growth traits	[108]
Oryza sativa	ZnO NPs	5, 10, 15, 20 and 25 mg L^{-1}	Cu and Pb	Reduced metal uptake	[109]
Oryza sativa	FeNPs	0.4–0.8 mg L^{-1}	Arsenic stress	Reduced As uptake and oxidative stress	[110]
Arundinaria pygmaea	Silicon dioxide NPs	100 µM	Cu and Mn	Improved growth, photosynthesis and the action of protective enzymes	[111]
Glycine max	AgNPs	2 mg kg^{-1}	Flood	Downregulated *alcohol dehydrogenase 1* and *pyruvate decarboxylase 2* genes	[112]
Zea mays	poly(epsilon-caprolactone)	2.5 kg ha^{-1}	Herbicide toxicity	Reduced the mobility of atrazine in the soil and genotoxicity	[113]
Glycine max	Ag NPs	5 mg kg^{-1}	Flood	Prevented mis-folding of proteins	[114]
Glycine max	Al_2O_3 NPs	50 mg kg^{-1}	Flood	Regulated the AsA/GSH pathway and increased ribosomal proteins	[115]

5.1. Drought

Among different stresses, drought is a frequently occurring stress, causing scarcity of water followed by high temperature and loss of water uptake by the plants. It is mainly found in the dry and semiarid regions thereby affects plant growth at early stage, i.e., starting from seed germination to seed setting [116]. Drought stress can be transformed by different NPs' application such as studies reported that drought stress tolerance in plants imparted by silica NPs. According to Ashkavand et al. [117], application of silica NPs in hawthorns improved seedling growth and physiological parameters under drought stress. Similar results were observed in *Triticum aestivum*, which improved starch and gluten content thereby improving growth and yield under drought condition [107]. This amendment is due to the ability of TiO_2 to facilitate germination of seeds and growth of seedlings. TiO_2 also helps to increase biomass, keep relative water content (RWC), and boost antioxidative enzymes in plants under drought stress [6]. Jute seeds treated with CaNP (hydroxyapatite nanoparticle) showed improved tolerance against drought stress via biosynthesis of proline and thus controlling the level of proline [118]. Although drought stress severely hampers the corn seedlings and decelerates its growth, whereas treatment with yttrium-doped Fe_2O_3 NPs improved photosynthetic machinery with increased chlorophyll, carotenoid content, and also ameliorated the negative impacts of drought on *B. napus* [69].

According to Sedghi et al. [119], ZnO in *G. max* improved seed germination percentage and dry weight, by utilizing seed reserves at faster rate due to the increased activity of gibberellins. Similarly, Fe_2O_3 enhanced tolerance against drought stress by modifying carbohydrate metabolism and stomatal movements. Studies conducted in maize proved that nano ZnO downregulate photosynthetic pigment degradation and thus enhance the rate of photosynthesis and stomatal movements. Starch and sucrose synthesis were also enhanced by manipulating key enzymes such as UDP glucose pyrophosphorylase, phosphoglucoisomerase, and cytoplasmic invertase leading to better performance under drought stress [57]. This makes ZnO a potential nano agent to mitigate the negative effects of drought stress. Van Nguyen et al. [103] reported that in maize, CuO NPs positively regulate pigment system and ROS scavenging mechanism to cope with drought stress. Application of the same NP at low concentration via roots and leaves has been found to improve crop performance by enhancing the performance of chlorophyll and photosynthetic enzymes such as RubisCO and thereby photosynthesis. It also helps in supplement uptake, fortifying stress resilience, and positively impacts on yield.

5.2. Salinity

Salt stress is the most noteworthy universal concern that influences crop growth and productivity. Unusual increase in sodium (Na^+) and chloride (Cl^-) generates cytotoxicity and imbalance in nutrition further coupled with oxidative stress due to ROS production followed by implementing a strategy of osmoregulation. During osmoregulation, the plant will accumulate the organic compounds such as amino acids, polyols, sugars, glycine betaine, and quaternary ammonium compounds which further results in decreased osmotic potential. Another key solution is ion homeostasis where the concentration of Na^+ is reduced and K^+ concentration will be increased in the cell to overcome the ROS affect and to start the activity of enzymatic machinery [120,121].

NPs help in mitigating such stresses by activating specific genes, accumulating osmolytes, and providing free nutrients and amino acids. In *Cucurbita pepo*, treatment with SiO_2 NPs improved the plant transpiration rate, water use efficiency (WUE), enzyme carbonic anhydrase activity, and defense response against salinity stress [122]. Correspondingly, TiO_2 (anatase) alters the photoreduction activity and hinders linolenic acid in the electron transport chain (ETC) [123]. A study carried out in *Abelmoschus esculentus* revealed that foliar application of ZnO improves photosynthetic functionality and enzymatic machinery to reduce negative impacts of salinity stress. It positively impacted on plant growth and resulted in enhanced photosynthesis by improving the efficiency of photosystem II. It also helps to maintain RWC thus decreasing membrane damage [124]. Similarly, combined

application of ZnO and Si as foliar spray in mango seedlings augmented the carbon assimilation and nutrient uptake further leading to improved growth conditions [125]. Various reports on SiO_2 application confirmed improved vegetative growth, increased epicuticular wax layer, accumulation of proline, and salt stress genes were up- or downregulated to mitigate salinity impact in different plants such as *Solanum lycopersicum*, strawberry, and *Ocimum basilicum* [126–128].

AgNPs is a well-known nanomaterial; it has been reported that AgNPs act as potential nano agents to mitigate salinity stress. AgNPS in *T. aestivum* increased the accumulation of POD, proline, and sugar, further followed by enhanced germination [129]. Similarly, treatment with CeO, CNTs, and graphene NPs improved the assimilation of photosynthetic carbon, increased the proteins and amino acids at reproductive stage, and thus imparted tolerance against salinity stress in cotton and *Catharanthus roseus* [80,130]. ZnO enhanced salt tolerance by lowering the contents of malondialdehyde (MDA) and Na^+ in lupine plants, and improved germination in cumin seeds. Application of n-ZnO diminished the negative effects of NaCl through enhancing photosynthetic system, proper osmoregulation, and bringing down the levels of MDA and Na^+ [19].

5.3. Extreme Temperature

Temperatures above maximum threshold level are called heat stress and below a minimum threshold level are known as cold stress. These stresses can create an imbalance of cell homeostasis and promote serious hindrance which may even lead to the death of the plants. Extreme temperature directly imparts a combination of heat, and as a consequence, oxidative stress leading to the excessive production of reactive species and further alterations in physiological and biochemical activity such as production of various osmolytes and heat shock proteins (HSPs) that can protect proteins and cell structures, and enhance antioxidant mechanism to restore the redox potential and homeostasis [131].

NPs such as selenium were found to be effective in combating high temperature stress. Djanaguiraman et al. [79] reported that application of selenium NPs in sorghum improved their antioxidant machinery to scavenge ROS produced as a result of heat, thus alleviating heat stress. Similar results of SeNPs were observed in *L. esculentum* that imparted tolerance against both high and low temperature stresses [108]. Photosynthetic apparatus of wheat plants was highly affected by heat, however, use of AgNPs imparted tolerance against heat stress and improved the morphological features such as root shoot length, root number, fresh and dry weight, leaf area, and number [132]. Furthermore, application of NPs such as ZnO regulated the antioxidative system and chilling response transcription factors under chilling stress in *Oryza sativa* L. [133].

5.4. Metal/Metalloid Toxicity

Application of NPs are arising as a competent technique in the field of phytoremediation due to the effective interaction of the NPs with plants' metabolism and metal ions. Phytoremediation is a sustainable technique for the removal of hazardous wastes from environment using potent plant candidates [134]. The NPs promoted growth of different plant species exposed to heavy metal toxicity by mitigating the oxidative stress elicited by heavy metals [111,135]. Application of 100 µM silicon dioxide improved the Cd, Cu, and Mn stress tolerance potential of *A. pygmaea* by augmenting biomass accumulation and increasing the activities of different biocatalysts in the plant [111]. Moreover, the silicon dioxide increased the absorption and accumulation of heavy metals in roots and thus prevented the translocation of the toxic compounds to the leaves [111]. NPs have the ability to immobilize the toxic metal ions and nanofibrous composite membranes using polyvinyl alcohol, and polyacrylonitrile have the metal chelation efficiency that aids in the removal of Cr and Cd [136]. This study also validated the metal chelation efficiency of NPs depends on the positive or negative charge it possesses on the surface [136]. The NPs have the potential to protect the membrane of the plant exposed to stress by preventing the membrane degradation through low MDA accumulation of NPs- treated plants exposed to metal stress [90].

In *Leucaena leucocephala*, ZnO NPs induced elevation of SOD, CAT, and APX activity that contributes to the reduction of MDA content under Cd and Pb stresses [90]. Addition of magnetic nano-Fe_3O_4 into the growing media of wheat seedlings contaminated with Pb, Zn, Cd, and Cu (10 mM) increased the activity of SOD and POD, and thus alleviated the MDA accumulation [135]. Fe NPs which upregulate the activity of antioxidant enzymes and glyoxalase through the accumulation of phytochelatins and glutathione simultaneously resulted in the boosting up of the tolerance to arsenic in rice [110]. Exposure to NPs recovered the mineral acquisition and thus maintained the biosynthesis of photosynthetic pigments in finger millet [137]. Parallel responses were observed in *G. hirsutum* when it was treated with ZnO NPs for tolerating Cd and Pb stresses [138]. The potential of ZnO NPs in the clearing of HM- contaminated media was established in a study performed in rice [109].

5.5. Flooding

The plants exposed to prolonged anaerobic condition as a result of flooding stress exhibit growth retardation and severe loss in crop productivity. Protein metabolism plays a significant role in the flooding stress tolerance of plants. Application of Ag NPs augmented the stress tolerance potential of soybean seedling by downregulation of protein mis-folding induced by flooding stress [112]. During flooding stress, augmentation of glyoxalase II 3, alcohol dehydrogenase 1, and pyruvate decarboxylase 2 genes was noticed, whereas upon the exposure of Ag NPs, the flood-induced metabolic changes were regulated and it reflected on the downregulation of all these enzymes [112]. Influence of Ag NPs in the production of the glyoxalase II 3 was one of the prominent outcomes of proteomics and this enzyme is considered as an indicator of cytotoxicity. When nicotinic acid and potassium nitrate (KNO_3) were incorporated with Ag NPs, it further boosts up the flood tolerance in plants [114]. Another metal NP of Al_2O_3 also showed significant contribution in flood stress tolerance of soybean [115]. Moreover, NPs aid to fasten the recovery kinetics of flooding stress; soybean exposed to aluminum oxide nanoparticles (Al_2O_3 NPs) has the potential to recovery by the involvement of S-adenosyl-l-methionine-dependent methyltransferases and enolase [139]. The findings from the study conducted by Mustafa and Komatsu [115] give clear indication on the influence of size of NPs in flood tolerance, rather than the quantity and types. Three different sizes of Al_2O_3 NPs triggered different metabolic responses in plants under flood. The catalytic activity of isocitrate dehydrogenase was increased with the application of 5 nm Al_2O_3 NPs, but 30–60 nm Al_2O_3 NPs induced ribosomal protein production under flood. Whereas by the high concentration, 135 nm Al_2O_3 NPs, improved permeability of the mitochondrial membrane [115]. The differential imprints of 2, 15, and 50–80 nm Ag NPs on the tolerance mechanisms of the soybean under flood stress was reported by Mustafa et al. [140]. Of the three sizes, 15 nm Ag NPs was more effective due to the increase in ribosomal proteins, and amino acid metabolism-related proteins with a reduction in protein synthesis-related proteins.

5.6. Other Abiotic Stresses

Apart from salinity, drought, temperature, and heavy metal stresses, other stresses such as high light, UV, and nutrient stresses can cause oxidative stress in plants, altering their growth and development. NPs such as TiO_2 play a significant role in mitigating light stress by catalyzing the redox reaction, which leads to the generation of superoxide and hydroxide radicals. UV imparts negative consequences on growth as it induces oxidative stress. Photosynthetic apparatus would be highly damaged leading to ROS production and change in leaf structure following exposure to UV-B whereas application of SiNPs enhanced the antioxidant machinery to regulate oxidative stress resulting from UV-B exposure [8]. Thus, NPs modulate abiotic stress-induced responses at different levels in plants, and may be considered as potential tools for abiotic stress management in crops.

6. Dose-Dependent Variability of the Nanoparticle Action

Entry of NPs into the plant cells occurs via roots and leaves, and cause differential morphological and physiological changes, which either become inhibitory or stimulatory, depending upon the NPs' properties, such as: chemical nature, size, reactivity, and the concentration of NPs. The inhibitory impacts of metallic NPs are apparent through its toxicity in plants. A number of research studies on plant–NPs interaction shows that NPs have both negative and positive effects, depending on the specific properties of NPs, their concentrations, reactivity, and plant species [141–145]. For instance, Lin and Xing [146] showed that seed supplemented with ZnO NPs at high concentration of 2000 mg L^{-1} negatively affected the germination of corn and ryegrass. Similarly, Ma et al. [147] observed the impacts of gadolinium (III) oxide (Gd_2O_3), cerium (IV) oxide (CeO_2), ytterbium oxide (Yb_2O_3), and lanthanum (III) oxide (La_2O_3) at high concentration on the growth of cabbage, lettuce, radish, rape, cucumber, tomato, and wheat, and propounded that CeO_2 inhibited the root elongation of lettuce at the concentration of 2000 mg L^{-1}, while La_2O_3, Gd_2O_3, and Yb_2O_3 at 2000 mg L^{-1} suppressed the root elongation of all these seven plant species. Likewise, seed treated with TiO_2 and aluminum oxide (Al_2O_3) affected seed germination, growth, and development of tobacco plants. A study of other researchers also showed the reduced growth of *C. annum* seedlings supplemented with 1 mg L^{-1} Ag NPs [148]. Inhibition of *Lemna minor* growth and the decreased activity of POX, CAT, and SOD activity were reported under CuO NPs (200 mg L^{-1}) [149]. Moreover, ZnO NPs significantly declined the biomass of rye seedlings as well as affected the root anatomy by shrinking root tip, epidermal, and cortex cell deformation [146].

Several studies have shown that NPs at concentrations below certain limits stimulates seed germination [150,151], and plant growth and development [152,153]. For developing the better understanding of NPs' influence on plant growth, further studies could be done based on the types and concentration of NPs.

Experimental findings of Suriyaprabha et al. [154] show that SiO_2 promoted seed sprouting of maize seedlings by increasing the nutrient uptake. A study related to TiO_2 NPs' impacts on soybean plant resulted in increased germination by enhancing the activity of nitrate reductase. Moreover, the NP-treated seed has the capability of increased water uptake, better water utilization, and increased nutrient uptake from the soil [155]. ZnO NPs at low concentration (10–20 μg mL^{-1}) reportedly enhanced the seed germination as well as stimulated the plant growth of soybean [119], onion [23], peanut [156], wheat [157], and in cluster bean, *Cyamopsis tetragonoloba* [158]. Furthermore, Kumar et al. [159] also stated that Au NP at 10 and 80 μg mL^{-1} increased the plant growth and yield as well as enhanced the number and leaf area along with chlorophyll and sugar content in *A. thaliana*. Reportedly, the addition of Ag NPs at 20–60 ppm stimulated the plant length of mustard, beans, and corn, and also increased carbohydrate, chlorophyll, and protein content in *B. juncea* [160,161]. In Table 3, we tried to show the positive and negative impacts of various nanoparticles on plants.

Table 3. Dose-dependent impacts of nanoparticles on different plant species.

Type of Nanoparticle	NPs Concentration	Target Plant Species	Nanoparticles Impact on Plants	References
		Positive impacts		
Copper NPs	69.4 μM	*Zea mays* L.	Increased leaf water content, biomass, anthocyanin, chlorophyll (Chl), and carotenoid contents. Controlled production of ROS and increased seed number, and yield.	[103]
Zinc-oxide NPs	50 and 100 ppm	*Solanum melongena* L.	Enhanced growth parameters, fruit yield, water productivity, and photosynthetic efficiency.	[162]

Table 3. *Cont.*

Type of Nanoparticle	NPs Concentration	Target Plant Species	Nanoparticles Impact on Plants	References
Titanium dioxide NPs	60 ppm	*Zea mays* L.	Increased growth regulating parameters, relative water content, potassium ion concentration, total phenolic content, proline content, and level of antioxidant enzymes.	[163]
Silicon NPs	300–1200 mg L^{-1}	*Triticum aestivum* L.	Enhanced growth parameters and chlorophyll content. Optimized level oxidative enzymes. Increased plant biomass and yield.	[164]
Iron (III) oxide NPs	10, 50 and 100 mg L^{-1}	*Sorghum bicolor* (L.) *Moench*	Improved and increased seed germination rate, seedling growth, photosystem II efficiency, Chl index, photosynthetic rate, and relative water content.	[165]
		Negative impacts		
Silver NPs	80 and 160 mg L^{-1}	*Pisum sativum* L.	Decreased seed germination and growth parameters. Deformation in root cells and caused increased chromosomal abnormalities.	[166]
Aluminum oxide NPs	50–1000 mg L^{-1}	*Glycine max*	Damaged root surface and root cap.Altered lignin monomer composition and cell-wall esterified hydroxycinnamic acids. Reduced phenylalanine ammonia-lyase activity in stems.	[167]
Zinc oxide NPs	300, 600, and 1000mg kg^{-1}	*Solanum lycopersicum* L.	Increased root uptake of zinc. Increased oxidative stress by overproducing H_2O_2 and reduced level of antioxidant enzymes (APX and SOD) also caused reduction in total phenols, flavonoids, β-carotene, and lycopene in fruits.	[168]
Ceria NPs	50, 100, and 200 mg kg^{-1}	*Phaseolus vulgaris*	Increased stomatal conductance. Decreased antioxidative defense. Induced lipid peroxidation in root and fresh weight.	[169]
Silica NPs	250 and 1000 mg L^{-1}	*Arabidopsis thaliana*	Reduced growth and development of seedlings. Caused chlorosis in leaves.	[170]

7. Priming with Nanoparticles: An Emerging Stress Elicitor

Seed priming is the most effective method for mitigation of stress tolerance and enhancement of crop production in plants [171]. Priming approaches are established to augment germination and seedling growth by changing seed vigor or physiological status of the seed [172,173]. In the recent few years, nanopriming method of seed priming with synthetic NPs gained significance in crop advancement owing to their small size and distinctive physicochemical properties of nanomaterials [174]. NPs, besides improving plant growth, also safeguard from various kinds of stresses. Heavy metals (HMs) are bound to the NPs' surface due to its great surface area and lesser size, therefore decreasing its accessibility [2]. NPs can simulate the antioxidant enzyme activity in nano-enzymes, which can scavenge from oxidative stress [175]. Photosynthesis is a key metabolic process in plants and a highly vulnerable approach, which alleviates oxidative and osmotic stress, and its usual working can be sustained. In photosynthesis apparatus, photosystem II, RubisCo, and ATP are the chief goals under stress conditions [176,177]. The SiO_2 NPs enhanced chlorophyll, transpiration rate, WUE, and carbonic anhydrase activity in *Cucurbita pepo* under salinity conditions [122]. Likewise, TiO_2 alters the photoreduction activity and prevents linolenic acid in the electron transport chain. It also reduces the oxygen evolution

rate of chloroplast [123]. Numerous stress responses are exhibited by plants like changes in molecular machineries, stress response gene expression, and generation of antioxidative enzymes, which helps to exhibit significant function in scavenging the plants in severe environmental conditions [178]. Plants guard themselves from osmotic stress by generating different organic osmolytes like polyols and trehalose, and diverse amino acids like glycine and proline. NPs provide sustenance to plants in mitigating this defense mechanism [179]. In stress situations, ROS are generated by cell organelles, and this is the sign of abiotic stress conditions. Plants are furnished with enzymatic apparatus to cope with oxidative stress levied by the environment [2].

Priming induces enhancement in amylases, lipases, and proteases enzyme activities that degrade macromolecules for growth and development of embryos. It also mitigates stress at the germination stage and eventually results in greater rates of seedling appearance and efficacious seedling formation [180]. These biological impacts provide assistance to farmers in that they decrease the time, fertilization, and expenditure of re-seeding. Nanopriming increases α-amylase activity in rice plants and ensuing greater soluble sugar concentration for supportive seedling growth. However, more ROS generation was found in germinating seeds of nanopriming treatment in contrast to control rice plants, indicating that both ROS and aquaporins exhibit significant function in increasing the seed germination [181,182]. Diverse approaches for nanopriming mediating seed germination were suggested, comprising formation of nanopores for augmented water uptake, restarting antioxidant systems, formation of hydroxyl radicals for cell wall relaxing, and nanocatalysts for rapid starch hydrolysis [181].

8. Biochemical Mechanism of Metal/Metalloid-Based Nanoparticles to Mitigate Abiotic Stresses

NPs are essential implements which act as nanofertilizers, pesticides, herbicides, etc., for the proper growth and development of plants under various environmental stresses, though the exact mechanisms in particular are still undiscovered [15]. It is believed that there are some biochemical mechanisms such as detoxification pathway, especially based on the activities of enzymatic antioxidants behind the mitigation process of stress-induced damage using NPs. The reactivity of NPs is dependent upon some essential factors like shape, size, composition, surface properties, stability, chemical properties, purity and production process, and most importantly, dose applied [183–186]. Additionally, the susceptibility of NPs to different environments are mainly due to the transformation of their configuration phase and oxidation process [187]. The core conformation of NPs may vary plant species to species and are dependent upon the changes of environments leading to alter their chemical and physical properties that eventually exert different responses [188]. Khan et al. [9] reported that metal/metalloid NPs can combat the adverse effects of abiotic stresses in crops. Generally, NPs' uptake take place via plasmodesmata, and the translocation of NPs occurs via apoplast and symplast [189]. They also demonstrated that application of NPs enhanced biomass levels, chlorophyll contents as well as photosynthetic processes, antioxidant machineries, synthesis of osmolytes, and carbohydrate contents in plant cells. Beside these, when NPs enter into the plant cells, it not only promotes N_2 levels and protein contents but also regulate the gene expression during both biotic and abiotic stresses [189,190]. According to Sharifi et al. [175], NPs can simulate the antioxidant defense system as nano-enzymes which restrict the production of ROS under stress environments. NP supplementation increased the activities of some enzymatic antioxidants viz., SOD, CAT, APX, POX, etc., and also boost up the levels of glutathione levels, proline levels, and the phytochelatin synthesis in plants [190]. Mahato et al. [191] also reported that NPs restrict the generation of oxidative stress by upregulating the antioxidant defense system under different stressed conditions viz., salt stress, temperature stress, drought stress, UV stress, etc. Thus, in this viewpoint, the enhancement of mentioned parameters due to NP supplementation are responsible for the increase in tolerability in plants under environmental stresses.

According to Liu and Lal [192] and Ranjan et al. [193], there are various kinds of NPs (viz., Mg NPs, TiO_2 NPs, ZnO NPs, Cu NPs as CuO, Ag NPs as $AgNO_3$, SiO_4, Mn NPs as $MnSO_4$, Ca NPs as $CaCO_3$, Mo NPs, phosphorous NPs as $[Ca_5(PO_4)_3OH]$, AlO_4 carbon nanotubes, Fe_2O_3 NPs, and chitosan complex of Cu or Zn) have been used in field conditions for proper growth and yield of agricultural crops. At first, NPs choose lateral root synapse to enter into the plant rhizosphere and outreach towards xylem via cortex and then pericycle [194]. However, their association with plants takes place on the basis of some biochemical activities which may activate not only the transport of ions into the cell but also reacts with -SH and -COOH groups, and modifies protein levels in the plant cells [195]. Additionally, NPs are able to form a network with the transporters present in the membrane of plant root cells to fetch inside the plants [196,197]. Thus, the transport of NPs into the cytoplasm occurs from roots to shoots, stem, leaves via cuticle, and ultimately in the grain but the main entrance is xylem [198,199]. Upon entry into the cell cytoplasm NPs form complexes with diverse cell organelles and consistently begin the metabolic pathways required for growth and yield of the plants [200]. In Figure 3, we have illustrated the effect of nanoparticles on abiotic stresses schematically, also, Table 4 lists the biochemical activities of some of the most common metal/metalloid-based NPs to combat the effects of abiotic stress.

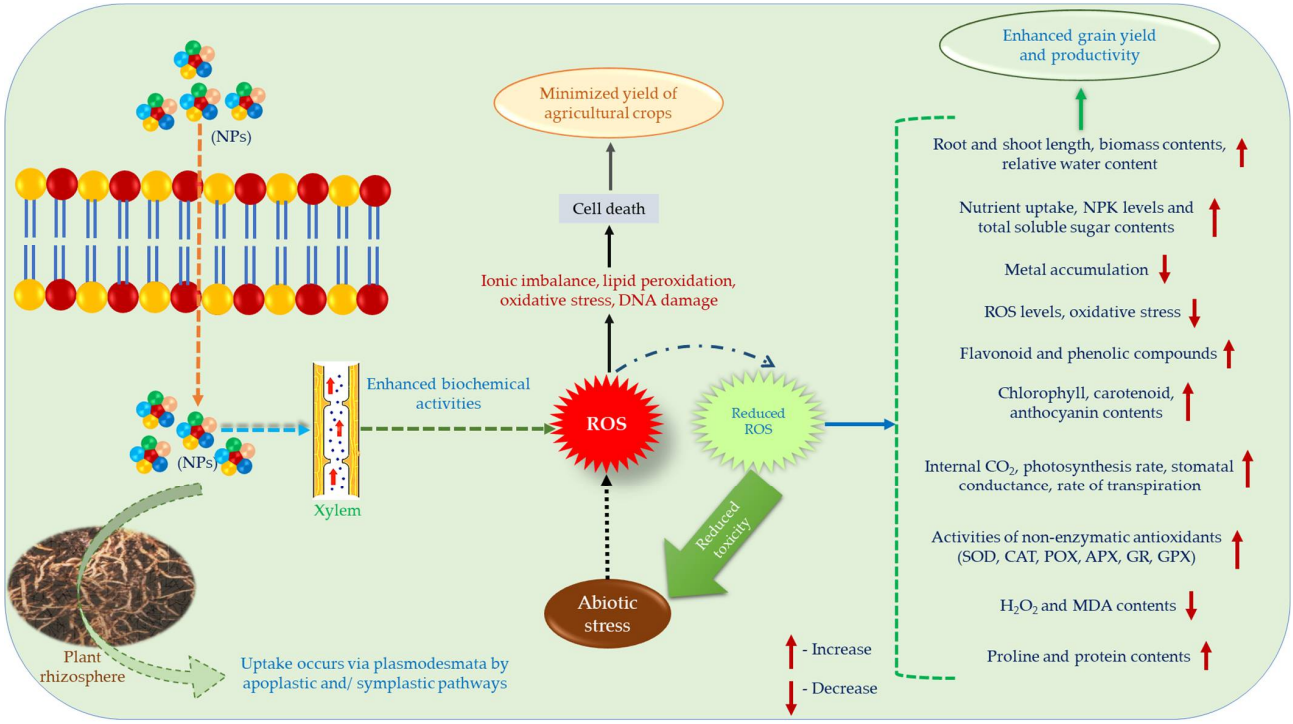

Figure 3. Schematic representation of uptake and impact of NPs during abiotic stress.

Table 4. Biochemical activities of some metal/metalloid-based NPs to combat abiotic stress effects.

Nanoparticles (NPs)	Abiotic Stresses	Impact on Plants to Mitigate Stress/to Enhance Tolerability	Plant Species	References
Si NPs (SiO_2)	Mercury	Enhanced growth, chlorophyll levels, and decreased Hg accumulation in both roots and shoots	*Glycine max* L.	[201]
	Drought and salinity	Increased leaves' growth and chlorophyll levels maintained an equilibrium between Na^+ and K^+ ions, promoted photosynthesis process	*Musa acuminata*	[202]
	Salinity	Increased growth, relative water content (RWC), proline contents, chlorophyll contents	*Fragaria* sp.	[127]

Table 4. *Cont.*

Nanoparticles (NPs)	Abiotic Stresses	Impact on Plants to Mitigate Stress/to Enhance Tolerability	Plant Species	References
	Salinity	Regulation of salt toxicity-associated genes, elevated seed germination efficiency, root growth and weight	*Solanum lycopersicum* L.	[126]
	Drought	Increased biomass contents, photosynthetic pigment levels, and upregulated photosynthesis process by improving rate of net photosynthesis and conductance of stomata	*Crataegus* sp.	[117]
	Chromium [Cr(VI)]	Enhanced growth, nutrient uptake, and antioxidant enzymes' activities reduced Cr(VI) accumulation	*Pisum sativum* L.	[50]
	Salinity	Increased RWC, crop yield, and the activities of enzymatic antioxidants	*Vicia faba* L.	[203,204]
	Cold	Inhibited seed dormancy, increased seed germination, and weight of seedlings	*Agropyron elongatum* L.	[205]
	Salinity	Enhanced growth parameters, proline levels, and pigment contents	*Ocimum basilicum*	[206]
	Salinity	Inhibited seed dormancy, increased seed germination, and fresh weight	*Lens culinaris* Medik.	[207]
	Salinity	Increased the rate of seed germination, growth; alleviated the levels of H_2O_2, MDA, electrolyte leakage; improved pigment contents and antioxidant defense system	*Cucurbita pepo* L.	[122]
	Salinity	Increased fresh weight, RWC, chlorophyll contents, and rate of photosynthesis	*Solanum lycopersicum* L.	[208]
	Salinity	Increased root growth, weight, seed germination	*Lycopersicum esculentum*	[209]
Ti NPs (TiO_2)	Salinity	Enhanced germination, growth parameters of seedlings, fresh weight and dry weight, RWC, K^+ ion, proline and total phenolic contents; also upregulated the activities of antioxidant enzymes and alleviated Na^+ ion, MDA levels, and electrolyte leakage	*Zea mays* L.	[163]
	Drought	Elevated the dry weight of seedlings, RWC, chlorophyll, and carotenoid contents; also promoted transpiration rate and stomatal conductance	*Triticum aestivum*	[6]
	Arsenic (As)	Improved growth and biomass contents, reduced MDA contents, and induced the regulation of antioxidant properties	*Vigna radiata* L.	[210]
	Salinity	Positive impact on agronomically important attributes by inducing antioxidant properties	*Dracocephalum moldavica*	[211]
	Drought	Enhanced chlorophyll and carotenoid levels, reduced the accumulation of H_2O_2 and MDA	*Linum usitatissimum*	[212]
	Cadmium (Cd)	Inhibited the toxic effects of Cd, enhanced RWC, growth parameters, chlorophyll contents, rate of net photosynthesis; restricted lipid peroxidation and proline levels	*Glycine max* L.	[213]
	Cold	Upregulated the activities of RubisCo and phosphoenolpyruvate carboxylase, downregulated H_2O_2 content	*Cicer arietinum* L.	[214]
	Drought	Modulated toxic effects, improved biomass accumulation, and RWC	*Ocimum basilicum* L.	[215]
	Drought	Increased growth and starch contents	*Triticum aestivum* L.	[107]
	Cold	Reduced electrolyte leakage index and MDA contents	*Cicer arietinum* L.	[216]

Table 4. *Cont.*

Nanoparticles (NPs)	Abiotic Stresses	Impact on Plants to Mitigate Stress/to Enhance Tolerability	Plant Species	References
Ag NPs	Salinity	Enhanced germination rate and no. of germinated seeds, downregulated the levels of oxidative stress, and induced the activities of antioxidant enzymes viz., APX, GR, GPX	*Triticum aestivum* L. cv. Pusa Kiran.	[217]
	Heat	Induced growth, area, and numbers of leaves	*Triticum aestivum* L.	[132]
	Salinity	Promoted growth and enhanced the synthesis of NAA, IBA contents, alleviated ABA level	*Triticum aestivum* L.	[102]
	Salinity	Increased seed germination rate, fresh weight, and dry weight	*Trigonella foenum-graecum*	[218]
	Salinity	Enhanced proline and carbohydrate levels	*Triticum aestivum* L.	[129]
	Cold	Upregulated the genes responsible for the activities of antioxidants	*Arabidopsis. thaliana*	[219]
	Flooding	Upregulated protein levels, growth parameters, and downregulated the production of toxic products in the process of glycolysis	*Glycine max*	[220]
	Dark	Enhanced pigments levels, activities of enzymatic antioxidants, reduced MDA level	*Pelargonium zonale*	[221,222]
	Post-harvest	Enhanced fresh weight and decreased bacterial colony formation in stem	*Chrysanthemum morifolium* L.	[223]
ZnO	Drought	Enhanced growth, RWC, and nutrient uptake	*Solanum melongena* L.	[162]
	Drought and cadmium (Cd)	Enhanced growth, chlorophyll contents, and SOD and POX activities	*Triticum aestivum* L.	[224]
	Salinity	Enhanced growth of both roots and shoots, biomass contents, chlorophyll contents, protein levels, photosynthetic parameters, and then, activities of CAT, SOD and POX	*Lycopersicon esculentum*	[225]
	Salinity	Upregulated protein and proline levels, enhanced the activities of antioxidants, reduced H_2O_2 and MDA levels	*Trigonella foenum-graecum*	[226]
	Arsenic (As)	Promoted growth and phytochelatin contents, decreased As uptake in the seedlings	*Oryza sativa* L.	[227]
	Salinity	Enhanced pigment contents, the activities of CAT and SOD; alleviated the levels of total soluble sugar and proline	*Abelmoschus esculentus* L.	[124]
	Arsenic (As)	Enhanced growth, reduced As uptake, increased photosynthetic activities, induced the activities of antioxidant enzymes	*Glycine max*	[228]
	Drought	Enhanced yield of grains and Zn accumulation	*Triticum aestivum* L.	[229]
	Salinity	Increased proline contents, total sugars, and the activities of CAT, SOD, and POX	*Mangifera indica* L.	[125]
	Drought	Enhanced antioxidant defense system and the synthesis of melatonin	*Zea mays* L. cv. Jidan 27	[57]
	Cadmium (Cd)	Enhanced growth, biomass contents, pigment contents, photosynthetic attributes, and the activities of antioxidant enzymes; alleviated Cd accumulation in shoots and roots	*Zea mays* L.	[230]
	Cadmium (Cd)	Enhanced growth, reduced Cd uptake and electrolyte leakage, induced the activities of POX and SOD	*Triticum aestivum* L.	[231]
	Cadmium (Cd) and lead (Pb)	Enhanced growth, pigment contents, protein levels, and antioxidant enzyme activities; reduced lipid peroxidation	*Lycopersicon leucocephala*	[232]
	Salinity	Enhanced growth, Zn levels, chlorophyll levels, rate of CO_2 assimilation; reduced Na^+ contents	*Helianthus annuus* L.	[233]
	Drought	Enhanced germination rate and reduced dry weight	*Glycine max*	[119]

Table 4. *Cont.*

Nanoparticles (NPs)	Abiotic Stresses	Impact on Plants to Mitigate Stress/to Enhance Tolerability	Plant Species	References
Cu NPs	Drought	Enhanced biomass levels and productivity of grains, elevated chlorophyll, carotenoid and anthocyanin contents; reduced oxidative stress by upregulating antioxidant defense system	*Zea mays* L.	[103]
	Cadmium (Cd)	Enhanced growth and weight, decreased Cd accumulation, elevated ion contents and antioxidative properties	*Triticum aestivum* L.	[234]
	Chromium (Cr)	Enhanced growth and biomass contents, reduced Cr uptake, increased nutrient uptake and antioxidative properties	*Triticum aestivum* L.	[235]
Fe NPs	Drought and cadmium (Cd)	Enhanced growth parameters, photosynthetic activities, uptake of Fe; decreased Cd accumulation	*Triticum aestivum* L.	[236]
	Drought	Promoted H^+-ATPase activity, maintained opening and closing of stomata; elevated biomass, pigment contents and internal CO_2	*Arabidopsis thaliana*	[237]
	Chromium (Cr)	Restricted the conversion of Cr (VI) to Cr (III) and Cr (VI) accumulation	*Brassica juncea*	[238]
Fe_2O_3	Salinity	Decreased MDA and proline contents, subdued antioxidant properties	*Mentha piperita* L.	[99]
	Drought and cadmium (Cd)	Enhanced growth, biomass contents, nutrient uptake; upregulated antioxidant enzymes, photosynthetic attributes; reduced uptake and translocation of Cd	*Oryza sativa* L.	[239]
	Salinity and cadmium (Cd)	Promoted growth, plant weight, biomass and NPK contents; deceased Cd accumulation; elevated pigment contents and antioxidant enzyme activities	*Triticum aestivum* L.	[240]
	Drought	Enhanced growth and chlorophyll levels, decreased H_2O_2 and MDA levels	*Brassica napus*	[69]
Fe_3O_3	Salinity	Induced the production of flavonoid, phenolic compounds, and anthocyanin; enhanced the activities of APX, GR, CAT, and GPX	*Dracocephalum moldavica* L.	[241]
Fe_3O_4	Salinity	Promoted growth, pigment contents, RWC, total soluble sugar; enhanced membrane stability	*Fragaria x ananassa* Duch.	[104]
	Cadmium (Cd), lead (Pb), copper (Cu) and zinc (Zn)	Restricted the toxic effects of heavy metals, enhanced the activities of SOD and POX	*Triticum aestivum* L.	[135]
$FeSO_4$	Salinity	Enhanced weight, pigment levels, photosynthetic attributes viz., net photosynthesis, stomatal conductance, assimilation of CO_2, Fe concentration; decreased Na levels	*Helianthus annuus* L.	[242]
Al_2O_3	Flooding	Enhanced growth and induced biochemical activities	*Glycine max* L. *cv. Enrei*	[115]
	Flooding	Enhanced growth of hypocotyl, promoted protein levels in mitochondrial membrane, and glycolysis process	*Glycine max* L.	[112]
CeO	Salinity	Maintained ionic equilibrium, enhanced root growth, reduced the generation of ROS	*Gossypium hirsutum L.*	[80]
	Light, dark chilling and temperature	Enhanced internal CO_2, quantum yield of PS-II, RuBisCo activity, and reduced ROS levels	*Arabidopsis thaliana*	[78]

Table 4. *Cont.*

Nanoparticles (NPs)	Abiotic Stresses	Impact on Plants to Mitigate Stress/to Enhance Tolerability	Plant Species	References
CeO_2	UV-B	Absorbed UV radiation and alleviated oxidative stress levels	*Chlorella vulgaris*	[243]
Chitosan NPs	Drought	Enhanced crop productivity, biomass contents, RWC, chlorophyll contents; promoted the rate of photosynthesis, and induced the activities of SOD and CAT	*Triticum aestivum* L.	[244]
	Drought	Enhanced RWC, weight and protein in grains, proline levels, and induced the activities of SOD and CAT	*Hordeum vulgare* L.	[245]

9. Limitations of Using Nanoparticles for Crop Production

Though the supplementation with NPs caused positive impact on agricultural crops to mitigate various kinds of environmental stresses, all NPs cannot possess proper defense as it varies from species to species differentially [246]. There are several reports based on the NPs' phytotoxicity that induced the synthesis of ROS and oxidative damage [198,247–251]. According to Gottschalk et al. [252] and Navarro et al. [253], the application of NPs in high dose caused toxicity whereas in low dose, NPs contributed a positive effect in combating abiotic stress-induced oxidative damage through antioxidant defense system [254,255]. NPs executed harmful effects by producing genotoxicity and oxidative stress in plants [146,247,256–259] that also affected the physicochemical metabolic pathways [94] by hampering the mineral uptake in agricultural crops [260]. The toxicity of NPs is dependent on not only the dose applied but also on the application process and its shape and size [251,261,262]. According to Manke et al. [263], the conformational alteration in shape and size of the NPs can lead to ROS production by affecting biochemical metabolism. They also demonstrated that the phytotoxicity of NPs is responsible for severe physiological deterioration by inducing inflammation, cell signaling, and genotoxicity. Ebbs et al. [251] reported that in plants, the toxicity levels of NPs regarding uptake, accumulation, and transportation also rely on the composition and surface area. Metal/metalloid-based NPs trigger Fenton reactions to generate free radicals that eventually produce ROS in plants [264]. There are some factors that are responsible for an imbalance of redox status of NPs, as a result, the antioxidant defense system would be downregulated and the generation of free radicals would be enhanced [265]. Priester et al. [266] stated that further investigation on the degree of NPs' toxicity is vital for NPs' supplementation in crops. Their uptake and accumulation should also be examined for better understanding. Therefore, keeping in mind these limitations, all the factors viz., size, shape, composition, surface area, application procedures, redox state, applied dose etc., should be investigated properly before application of NPs in agricultural fields to avoid ecotoxicological risks for both plants and humans.

10. Conclusions

Crop production globally has undergone several challenges in terms of climate and stresses. To overcome such challenges, nanotechnology has come up as a key component for sustainable development. Nanomaterials have the properties to nullify the harmful effects of abiotic stresses in plants by activating the antioxidant defense system of plants. Due to their property of being able to penetrate in plants and large surface area, they have more effective adsorption and targeted delivery, can be responsible in regulating photosynthetic efficiency and water uptake, and detoxifying reactive oxygen species, thereby enhancing seed germination, growth, and yield of crops. By careful analysis of dosage to be used for different nanomaterials, they can be sustainably utilized in the agriculture for better productivity. However, there is still a need for the risk assessment and fate of nanomaterials in plants and soil as well as their interaction with the ecosystem.

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Review

Diverse Physiological Roles of Flavonoids in Plant Environmental Stress Responses and Tolerance

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Abstract: Flavonoids are characterized as the low molecular weight polyphenolic compounds universally distributed in *planta*. They are a chemically varied group of secondary metabolites with a broad range of biological activity. The increasing amount of evidence has demonstrated the various physiological functions of flavonoids in stress response. In this paper, we provide a brief introduction to flavonoids' biochemistry and biosynthesis. Then, we review the recent findings on the alternation of flavonoid content under different stress conditions to come up with an overall picture of the mechanism of involvement of flavonoids in plants' response to various abiotic stresses. The participation of flavonoids in antioxidant systems, flavonoid-mediated response to different abiotic stresses, the involvement of flavonoids in stress signaling networks, and the physiological response of plants under stress conditions are discussed in this review. Moreover, molecular and genetic approaches to tailoring flavonoid biosynthesis and regulation under abiotic stress are addressed in this review.

Keywords: environmental stress; phenolics; photosynthesis apparatus; reactive oxygen species; secondary metabolites

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1. Introduction

Abiotic stresses affect different aspects of plants' physiological, biochemical, and molecular status. Nevertheless, through evolution, plants evolved various strategies to overcome stressful conditions by altering their physiological and metabolic pathways. Recent progress in metabolomics enabled the studying of the regulatory roles of metabolites in plants under abiotic stress conditions. It has been well-documented that metabolites play versatile roles in plants' response to abiotic stresses [1]. Among secondary metabolites, flavonoids are known as "specialized metabolites". They are low molecular weight polyphenolic compounds that play crucial biological functions in plants and animals [2,3]. More than 6500 flavonoids have been discovered [4]. The US Department of Agriculture has identified several dietary flavonoid subgroups that significantly benefit human health, including anthocyanin, flavonols, flavanones, proanthocyanidins, (iso) flavones, and flavan-3-ols [2]. Most flavonoid compounds prevail in nature as glycosides, and they are soluble in water for the occurrence of sugar and hydroxyl groups in their structure; they are also lipophilic for the presence of isopentyl and methyl groups [5]. Flavonoids are synthesized

in specific sites of plant cells, and they control different physiological activities, such as the germination of spores and seeds, the development of aroma and color of flowers, seedlings growth, and also attracting the pollinators toward flower pollen for its dispersion [6,7].

These secondary metabolites participate in defense processes by initiating some biological activities to protect plants when exposed to diverse environmental stresses [8,9]. The accumulation of flavonoids in plants in response to various abiotic stresses, including temperature, heat, freezing, light, UV, nitrogen deficiency, phosphate deficiency, and drought, have been evidenced [10,11]. Flavonoids also play protective roles, including detoxification, allelopathic and antimicrobial effects, phytoalexins, signaling molecules, and signaling UV-filter [12]. Having antioxidant properties, flavonoids can scavenge reactive oxygen species (ROS) under biotic and abiotic stresses [13]. Flavonoids restrict the metabolic activities of enzymes in ROS-generation pathways, thereby stimulating the antioxidant defense system. It is worth mentioning that the diversity in the structure of flavonoids enables them to interact with an immense variety of biomolecules simultaneously [14]. Moreover, several groups of enzymes (isomerases, reductases, and hydroxylases), and Fe^{2+}/2-oxoglutarate-dependent dioxygenases act differently in flavonoid biosynthesis, which modifies the fundamental pathway of flavonoid biosynthesis and leads to a different flavonoid subclass [15]. This flexibility at the biosynthesis and functional level makes flavonoids a versatile molecule that can regulate the activities of various enzymes, cell cycles, DNA and protein functions, and lipid peroxidation [14]. However, the biological functions of flavonoids and their role under various environmental stimuli are yet to be unraveled. In the present review, we briefly review the chemistry and biosynthesis of flavonoids in plants to have an insight into their biochemical properties and the mechanism of action in the plant cell. The antioxidative properties of flavonoids and the evidence of the involvement of flavonoids in plants under different abiotic stresses are also discussed. In addition, the underlying mechanisms of the functional roles of flavonoids in shaping a response to different abiotic stresses and their role as signaling molecules in abiotic stress response pathways are probed. Finally, the recent progress in molecular and genetic approaches to tailoring flavonoid regulation under abiotic stresses is discussed. This review provides an overview of the mechanism of plant stress response from the metabolic perspective and enables the assessment of flavonoids as a promising stress marker.

2. Chemistry and Biosynthesis of Flavonoids

Flavonoids are the largest group of naturally produced substances, of which more than 9000 phenolic products are detected in *planta* [16]. Flavonoids comprise some primary chemical conformations with three rings of phenols, two of which are joined with the central phenolic ring. The two rings of phenols are associated with 6-carbons independently, and the central ring is associated with the 3-carbons [17]. Various kinds of chemical compounds, as well as derivatives, are synthesized from flavonoids with discrete interchange in their basic chemical constitution. The precursor of flavonoids is flavones, originating in the cell sap of immature plant tissues [18]. Generally, flavonoids are synthesized in the cytosol of the plant cell through different pathways. The synthesis of major classes of flavonoids, including anthocyanins, isoflavonoids, and proanthocyanidins, occur along the general phenylpropanoid and polyketide pathways, transforming phenylalanine into 4-coumaroyl-CoA through cytosolic multienzyme complex (flavonoid metabolon) that is loosely attached to the cytoplasm of the endoplasmic reticulum [19]. The expressions of flavonoid biosynthetic genes such as chalcone synthase (CHS), flavanol synthase (FLS), flavonoid 3′-hydroxylase (F3′H), flavanone 3-hydroxylase (F3-H), and chalcone isomerase (CHI) are mediated by some flavanol regulators, including MYB11/PFG2, MYB12/PFG1, and MYB111/PFG3 [20,21].

In plants, flavonoid accumulation depends upon the modulation of the expression of genes related to the flavonoid biosynthetic pathway [22–24]. The phenylpropanoid pathway gives p-coumaroyl-CoA. This pathway starts from the aromatic amino acids phenylalanine and tyrosine, produced by the shikimate pathway (Figure 1). The flavylium ion is known

as the core of the flavonoids' biosynthesis pathways, the upstream of which is three molecules of malonyl-CoA and one molecule of 4-coumaroyl-CoA [25]. Furthermore, CHS and CHI enzymes are involved in the two-step condensation, which yields in naringenin (flavanone) [26].

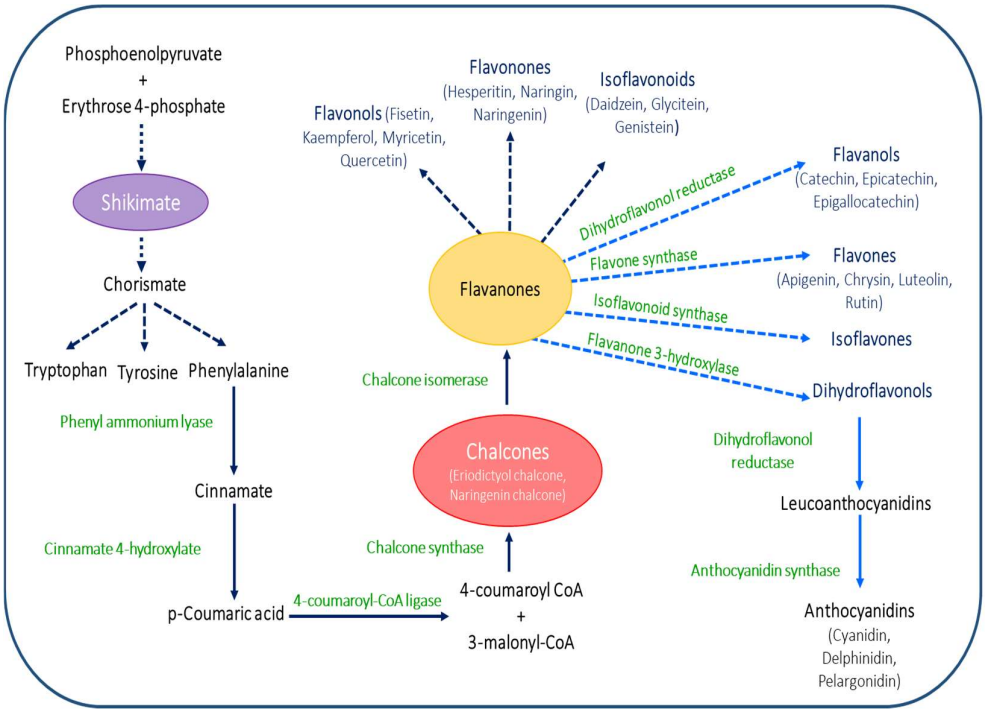

Figure 1. Biochemistry of flavonoids with their various subgroups: Phosphoenolpyruvate and erythrose-4-phosphate are converted to chorismate via the shikimate pathway in seven metabolic stages. Chorismate is the common precursor of three aromatic amino acids viz., tryptophan, tyrosine, and phenylalanine. The enzyme phenyl ammonium lyase (PAL) induces the synthesis of cinnamic acid from phenylalanine, and cinnamate is converted to p-Coumaric acid by the activity of cinnamate 4-hydroxylate. Another enzyme 4-coumaroyl CoA ligase converts p-Coumaric acid into 4-coumaroyl CoA and 3-malonyl CoA, which are responsible for synthesizing chalcones by chalcone synthase activity. Eriodictyol chalcone and naringenin chalcone are the two classes of chalcones. The flavanones are synthesized from chalcones by the activity of chalcone isomerase. There are different subgroups of flavonoids, shown in this diagrammatic representation. Fisetin, kaempferol, myricetin, and quercetin are the types of flavonols. Hesperitin, naringin, and naringenin are the types of flavanones. Some types of isoflavonoids are daidzein, glycitein, and genistein. Flavanols are produced from flavanones by dihydroflavonol reductase activity, and some examples of flavanols are catechin, epicatechin, and epigallocatechin. The enzyme flavone synthase is responsible for the production of flavones from flavanones. Apigenin, chrysin, luteolin, and rutin are some types of flavones. The two other flavonoid subgroups—isoflavones and dihydroflavonols—are synthesized by the activity of isoflavonoid synthase and flavanone 3-hydroxylase, respectively. Dihydroflavonol reductase converts dihydroflavonols into leucoanthocyanidins, which are converted into anthocyanidins by the anthocyanidin synthase enzyme. Cyanidin, delphinidin, and pelargonidin are some types of anthocyanidins.

The oxidation of naringenin by F3-H produces the dihydrokaempferol that could further be hydroxylated on the 3′ or 5′ end of the B-ring, by F3′H or flavonoid F3′5′H, producing dihydroquercetin (dihydroflavonols). F3′H or F3′5′H could directly hydroxylate naringenin to produce eriodictyol and pentahydroxy-flavanone (flavanone); they are further hydroxylated to dihydroquercetin and dihydromyricetin. The synthesized dihydroflavonols are further transformed into flavonols, flavan-3,4,-diols, and anthocyanidins by reactions catalyzed by FLS, DFR, and LDOX. The DFR changed dihydroquercetin, dihydrokaempferol, and dihy-

dromyricetin to leucocyanidin, leucopelargonidin, and leucodelphinidin (flavan-3,4,-diols); further catalyzation by LDOX causes their oxidation to cyanidin (red-magenta anthocyanidin), pelargonidin, and delphinidin (anthocyanidins) [27] Figure 2.

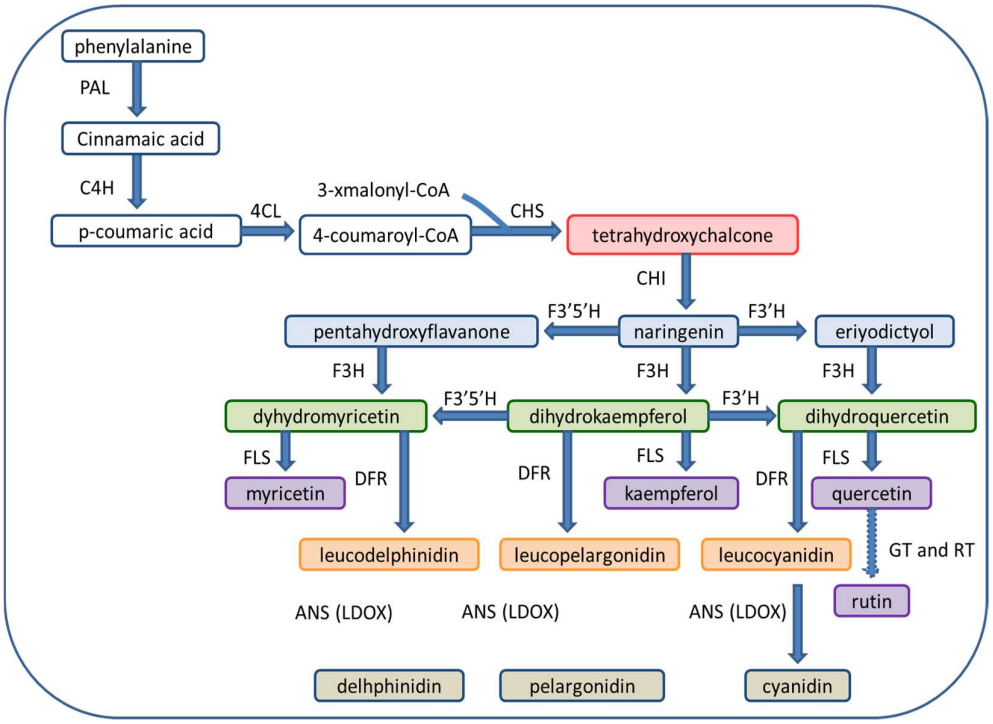

Figure 2. Basic pathway of flavonoid biosynthesis in plants. Abbreviations:—PAL, phenylalanine ammonia lyase; C4H, cinnamate 4-hydroxylase; 4CL, 4-Coumaroyl CoA ligase; CHS, chalcone synthase; CHI, chalcone isomerase; F3H, flavanone 3-hydroxylase; F3′H, flavonoid 30-hydroxylase; F3′5′H, Flavonoid 3050-hydroxylase; FLS, flavonol synthase; DFR, dihydroflavonol 4-reductase; ANS, anthocyanidin synthase; LDOX, leucoanthocyanidin dioxygenase; GT, glucosyltransferase; RT, rhamnosyltransferase.

The flavonoid-synthesizing enzymes have a loose attachment with the endoplasmic reticulum (ER). Other enzymes in flavonoid biosynthesis pathways are linked with the membranes of the vacuole, plastids, and nucleus [28]. Moreover, a supermolecular network via protein–protein association between flavonoid biosynthesizing enzymes with the ER membrane has been reported [12]; those flavonoid-synthesizing enzymes are classified in different enzymatic groups, including glycosyl transferases, cytochromes P450 (cyt P450), and 2-oxoglutarate dioxygenases (2-OGD) [29]. The important flavonoid subgroups found in plants are anthocyanins, chalcones, flavonols, flavanols, flavanonols, flavanones, flavones, and isoflavonoids [7] Figure 1. Depending upon the attachment of carbon rings, the flavonoids' subgroups were recognized, such as neoflavonoids or 4-benzopyrans, isoflavonoids or 3-benzopyrans, flavonoids or 2-phenylbenzopyrans, etc. [12].

Several studies noted the localization of FLS 1, CHS, and CHI in nuclei of *Arabidopsis* [30–32]. However, most of the flavonoids accumulated in the cytoplasm are then possibly moved into the vacuole via an autophagic mechanism [33] and grape-vesicle, concerning a GST and two multidrug and toxic compound extrusion-type transporters (anthoMATEs) [34,35]. This transformative nature and reactivity may underly flavonoids' versatility in abiotic stress response in plants.

3. Antioxidant Properties of Flavonoids

Flavonoids act as antioxidant in plants and provide protection against various environmental stresses (Figure 3; Table 1). A consequence of abiotic stresses is the production of harmful ROSs [36,37]. These are known as highly reactive superoxide anion radical ($O_2^{\bullet -}$),

singlet oxygen (O_2), hydrogen peroxide (H_2O_2), and hydroxyl radical (•OH). Among the highly reactive and dominant ROSs are H_2O_2 and $O_2^{\bullet -}$. These ROSs cause oxidative stress that occurs as a consequence of disturbance in maintaining homeostasis between ROS production and endogenous antioxidant defense mechanism [37]. During environmental stress, ROSs act as oxidants of the DNA, proteins, carbohydrate, and lipids and eventually cause damage to plant cells [38]. To cope with oxidative damage, plants produce antioxidant enzymes (e.g., SOD, CAT, ascorbate peroxidase (APX), glutathione peroxidase (GPX), glutathione reductase (GR), etc.). However, under extreme environmental stress conditions, the production of antioxidants in plants cannot keep pace with the magnitude of the oxidation, leading to increased ROS content in the cell [39]. Under such circumstances, the antioxidant properties of flavonoids help plants to counterbalance the excessive ROS production and repair the damage caused by them [40,41]. Flavonoids are a large class of secondary metabolites, and several pieces of evidence confirm the hypothesis of their antioxidant functions in higher plants under a range of environmental stresses [42,43]. With potent antioxidant properties, flavonoids help plants to cope with oxidative stresses by quenching free radicals, thereby protecting plants from cellular peroxidation [44]. The suppression of ROS generation by flavonoids occurs through the four following pathways: (i) restriction of singlet oxygen, (ii) inhibition of ROS-producing enzymes (cyclooxygenase, lipoxygenase, monooxygenase, and xanthine oxidase), (iii) chelation of transition metal ions, and (iv) recycling of other antioxidants [45,46].

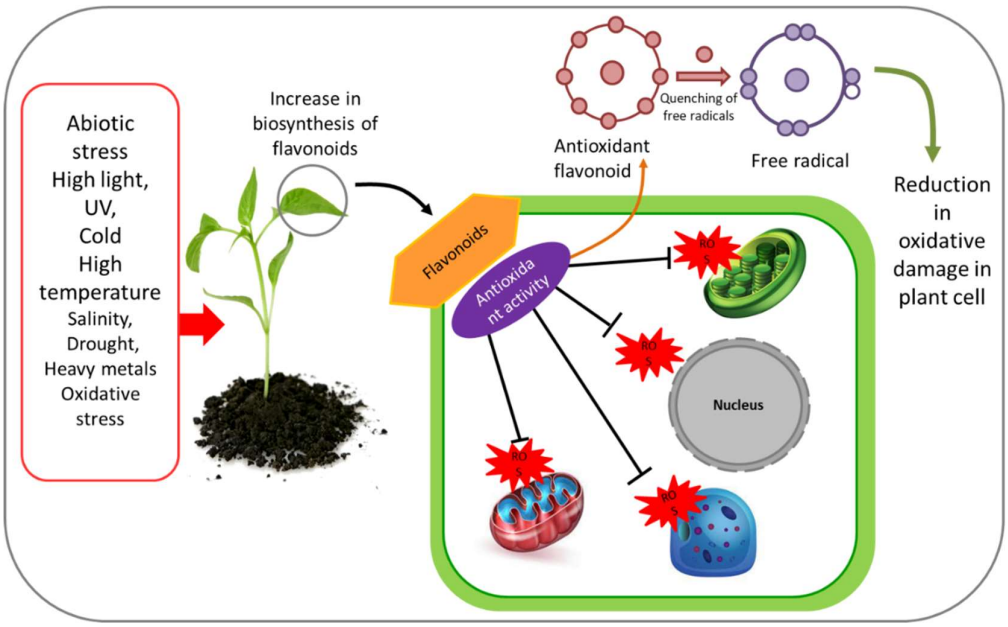

Figure 3. Antioxidant activities of flavonoids under abiotic stress. Following abiotic stress in plants, biosynthesis and accumulation of flavonoids takes part in reactive oxygen species (ROS) scavenging in different plant cell organelles and reduces oxidative damage in plant cells.

Flavonoids occur abundantly in different parts of plants, mostly in the vacuole and chloroplasts of the mesophyll cells, and are also found consistently in the subcellular sites to function as ROS-quenchers [47,48]. During stress, the presence of flavonoids in the vacuole helps detoxification of H_2O_2 molecules, which are generally released from the chloroplast [49]. Several studies have shown the antioxidant properties of flavonoids through different actions. The general modes of action of flavonoids against stresses are (i) quenching of free radical molecules, (ii) metal chelation, (iii) interfering with the enzymes related to free radical generation, and (iv) activation of plants' natural antioxidant enzymes [50]. Flavonoids are directly involved in scavenging ROS. Having chelating properties, flavonoids take part in the chelation of free radicals by donating a hydrogen atom or by single-electron transfer, as well as through the chelation of transition metal elements

to prevent free-radical formation [51]. Additionally, flavonoids function as an internal antioxidant enzyme by hindering free-radical triggering enzymes, for instance, xanthine oxidase, lipoxygenase, protein kinase C, cyclooxygenase, microsomal monooxygenase, mitochondrial succinoxidase, and NADPH oxidase [50,52].

Numerous abiotic stresses trigger highly hydroxylated flavonoids. Under such a state, the stronger scavenging function occurs by the activity of an extra free hydroxyl radical (–OH) on the C-30 position of the B-ring [42,53]. A study on soybean seedlings treated with lanthanum demonstrated flavonoid potential for scavenging O_2 and ·OH [54] by decreasing the MDA concentration and maintaining standard plasma membrane permeability. Quercetin 3-O- and luteolin 7-O-glycosides, having a catechol group (ortho-dihydroxy B-ring substitution) in the B-ring of the flavonoid skeleton, show considerable antioxidant activity in plant cells [53]. Moreover, quercetin derivatives protect chloroplast damage from the singlet oxygen induced by high light in *Phillyrea latifolia* leaves [48]. Similarly, kaempferol, a monohydroxy B-ring flavanol, also showed antioxidant properties under light irradiance [55]. It has been observed through studies that in most cases, quercetin derivatives are more efficient than monohydroxy B-ring, particularly during complex formation with ions of Cu and Fe. They are also found to be involved in inhibiting ROS production by the Fenton reaction [56] and suppressing generated ROS, as well as equipping plants with versatile compounds to cope with environmental stresses.

Table 1. Antioxidative role of flavonoids in plant response to abiotic stress.

Abiotic Stress	Plant Species	Antioxidant Response of Flavonoids	References
UV-B radiation	*Medicago sativa*	Increased content of flavonoid compound induces enhanced antioxidant capacity of the plant.	[57]
UV-B radiation	*Kalanchoe pinnata*	Increases total flavonoid and quercitrin content, which have antioxidant properties to protect the plant.	[58]
UV-B stress and drought	*Populus tremula* × *P. tremuloides*	Transgenic line of poplar with high proanthocyanidins content displayed lower hydrogen peroxide content.	[59]
Salinity	*Zea maize*	Improved plant performance under salt stress through antioxidant activities.	[60]
Salinity	*Arabidopsis thaliana*	CrUGT87A1, a UDP-sugar glycosyltransferases (UGTs) gene, improved salt tolerance by increasing antioxidant capacity resulting from the accumulation of flavonoids.	[61]
Salinity	*Amaranthus tricolor*	Increases flavonoid content, which showed the potent antioxidant activity in scavenging ROS.	[62]
Salinity	*Amaranthus lividus*	Increases flavonoid content and the antioxidant capacity of leaves, total flavonoid content scavenged ROS.	[63]
Water stress	*Chrysanthemum morifoilum*	Increases flavonoids (rutin, quercetin, apigenin, and luteolin) and enhanced antioxidant activity.	[64]
Drought	*Arabidopsis thaliana*	Increase in total flavonoid content followed by an increase in antioxidant activity.	[65]
Drought	*Cistus clusii*	prevented oxidative damage.	[66]
Drought	*Swingle citrumelo*	Proline accumulation was concomitant with an increase in antioxidant activity.	[67]
Temperature stress	*Solanum viarum Dunal*	Flavonoids inhibited ROS-mediated oxidative damage.	[68]
Heat and salinity	*Solanum Lycopersicon*	Lower antioxidative damage was observed following a high accumulation of flavonols.	[69]

Table 1. *Cont.*

Abiotic Stress	Plant Species	Antioxidant Response of Flavonoids	References
Cadmium stress	*Trigonella foenum-graecum*	H_2S-induced polyamines accumulation was concomitant with an increase in ROS-detoxification capacity.	[70]
Cadmium stress	*Solanum Lycopersicon*	Nitric oxide-induced increase in flavonols resulted in improved antioxidant capacity.	[71]
Lead stress	*Tritium aestivum*	Accumulation of proline was concomitant with a lower level of lipid peroxidation.	[72]

4. Flavonoids-Mediated Defenses against Abiotic Stress

To survive under abiotic stresses, plants adopt different strategies at molecular [73], metabolomic [74], physiological, and morphological levels. The common aftermath of abiotic stress is ROS production, accumulation, and signaling. Accordingly, the scavenging of ROSs is an inevitable part of shaping a response to abiotic stress. Flavonoids are secondary metabolites with antioxidant properties that play an efficient role in ROS scavenging and the prevention of ROS generation [41]. Besides antioxidant properties, different mechanisms and sites of action have been proposed for flavonoids in plants' stress tolerance (Figure 4; Tables 2 and 3). Flavonoids are mostly species-specific compounds [3,4], and their biosynthesis is dependent on the plant species, developmental stage, and the nature of the stresses [12,75]. Many studies have reported the alternation in the level of flavonoid contents under different stress conditions [76].

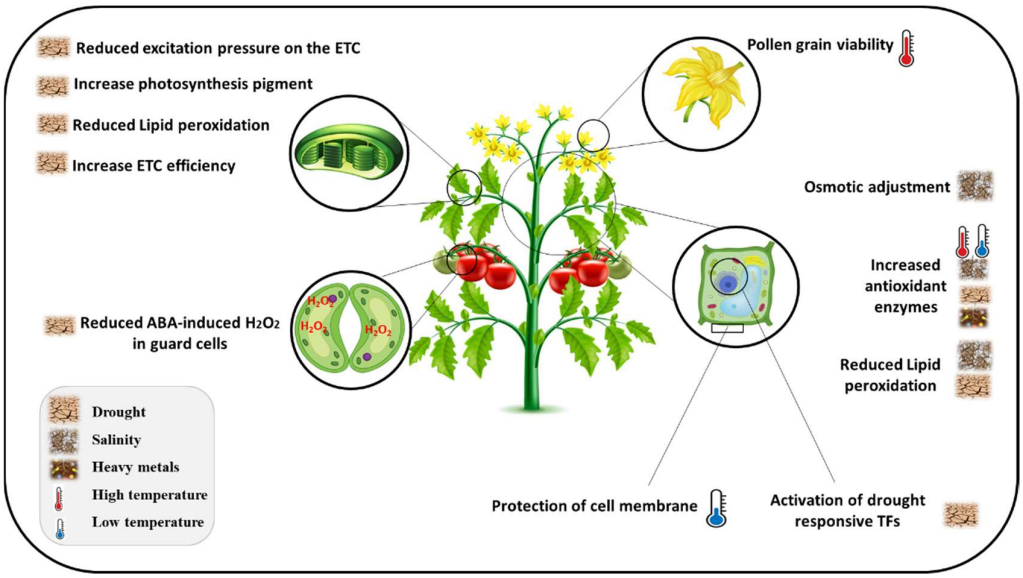

Figure 4. The role of flavonoids in abiotic stress response in plants. Modulation of excitation pressure, increase in photosynthesis pigments, reduced lipid peroxidation in the thylakoid membrane, enhancement of osmotic adjustment, reduction of ABA-induced ROS in guard cells, and activation of stress-responsive transcription factors under osmotic stress. Improving pollen grain viability under high temperature and protection of cell viability under cold temperature.

Table 2. Differential response of flavonoids under different abiotic stress.

Abiotic Stress	Concentration/Levels	Duration of Stress	Plant Species	Flavonoids Level under Stress	References
Salinity	50 and 100 mM NaCl	35 days	*Amaranthus lividus*	An increase was observed in total flavonoid content by 31%.	[77]
Salinity	200 mM NaCl	3 weeks	*Apocynum venetum* L.	The total flavonoid content and dihydroquercetin decreased by 20.46% to 23.08%, but an increase in flavonols (quercetin and kaempferol) by 1.6-fold and 2.2-fold was detected in comparison to control.	[78]
Drought	Stop watering	5 days	*Arabidopsis thaliana* L.	Quercetin 3-O-glucoside and cyanidin 3-O-glucoside exhibited approximately10-fold higher activity than kaempferol 3-O-glucoside, whereas a slight reduction in total flavonoid content was observed.	[79]
Drought	Osmotic potential of 0.49 MPa	48 h	*Triticum aestivum* L.	Significant increase in total flavonoid content was detected by 143% in cultivars aikang 58 compared with Chinese spring (115%).	[80]
Drought	Soil water content 25% (±2.5%)	At three-leaf seedling stage	*Zea mays* L.	Flavonol in guard cells was observed 1.7-fold higher compared to control.	[81]
Copper	200 mg L^{-1}	35 days	*Belamcanda chinensis*	Increased generation of 11 kinds of flavonoids.	[82]
Copper and Zinc	200–500 ppm	28 days	*(Lycopersicon esculentum Mill*	Accumulation of flavonoids increased (1.44, 0.93 mg QE/g DW) compared to the control (0.18, 0.13 mg QE/g DW) in roots and leaves, respectively.	[83]
UV-B and drought	40% drought-stressed	8 weeks	*Ligustrum vulgare* L.	Increases in the biosynthesis of quercetin-3-O-rutinoside, luteolin 7-O-glucoside, and echinacosid were observed.	[53]
Extreme temperature and high CO_2 levels	Light intensity 700 PAR and ambient CO_2 (400 µmol mol^{-1})	35–39 days	*Lactuca sativa* L.	Increased accumulation of quercetin-3-O-glucoside, quercetin-3-O-glucuronide, luteolin7-O-glucoside, cyanidin derivatives (61%), and cyanidin-3-O-glucoside (28%), while lower accumulations of kaempferol, myricetin, quercitrin (99–94%), and rutin were found under high light condition. Total flavonoid content increased by 7.5-fold in comparison to control.	[84]

Table 3. Functional role of flavonoids in plants' response to abiotic stresses.

Stress	Stress Level	Duration of Stress	Plant Species	Flavonoids Modulation	Function of Flavonoids	Reference
Drought	Drought (mild drought stress)	24 h	Tea (*Camellia sinensis*)	Accumulation phenylalanine ammonia-lyase (PAL), cinnamic acid 4-hydroxylase (C4H), 4-coumarateCoA ligase (4CL), chalcone synthase (CHS), and dihydrofavonol 4-reductase (DFR).	Increase in flavonoid content was concomitant with stress tolerance in plant.	[85]
Drought	15–25% of soil water-holding capacity	8 days	Tea (*C. sinensis*)	Accumulation of endogenous flavonoids, including: C4H, CHS, F3′5′H, F3H, kaempferol, quercetin, and myricetin triggered by fulvic acid.	Increase in flavonoid content took part in improved tolerance of plants against drought.	[86]
Drought	8% PEG 6000	7 days	Maize (*Zea mays*) Pigeon pea (*Cajanus cajan*)	Accumulation of endogenous flavonoids, including: genistein, genistin, and pterostilbene.	ABA and CcMYB114 improve drought tolerance by regulating the accumulation of flavonoids.	[81,87]
Drought	Stopped watering	3 weeks	*Arabidopsis* (*A. thaliana*)	Accumulation of endogenous flavonoids triggered by ectopic expression of Arabidopsis glycosyltransferase gene (UGT76E11).	Activation of stress-related transcription factors.	[88]

Table 3. *Cont.*

Stress	Stress Level	Duration of Stress	Plant Species	Flavonoids Modulation	Function of Flavonoids	Reference
Salt	300 mM NaCl	14 days	*Arabidopsis* (*A. thaliana*)	Accumulation of endogenous flavonoids including: chalcone, dihydrokaempferole, and quercetin.	Act in MYB111-regulated salt stress response.	[89]
Salt	100, 150, and 200 mM NaCl	19 days	Maize (*Z. mays*)	Exogenous application of α-tocopherol in combination with selenium (Na_2SeO_4 (0.5 mM) + a-tocopherol (200 ppm)).	Improved plant performance under salt stress through antioxidant defense.	[60]
Salt	150 mM NaCl	5 days	Tomato (*Solanum Lycopersicon* L.)	Exogenous application of vanillic acid (4-hydroxy-3-methoxy benzoic acid) (50 µM).	Increase in the activity of AsA-GSH cycle and glyoxalase system and a further increase in accumulation of osmolytes. Improved K^+ accumulation and restricted Na^+ accumulation. Increase in superoxide dismutase (SOD), catalase (CAT), and ascorbic acid (AsA).	[90]
Salt	100 mM NaCl	8 days	Bean (*Phaseolus vulgaris*)	Exogenous application of naringenin (0.1–0.4 mM).	Regulation of cellular redox, chloroplast antioxidant system, and photosynthesis.	[91]
Heavy metals	150 mg L^{-1} of Pb2 þ (which corresponds to 724 µM $Pb(NO_3)_2$)	Incubated for 2 h	Lupin	Incubation of seedlings with catechin before exposure to lead stress (5, 10, and 20 µg mL^{-1} of catechin equivalents).	Increased root growth and reduced accumulation of ROS, lipid peroxidation, and cell death.	[92]
Heavy metals	Wastewater	100 days	Lettuce and turnip	Accumulation of endogenous flavonoids, including putrescine and spermidine.	Counteract the oxidative stress.	[93]
High temperature	37 °C (day), 25 °C (night)	During growth period	Tomato (*Solanum Lycopersicon* L.)	Accumulation of endogenous flavonoids.	Reducing the abundance of ROS, enhancing fertility.	[94]
High temperature	Moderate (36 °C/24 °C day/night) or severe (42 °C/26 °C day/night)	During the growth period since the pod's color changed to an individual level	Soybean (*Glycine max*)	Accumulation of endogenous flavonoids, including tocopherols, flavonoids, phenylpropanoids, and ascorbate precursors.	Scavenging of heat-induced ROS damage during seed maturity.	[95]
Air pollutant	Sulfur dioxide (SO_2), NO_2, carbon monoxide (CO), hydrocarbons (HC), and airborne particulate material (APM)	During growth period	*Spartium junceum* L., *Lagerstroemia indica* L., *Th uja orientalis* L., and *Petunia hybrida* L. w	Accumulation of endogenous flavonoids.	Reduced ROS accumulation in pollen grain and improved development of pollen tube and germination.	[96]
Air pollutant	O_3 stress (300 nL L^{-1})	6 h	*Medicago truncatula*	Accumulation of endogenous phenolic compounds.	Phenols were oxidized red/purple pigments and resulted in the accumulation of antioxidant compounds.	[97]

4.1. Drought and Salinity

Drought is known as the most important physical stress of terrestrial ecosystems [98]. Therefore, different research has dealt with drought by studying either agricultural water saving and water reuse [99] or by considering plants' physiological adaption to the limited water supply [100]. Salinity occurs when the number of nutrient elements exceeds a species-specific threshold and threatens plant productivity [101].

Alternation in gene expression, metabolic modifications, osmotic adjustment [102], regulation of stomatal movement [103,104], and adjustment of growth and development are among drought-adaption strategies that are activated in plants to maintain the water balance [105–107].

A study on tea plants revealed that under drought stress, the expression of the genes related to flavonoid biosynthesis, including CHS, dihydrofavonol 4-reductase (DFR), Leucoanthocyanidin reductase (LAR), and leucoanthocyanidin dioxygenase (ANS), was decreased in the early stages of the drought but subsequently increased by continuous drought stress [108]. The significant upregulation of flavonoid biosynthesis genes (phenylalanine ammonia-lyase (PAL), cinnamic acid 4-hydroxylase (C4H), 4-coumarateCoA ligase (4CL), CHS, and Dihydrofavonol 4-reductase (DFR)) was demonstrated by another study on tea plant under drought condition [85]. The positive effect of fulvic acid in improving the drought resistance of tea was shown to be related to its role in activating flavonoid biosynthesis pathway genes [86]. Another piece of evidence of the involvement of flavonoids in drought stress response was reported in *Arabidopsis* by indicating that a highly drought-induced gene, CYTOCHROME P450, was involved in the upregulation of antioxidant flavonoids genes in *Arabidopsis* [65]. Coexpression of flavonoid biosynthesis genes and drought-induced genes, as well as upregulation of flavonoid biosynthesis genes under drought stress, accounts for the involvement of flavonoids in drought stress responses. The mechanism of flavonoid action under drought has been proposed by previous studies and portrays several interlinked pathways, including antioxidant properties, signaling components, osmotic adjustment, stomatal movement, and photosynthesis regulation.

In plants, the role of flavonoids in response to salt stress has also been proposed. A transgenic line of *Arabidopsis*, UGT76E11, that overaccumulates flavonoids exhibited a high antioxidant capacity, reduced ROS accumulation, and enhanced NaCl and mannitol stress resistance [88]. A genotype-dependent manner was detected in the accumulation of flavonoids upon short-term or long-term salt stress in two Cardoon genotypes. The genotype "Bianco Avorio" showed a constant increase in flavonoid content in response to both short- and long-term stresses, while in "Spagnolo", only long-term salt stress triggered flavonoids accumulation [109]. The *Arabidopsis* MYB transcription factor, *MYB111*, regulates salt stress responses, as a reduction in *MYB111* is significantly linked with reduced salt tolerance in *Arabidopsis*. An increase in flavonoid biosynthesis was associated with *MYB111* overexpression, suggesting that flavonoids act in *MYB111*-regulated response to salt stress tolerance. To test the hypothesis, the researchers examined the effect of exogenous bioflavonoids such as chalcone, dihydrokaempferole, and quercetin on salt-stressed *Arabidopsis* plants. They found that these isoflavones rescued the decreased salt tolerance in *MYB111* mutants [89]. Coexpression network analysis of salt-tolerant wild soybean revealed that the mechanism of class B heat shock factor, HSFB2b, in soybean response to salinity stress partially underlies its role in activating a subset of genes related to flavonoid biosynthesis [110]. This part explains the mechanism of flavonoid involvement in drought stress response in plants.

A primary consequence of drought stress is oxidative damage. Antioxidant systems take part in the amelioration of oxidative damage through the activation of enzymatic or nonenzymatic antioxidants that provide effective scavenging of ROS [111]. Flavonoids are among nonenzymatic antioxidants that improve plants' fitness to drought stress.

An increase in the antioxidative defensive mechanism as a result of selenium and a-tocopherol was the result of enhancement in the production of phenolics and flavonoid content in maize plants under salt stress, signifying the antioxidative role of flavonols in the salt stress response pathway [60]. Exogenous application of vanillic acid took part in osmolyte accumulation, regulation of ion uptake, and augmentation of superoxide dismutase (SOD), catalase (CAT), and ascorbic acid (AsA) under salt stress [90].

Another role of flavonoids is improving the plants' adaption to drought by regulating stomatal movements. It was revealed that flavanols hinder ABA-induced hydrogen peroxide (H_2O_2) accumulation in stomata guard cells of *Arabidopsis* [112]. It was also found that

the accumulation of flavonols in stomata guard cells was highly induced by drought, and the accumulation of flavonols was higher in a drought-overly-insensitive (doi57) mutant compared with the wild type, which was associated with a relatively lower accumulation of H_2O_2 in stomata guard cells of doi57 [81]. In a study on pigeon pea, the accumulation of flavonoids (genistein, genistin, and pterostilbene) was accompanied by the initiation of stomatal closure by ABA treatment under drought [87]. Gene coexpression networks in sea buckthorn revealed that ABA and flavonoid signaling crosstalk determines the levels of drought resistance among different subspecies [113]. Unraveling the metabolic signature of *Brassica napus* in response to ABA suggested a role for flavonols in stomatal movement under drought stress. Further examination showed that the exogenous application of 1 µM quercetin resulted in a slight increase in the stomatal aperture of *B. napus* [114].

A role as a signaling molecule for flavonols has also been suggested [88,115]. Increased transcription of stress-related genes in the UGT76E11 transgenic line of *Arabidopsis* was featured by flavonols overaccumulation, suggesting a role for flavonols as a signaling molecule that activates stress-related transcription factors [88]. A study on *Arabidopsis* indicated that ectopic expression of a grape Basic helix-loop-helix (bHLH) transcription factor gene, VvbHLH1, increased the accumulation of flavonoids. Authors suggested that overexpression of VvbHLH1 resulted in adaption to salt and drought stress by upregulation of genes involved in the ABA biosynthesis pathway, which further increases the generation of signaling molecules and the expression of stress-tolerance genes [116].

Flavonoid accumulation improved photosynthesis by decreasing lipid peroxidation and lowering excitation pressure and loss of energy through nonphotochemical quenching [117]. Therefore, flavonoids take part in drought stress responses at different levels, including signal transduction, regulation of gene expression, ROS scavenging, stomatal movements, and retention of photosynthetic system functionality, and eventually improve plants' performance under drought stress conditions. Microarray analysis indicated that upregulation of a gene encodes chalcone isomerase2 (OsCHI2) under drought and salt stress. The OsCHI2 is responsible for increasing the transcripts of structural genes related to the flavonoid's biosynthesis pathway. Rd29A::OsCHI2 transgenic rice plants exhibited prolonged photosynthesis activity under drought and salinity stress. An increase in relative water content, photosynthetic pigments, and proline with reduced relative electrolyte leakage and malondialdehyde content detected in plants were suggested as the mechanisms by which flavonoids take part in the regulation of photosynthesis activity under drought and salinity [118]. Another study proposed that the positive effect of mild NaCl treatment on net photosynthesis (P_n) and quantum yield efficiency of electron transfer (F_V/F_M) was the result of an increase in the total flavanols content of *Tetrastigma hemsleyanum* [119]. Alleviation of the effect of salinity on cellular redox, chloroplast antioxidant system, and photosynthetic activity is indicated by applying exogenous naringenin on bean plants (*Phaseolus vulgaris*) under salt stress [91]. A genotype-dependent response of photosynthesis to salt stress was detected in two Paulownia genotypes. Further investigation that displayed different capacities for the accumulation of flavonoids in *Paulownia tomentosa* × *fortune* (TF) compared with *Paulownia elongata* × *elongata* (EE) underlies the variation in their potential to respond to salt stress. The genotype with a higher capacity of flavonoid accumulation (TF) showed higher resilience of photosynthesis apparatus, indicated by higher F_V/F_M and higher QA^- reoxidation compared to EE [120].

Moreover, flavonoids improve plants' resistance to drought and salt stress by preventing oxidative processes, maintaining a fine-tuned oxidation/redox potential, osmotic regulation, and improving photosynthesis efficiency. Therefore, the accumulation of flavonols in plants under salt stress favors plants' resilience to drought and salt from both molecular and physiological aspects.

4.2. Toxic Metal/Metalloids

Flavonoids, as a versatile compound in abiotic stress alleviation, also take part in response to heavy metal stress. The concomitant increase in flavonoids with an increase

in the concentration of heavy metals in plant tissue suggested an antioxidative role for flavonoids in alleviating heavy metal stress in plants [121–123]. Moreover, the phytoremediation capacity of *N. biserrate* was concluded to be the result of a high accumulation of myricetin and kaempferol in its tissue when grown in heavy metal-contaminated soils [124]. Preincubation of lupin seedlings exposed to lead stress for 48 h with flavonoids attenuated the adverse effects of lead stress. Increased root growth, reduced accumulation of ROS, lipid peroxidation, and cell death were detected in flavonoid-incubated plants compared to control under lead toxicity. To answer the query related to the effect of flavonoids on the removal of excess lead due to its antioxidant properties, the capacity of root extracts to scavenge 1-diphenyl-2-picrylhydrazyl (DPPH) was investigated and confirmed the antioxidative role of flavonoids in lead stress-exposed plants [92]. Flavonoids enhanced the tolerance of *Avicennia marina* to Cd. However, flavonoids showed no influence on the uptake of Cd in root cell walls since the exposure of roots to ion transport inhibitor ($LaCl_3$) evidenced the facilitation of Cd transport in roots, indicating that flavonoids have a significant stimulative effect on symplastic transport of Cd in roots, and Ca-channel was not the unique means of symplastic transport for Cd absorption. Flavonoids facilitate symplastic transport when roots take up Cd but do not affect apoplastic transport [125]. According to the existing literature, the antioxidative role of flavonoids is the only mechanism of heavy metal stress alleviation in plants that has been taken into consideration thus far. Nevertheless, there are a limited number of reports on the metal-chelation properties of flavonoids. In a study on *Fagopyrum esculentum* by Moench, the role of salicylic acid in alleviating Cd stress was attributed to its effect on the enhancement of the metal-chelation properties. Heavy-metal chelation properties have also been assigned to plant-based natural flavanols in a study on the effect of lead poisoning in mice [126].

4.3. Extreme Temperature

Low temperature upregulates the expression of flavonoids' biosynthetic genes and increases the content of flavonoids in plant tissue in a species-dependent manner [127,128]. Flavonoids were also introduced as the potential biomarkers for cold stress in barley [129]. Reportedly, anthocyanin synthesis plays an essential role in cold stress tolerance in *B. rapa* since the expression of anthocyanidin synthase (BrANS) genes was sturdily related to cold-stress tolerance [130], whereas knock-out mutation of PRODUCTION OF ANTHOCYANIN PIGMENT 1 (PAP1) MYB transcription factor depicts impaired leaf-freezing tolerance in *Arabidopsis* [128].

The role of anthocyanin and other flavonoids in the tolerance of *Arabidopsis* to cold stress has been reported. Nevertheless, the precise causal relationship between flavonoids and cold stress tolerance was not proposed [131]. Other researchers have studied the tolerance of *Arabidopsis* against freezing to initiate the stress linked with apoplastic ice crystal formation at subzero temperatures. Their investigation indicated minor effects of flavonoids on primary metabolism. They also refuted the possibility of involvement of flavonoids in the modification of phytohormones' balance or stabilization of proteins as a possible function of flavonoids in chilling stress. This was because plant growth, development, and primary metabolism were unaltered in all flavonoid biosynthesis mutants used in their study. Instead, they approved a previously proposed role for flavonoids in freezing tolerance because flavonoids take part in the protection of cell membranes and proteins against cold stress since flavonoids-mediated partition and stability of plants' membranes have been evidenced [132]. They also proposed that the redundancy of flavonoid structures allows the deficiency of flavanols or anthocyanins to be compensated by other flavonoid compound classes [133]. A close association between cold stress tolerance and expression of dihydroflavonol 4-reductase (DFR) genes is known to be another essential function in the flavonoid biosynthetic pathway. This association proposed that the BrDFR gene is a useful resource for molecular breeding of freezing stress-resistant Brassica crops [134].

In addition, a role for flavonoids as an osmoticum has been proposed in a study on apple leaves exposed to cold temperatures. Although the role of anthocyanin in the osmotic

adjustment of apple leaves has been proved by their study, due to metabolic costliness relative to other osmolytes and low concentrations, it is unlikely that they solely take part in osmoregulation [135]. Moreover, in a study on *Liriope spicata*, it was revealed that genes and metabolites involved in the flavonoid pathway had a synergist role in osmoregulation under freezing stress [136].

Interactions between light and cold stress have been depicted by several studies [137]. A study on the interactive pathway of blue light signaling with cold stress response depicted the dependency of anthocyanin biosynthesis on the expression of cold-stress-responsive genes affected by blue light signaling [137,138]. The role of light intensity and spectra on flavonoids, particularly anthocyanin, has recently attracted attention and was briefly discussed in the section on light stress.

The comparison between pepper plants (*Capsicum annuum* L.) incubated by *Penicillium resedanum* with nonincubated plants showed that tolerance to high temperature was associated with the uplift in amino acid and the production of flavonoids in high quantities [139]. On the other hand, transcriptomic analysis of eggplants under high temperature displayed downregulation of genes in the anthocyanin biosynthetic pathway of eggplant [140]. The role of flavonoids in enhancing the fertility of tomatoes under high temperatures was investigated. Studying anthocyanin-reduced (*are*) tomato mutants demonstrated that flavanols ameliorated the adverse effects of high temperature by reducing the abundance of ROS [94]. The ROS scavenging role of flavonoids as the potential function of flavonoids in attenuation of heat stress was also reported in heat-stressed soybean seeds. The authors proposed that higher concentrations of flavonoids, ascorbate precursors, and tocopherols alleviated heat stress damage during seed maturity via scavenging heat-induced ROS damage [95]. In contrast, the reduction of flavonoids in response to high temperatures has also been reported, suggesting a negative role for flavonoids in plants' fitness to high temperatures [141,142]. However, combined heat and drought stress led to increased flavonols content in *Quercus ilex* L. [143].

In conclusion, an increase in flavonoid content can be considered a cold-tolerance strategy, while it is not the case under high-temperature stress since under high-temperature stress, flavonoid content in different plant organs may depict different patterns. ROSs' scavenging properties of flavonoids are introduced as the functional role of flavonoids for both cold and heat stress, and membrane protection properties are proposed as a cold-stress alleviation strategy. Overall, the crosstalk of flavonoids with the various temperature stress response pathways is yet to be studied.

4.4. Atmospheric Pollutants

As biomarkers of air pollutants, the fluorescence emission of selected chloroplast metabolites, including flavonoids, carotenoids, lipofuscins, and pheophytins, revealed that nitric oxide (NO_2) toxicity resulted in the modification of the fluorescence emission profile of carotenoids and flavonoids, suggesting a role for flavonoids in plants' resistance against air pollutant stress [144]. HPLC analysis of the pollen grain of three ornamental plants grown under polluted areas contained mainly sulfur dioxide (SO_2), NO_2, carbon monoxide (CO), hydrocarbons (HC), and airborne particulate material (APM) revealed that the flavonoids content in ethanolic aquatic extracts of pollen grain of studied plants was increased. The increase in flavonoids led to reduced ROS accumulation in pollen grain and further resulted in improved pollen tube development and germination and eventually enhanced the plants' fecundity [96]. Moreover, an antioxidative role is proposed for flavonoids in air pollutant stress scenarios. In this regard, it was noted that *Passiflora quadrangularis* L. plants grown in a hazy atmosphere synthesized more anthocyanin to cope with the oxidative stress caused by the hazy atmosphere [145]. In addition, an alternation in anthocyanin content has been noted in grape berry plants fumigated by SO_2, which was claimed to be the result of preventing its degradation rather than de novo synthesis [146]. Application of H_2S on *Brassica oleracea* L. resulted in an increase in anthocyanin content, which also accounts for the signaling role of H_2S in antioxidative pathways [147]. Furthermore, treating *Vitis vinifera* cell suspension by the donor of H_2S

(sodium hydrosulfide) also resulted in increased flavonols and total phenolic, sinigrin, and anthocyanins [148].

Transcriptome and metabolome analysis of Malus crab apple indicated that a key (O_3)-responsive transcription factor, McWRKY75, was positively correlated with a flavonoid-related structural gene. In addition, the exogenous application of methyl jasmonate decreased the negative impacts of O_3 stress by enhancing the flavonoid metabolic pathway [149]. Studying *Medicago truncatula* response to O_3 stress revealed that the potential for upregulation of flavonoid biosynthesis pathway and being benefited by flavonoids' antioxidant properties account for the resilience of ozone-insensitive accession against O_3 pollution [97]. Air pollutants intrude plant tissue through stomata and affect stomatal characteristics and apparatuses [150]. In cuticles and epicuticular waxes, flavonoids play the role of an antioxidant barrier to protect cellular components against air pollutants such as ozone (O_3) and sulfur dioxide (SO_2) [13].

Involvement in the signaling of stomatal movement and scavenging of ROS to block the transduction of signals that lead to stomatal malfunctioning is a well-defined role of flavonoids [112,115]. Given that, a possible role of flavonoids in ameliorating air pollutant stress can be their involvement in the signaling network of stomatal movement.

4.5. Light Stress

Light provides the fuel for photosynthesis, the process that a plant's life entirely depends on. Light quality, intensity, and duration affect plant growth, morphology, resource acquisition, and adaption to the environmental condition [151–154]. Nevertheless, excess levels of light impose detrimental effects and cause light stress on plants. Flavonoids have been demonstrated to play a positive role in the amelioration of light stress effects on plants. However, some studies cast doubt on the positive role of flavonoids in stress response because, in some cases, flavonoids had a negligible role against light stress. Studies on different plant species showed that high light intensity increases flavonoid accumulation [155,156]. Further, the accumulation of flavonoids in epidermal cells, apical meristem, and pollens take part in filtering the extreme sunlight, thus reducing the likelihood of the collision of the harmful spectra on the vulnerable cellular organism causing oxidative stress [157]. Nevertheless, a contrasting report on the modification of flavonoid content under light stress is further elaborated by comprehensive metabolomics studies.

A study on *Ginkgo biloba* leaves exposed to UV-B radiation depicted a significant increase in the accumulation of flavonols in leaves under long-term UV-B exposure [158]. Similar work on white asparagus (*Asparagus officinalis* L.) showed that accumulation of a specific flavanol, quercetin-4′-O-monoglucoside, increased following exposure to UV-B stress [159]. Moreover, the effect of high light stress on the anthocyanin content of rose has been investigated and showed a high level of dependency on the light spectra in such a way that monochromatic red and blue light decreased while full-spectrum white light increased anthocyanin content. Interestingly, plants grown under white light depicted a better tolerance to high light stress [160]. Similarly, another study depicted that UV-B stress has a negligible effect on anthocyanin and flavonol index in cucumber plants grown under different light spectra [161]. Nevertheless, a more comprehensive metabolomics study showed that the ratio of four flavonoid compounds, kaempferol, quercetin, flavonol disaccharide I, and flavanol disaccharide II, varied after exposure to UV-B stress, and this modulation in flavonoids content was highly dependent on growing light spectra [162]. These reports suggest a spectral-dependent manner for the role of flavonoids in the regulation of light stress response.

4.6. Other Stresses

An *A. thaliana* ROS1-dependent flavonoid accumulation in response to herbicide stress has been revealed through the transcriptomic analysis of the imazethapyr-treated wild-type and ROS1 plants [163]. In an attempt to grow and develop multiple-herbicide resistance (MHR) in grass weeds, Schwarz et al. [164] examined the binding affinity of flavonoids to a

phi class glutathione-S-transferase (AmGSTF1), which is a functional biomarker of MHR in black-grass (*Alopecurus myosuroides*). Using the ligand fishing experiment, they indicated that a variety of flavonoid structures are potent binders to AmGSTF1 [164].

It was indicated that stress caused by the flood could alter the accumulation pattern of flavonoids by influencing the expression of key enzymes involved in the flavonoid synthesis pathway and eventually resulting in an increase in the total flavonoid content of the *Chrysanthemum morifolium* [165]. The tolerance of *Pterocarya stenoptera*, a species widely distributed along rivers, to flooding stress was also attributed to increasing the synthesis of alpha-Linolenic acids and flavonoids in areal organs and activation of phytohormone biosynthesis and signaling pathways [166]. On the contrary, a study on soybean indicated that the genes related to the biosynthesis of phenylpropanoids, lignin, and flavonoids were downregulated under flooding stress and rendered plants' roots more susceptible to pathogens [167]. These findings may propose the organ-specific response of flavonoid accumulation in plants under flooding stress.

5. Flavonoids-Mediated Abiotic Stress Signaling

Exposure of plants to external stresses initiates the increased regulation of flavonoid biosynthetic responsible genes, thus increasing the flavonoid content. In the desert plant *Reaumuria soongorica*, a rapid increase in RsF3H (flavanone 3-hydroxylase) gene expression and hindered lipid peroxidation triggered by antioxidant flavonoids has been evidenced as a protective strategy against UV-B and drought stress [168]. Tolerance to UV radiation occurs following flavonoids accumulation since they act as a sunscreen that filters the UV radiation, thereby hindering the generation of ROSs. The activation of UV-B photoreceptor activates the transcriptional factors (TFs), which further activate the transcription of flavonoid biosynthetic genes [13,169]. Similarly, UV-B stress in different species led to a modification in the transcription of flavonoid biosynthetic genes, which further enhanced the ratio of dihydroxy to monohydroxy B-ring-substituted flavonoid glycosides [170,171]. Luteolin and quercetin are glycosides actively involved in chelating iron (Fe) and copper (Cu) ions [56]. For instance, Berli et al. [172] observed that in grape leaves, UV-B radiation triggered an increase in quercetin derivates as an antioxidant for plant protection. It was demonstrated that when *A. thaliana* is exposed to drought stress, increased accumulation of flavonoids resulted in plant tolerance through the overexpression of MYB12/PFG1 (PRODUCTION OF FLAVONOL GLYCOSIDES1) or MYB75/PAP1 (PRODUCTION OF ANTHOCYANIN PIG-MENT1), MYB12 and PAP1, transparent testa4 (tt4) as a flavonoid-deficient mutant, and flavonoid-deficient MYB12 or PAP1 (obtained by crossing tt4 and the individual MYB overexpressor in *A. thaliana*) [2] Figure 5. In addition, direct estimation of the antioxidant activity revealed that enhanced accumulation of anthocyanin with effective in vitro antioxidant activity directly alleviates ROS in vivo [2]. In salt-stressed transgenic tobacco, overexpression of a repressor of silencing from Arabidopsis (AtROS1) occurred, which consists of genes encoding enzymes of flavonoid biosynthetic and antioxidant pathways, the influence of AtROS1 increasing the demethylation levels of these genes encoding CHS, CHI, F3-H, FLS, dihydroflavonol 4-reductase, and anthocyanidin synthase of the flavonoid biosynthetic pathway, and antioxidant enzymatic pathway that confirms the flavonoids mediated tolerance to salt stress [173]. Ismail et al. [174] reported that flavonoid (rutin) level increased by 25-fold in quinoa leaves under salt stress, which improved tissue tolerance and decreased the negative impact of high salinity on leaf photochemistry by elevating the availability of potassium (K^+) and rate of (Na^+) pumping. In addition, the negative correlation between rutin-stimulated modifications in K^+ and H^+ fluxes proposed that the accretion of rutin in the cytosol takes part in scavenging the hydroxyl radicals, thereby preventing K^+ leakage through K^+ efflux pathways [174]. These findings suggest the potential role of flavonoids in alleviating the negative impacts of abiotic stress.

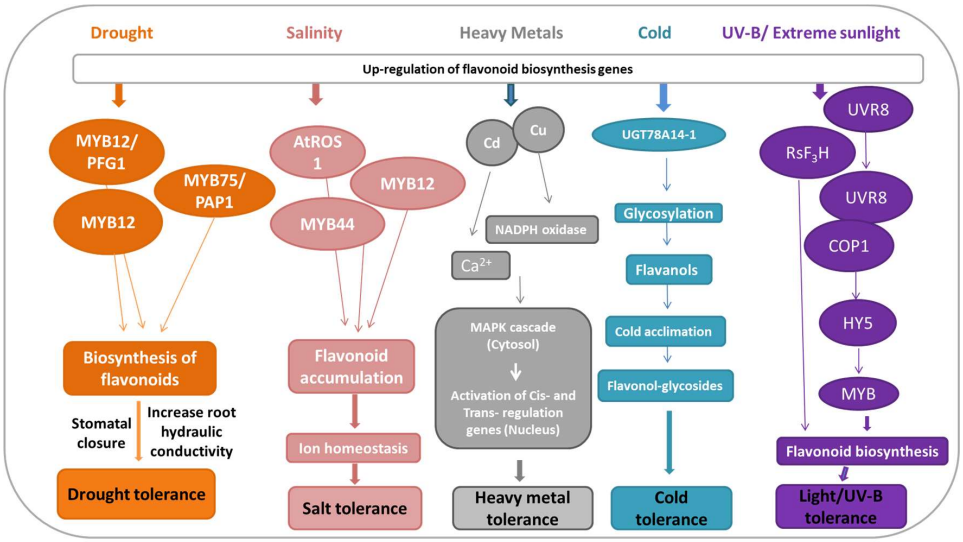

Figure 5. Actions of flavonoids under environmental stress conditions. Following abiotic stress, stress-specific transcription factors are activated and initiate the flavonoids biosynthesis pathway. Flavonoids improve plants' resilience against abiotic stress by improving root hydraulic conductivity and stomatal movement under drought stress, improving ion homeostasis under salt stress, activation of cis- and trans-regulation genes in the nucleus under heavy metal stress, and increasing flavanol glycosides under cold stress.

6. Molecular and Genetic Approaches in Tailoring Flavonoids Biosynthesis and Regulation under Abiotic Stress

Several researchers adapted molecular techniques to examine the role of flavonoids in triggering the adaptive responses to abiotic stresses (Table 4). Calcium-dependent protein kinases actively participate in calcium signaling and stimulate the production of flavonoids to participate against the plethora of environmental stresses. In this regard, higher expression of GuCPKs genes in *Glycyrrhiza uralensis* under treatments of NaCl (30 mM) and $CaCl_2$ (2.5 mM) has been reported. Induced expression of GuCPKs significantly improved the accumulation of flavonoid biosynthesis and glycyrrhizic acid under different salinity treatments [175]. Moreover, the study of Jan et al. [176] shows that transgenic plants with F3-H showed improved biosynthesis of quercetin and kaempferol in rice under salinity (150 mM) and heat stress (28–30 °C, light 16/8 h). They noted that heat and salinity stress increased oxidative damage, which was mitigated by the accumulation of flavonoid content. In addition, the overexpression of the AtMYB12 gene increased the accumulation of flavonoids by upregulating the genes involved in flavonoid biosynthesis in transgenic *Arabidopsis* under drought (25% PEG6000 for 2 weeks) and salinity (300 mM once every 2 days for 4 weeks) stresses [177]. Similarly, VvMyBF1 gene, cloned from grapevine, enhanced the accumulation of flavonoids in transgenic *Arabidopsis* for confronting drought (25% PEG6000 for 2 weeks) and salt stress (200 mM NaCl for 2 weeks) [178]. The transgenic plants showed higher activities of SOD, POD, pyrroline-5-carboxylate synthase, dihydroflavonol reductase, FLS, CHI, and PAL, as well as a significant reduction of MDA and H_2O_2 content. Overexpression of the GmMyB12 transcription factor increased the downstream flavonoids by improving the expression of flavonoid biosynthesis-related genes in *Arabidopsis* [179]. Its overexpression also increased the pyrroline-5-carboxylate synthase, SOD, and POD genes under salinity (200 mM NaCl, 2 weeks) and drought stress (25% PEG6000, 2 weeks). According to Wang et al. [180], a basic helix-loop-helix (bHLH) transcription factor gene antirrhinum (AmDEL) increased flavonoids accumulation under drought (25% PEG6000 for 2 weeks) and salinity (300 mM 2 days for 4 weeks) stresses via upregulating flavonoids biosynthesis genes in *Arabidopsis*. Moreover, the enzymatic analysis and Western blotting showed the higher activities of pyrrline-5-carboxylate synthase, dihydroflavonol reductase, CHI, and phenylalanine ammonia lyase (PAL) in transgenic plants as compared to wild

plants against stressful conditions. Overexpression of SIbHLH22 in tomatoes showed small leaves, short height, and higher accumulation of flavonoids under drought (100 mM mannitol) and salt (200 mM NaCl) stresses [181]. Transgenic plants showed enhanced vigor by improving the ROS scavenging system. In another study, Jayaraman et al. [118] isolated gene encoding for chalcone isomerase 2 (OsCHI2) from drought-tolerant upland rice variety "Nagina22" and transduced it in drought-sensitive rice cv. Pusa Sugandh 2. by using inducible promotor AtRd29A. Stable chromosomal integration of transgenes showed abundant structural genes of flavonoid biosynthesis, which thereby resulted in higher production of flavonoids in mutant rice plants against abiotic stresses including heat (40 °C for 3 days), cold (2 °C; 16 h light/8 h dark for 12 days), salinity (150 mM NaCl for 7 days), and drought (withholding water 7 days at 9 to 10 leave stage) stresses. Their findings suggested that induction of OsCHI2 genes modulates flavonoid metabolism and enhanced abiotic stress tolerance, other than heat stress. In another case, the AeCHS gene isolated from *Abelmosschus esculentus* also increased flavonoid biosynthesis under treatments of osmotic (300 mM mannitol for a week) and salt (200 mM NaCl for a week) stresses in *Arabidopsis* plants [182]. Similarly, overexpression of the CHS gene in *Arabidopsis* improved high light stress by increasing the synthesis of anthocyanins that enhances the plant's adaption to light when transferred from 100 µmol m^{-2} s^{-1} to 200 µmol m^{-2} s^{-1} [183].

Table 4. Molecular and genetic approaches in tailoring flavonoids biosynthesis and regulation under abiotic stress.

Genes, Transcript	Method	Plant Species	Stress	Results	Reference
GuCPKs	Induced expression of *GuCPKs* gene	*Glycyrrhiza uralensis*	NaCl (30 mM) and $CaCl_2$ (2.5 mM)	Improved the accumulation of flavonoids biosynthesis and glycyrrhizic acid.	[175]
flavanol 3-hydroxylase.	Induced expression of *flavanol 3-hydroxylase* gene	Rice	Salinity (150 mM) and heat stress (28–30 °C, light 16/8 h)	Improved biosynthesis of quercetin and kaempferol. Increased oxidative damage, which was mitigated with the accumulation of flavonoids content.	[176]
AtMYB12	Overexpression of *AtMYB12*	*Arabidopsis*	Drought (25% PEG6000 for 2 weeks) and salinity stress (300 mM once every 2 days for 4 weeks)	Increased the flavonoids agglomeration by the upregulation of genes actively involved in flavonoid biosynthesis	[177]
VvMyBF1	*VvMyBF1* gene cloned from grapevine induced into Arabidopsis	*Arabidopsis*	Drought (25% PEG6000 for 2 weeks) and salt stress (200 mM NaCl for 2 weeks)	Increased the accumulation of flavonoids. Higher activities of SOD, POD, pyrroline-5-carboxylate synthase, dihydroflavonol reductase, FLS, CHI, and PAL, as well as a significant reduction of MDA and H_2O_2 content.	[178]
GmMyB12	Overexpression of *GmMyB12*	*Arabidopsis*	Salinity (200 mM NaCl, 2 weeks) and drought stress (25% PEG6000, 2 weeks)	Increased the downstream flavonoids by improving the expression of flavonoid biosynthesis-related genes. Increased the *pyrroline-5-carboxylate synthase, SOD, and POD.*	[179]
Basic helix-loop-helix (*bHLH*)	Transcription factor gene of (*bHLH*) *antirrhinum* (*AmDEL*) induced in Arabidopsis	Arabidopsis	Drought (25% PEG6000 for 2 weeks) and salinity stress (300 mM 2 days for 4 week)	Higher activities of pyrrline-5-carboxylate synthase, dihydroflavonol reductase, chalcone isomerase, and phenylalanine ammonia lyase (PAL) in transgenic plants. Upregulated flavonoids biosynthesis genes.	[180]
SIbHLH22	Overexpression of *SIbHLH22*	Tomato	Drought (100 mM mannitol) and slat stress (200 mM NaCl)	Transgenic plants showed enhanced vigor by improving ROS scavenging system. Showed small leaves, short height, and higher accumulation of flavonoids.	[181]

Table 4. *Cont.*

Genes, Transcript	Method	Plant Species	Stress	Results	Reference
Chalcone isomerase 2 (*OsCHI2*)	Induction of *OsCHI2*	Rice	Heat (40 °C for 3 days), cold stress (2 °C; 16 h light/8 h dark for 12 days), salinity stresses (150 mM NaCl for 7 days), and drought stress (withholding water 7 days at 9 to 10 leave stage).	Abundant structural genes of flavonoid biosynthesis and modulation of flavonoid metabolism.	[118]
AeCHS o in *Arabidopsis* plants	*AeCHS* gene isolated from *Abelmosschus esculentus* and induced in *Arabidopsis*.	*Arabidopsis*	Osmotic (300 mM mannitol for a week) and salt stress (200 mM NaCl for a week)	Increased flavonoid biosynthesis and abiotic stress tolerance.	[182]
CHS gene by	Overexpression of *CHS* gene in *Arabidopsis*	*Arabidopsis*	High light stress (200 µmol m^{-2} s^{-1})	Increased the synthesis of anthocyanins that enhance the adaptability of plants against light stress.	[183]
EkFLS gene	Overexpressed the *EkFLS* gene in *Arabidopsis*; isolated from *Euphorbia kansui* Liou	*Arabidopsis*	Drought stress (20% PEG600) and salinity stress (200 mM NaCl)	Increased flavonoids biosynthesis and gave a theoretical base for improving the phytoextracts of medicinal plants and their resistance against multiple stresses simultaneously.	[184]
GSA1 gene	Overexpression of *GSA1* in rice	Rice	Salinity stress (150 mM for 7 days), drought stress (16% PEG8000 for 2 to 3 weeks), and heat stress (42 °C for dozens of hours)	Redirected the metabolic flux from lignin synthesis toward flavonoids synthesis. Accumulated more glycosides and flavonoids.	[185]
glycosyltransferase gene (*UGT76E11*)	Overexpression of *UGT76E1*	*Arabidopsis*	H_2O_2 (0.4 mM), drought (200 mM mannitol), and salinity (100 mM NaCl for 10 days) stress	Showed substantially enhanced tolerance through producing of higher glucosylate quercetin by modulating flavonoid biosynthesis pathway.	[88]
RtLDOX/ RtLDOX2	Expressed leucoanthocyanidin dioxygenase genes (*RtLDOX/RtLDOX2*) of *Reaumuria trigyna* in *Arabidopsis*	*Arabidopsis*	Drought (150 mM and 300 mM mannitol for 15 days), salinity (75 mM and 100 mM NaCl for 10 days), and ultraviolet-B-stress (30 min per day for 7 days)	Overexpression of *RtLDOX2* showed a higher accumulation of flavonols and anthocyanin and converted dihydrokaempferol to kaempferol, scavenging ROS.	[186]
UDP-sugar glycosyltransferase gene (*CrUGT87A1*)	*CrUGT87A1* cloned form *Carex rigescens* in Arabidopsis	*Arabidopsis*	Salt stress (100 mM and 125 mM NaCl for 7 days)	Higher accumulation of antioxidants and flavonoids.	[61]
R2R3-MYB (*SbMYB2* and *SbMYB7*)	Overexpression of R2*R3-MYB* form *Scutellaria baicalensis* in tobacco	Tobacco	Salt stress (150 mM NaCl), drought (0.2 M mannitol), and ABA (100 µ M) for 3, 6, and 9 days, respectively	Higher fresh weight, lower flavonoid synthesis gene and antioxidants, and higher phenylpropanoid accumulation.	[187]
PA1-type *MYB* transcription factor (*MdMYBPA1*)	*MdbHLH33* directly binds to the cis element of the *MdMYBPA1* responsive to low temperature	Apple (*Malus x domestica*)	Low temperature (14 °C)	Responded to flavonoid biosynthesis by synthesizing anthocyanin from proanthocyanin.	[188]
Ethylene insensitive 2 (*EIN2*)	Overexpression of *EIN2*	Rice	Cd stress (10 µM for 10 days)	Increased flavonoid and phenolics biosynthesis.	[189]
Core apple autophagy-related gene (*MdATG8i*)	Overexpression of *MdATG8i*	Apple	Drought (withholding water for 6 days)	Higher photosynthesis, amino acids, flavonoids, and antioxidant activities, lower ROS and oxidized and insoluble proteins, higher roots hydraulic conductivity, and improved water uptake.	[190]
AvFLS	*Apocynum venetum* gene overexpression in *AvFLS* induced in tobacco	Tobacco	Salinity stress (200 mM for 72 h)	Increased flavonoids synthesis, absorbed more K^+, maintained Na^+/K^+ homeostasis, and increased K^+/Na^+ ratio.	[191]
SbMYB8	Overexpression of R2*R3-MYB* form *Scutellaria baicalensis* in tobacco	Tobacco	Salt stress (150 mM NaCl), drought (0.2 M mannitol), and ABA (100 µM) for 3, 6, and 9 days, respectively	Higher flavonoid biosynthesis and antioxidants, and improved tolerance against stress.	[192]

Flavonol synthetase (FLS) is among the essential enzymes that participate in flavonoid biosynthesis. Wang et al. [184] overexpressed the *EkFLS* gene in *Arabidopsis*, isolated from *Euphorbia kansui* Liou under drought stress (20% PEG600) and salinity (200 mM NaCl)

stresses. Their results revealed that *EkFLS* overexpression was strongly correlated with higher flavonoid biosynthesis and offer the theoretical basis for further improving the phytoextracts of medicinal plants and their resistance against multiple stresses simultaneously. Dong et al. [185] characterized *GSA1* (a quantitative trait locus regulating grain-size of rice) that encodes a UDP-glucosyltransferase and exhibits glucosyltransferase activity toward monolignols and flavonoids. They noted that *GSA1* redirects the metabolic flux from lignin synthesis toward flavonoid synthesis under abiotic stresses and accumulates more glycosides and flavonoids in rice for abiotic stress tolerance. Moreover, the *GAS1* overexpression resulted in larger grain size and played a key role in metabolic flux direction against multiple stresses, including salinity (150 mM for 7 days), drought (16% PEG8000 for 2 to 3 weeks), and heat (42 °C for dozens of h) stresses. Their findings suggested that *GSA1* catalyzes the glucosylation of flavonoids and monolignols to modulate the metabolic flux by altering the phenylpropanoid pathway and flavonoid glycoside profile in response to abiotic stress conditions. In another case, Li et al. [88] cloned the *Arabidopsis glycosyltransferase gene* (*UGT76E11*), and overexpressing plants showed substantially enhanced tolerance against H_2O_2 (0.4 mM), drought (200 mM mannitol), and salinity (100 mM NaCl for 10 days) stresses through producing higher glucosylate quercetin by modulating the flavonoid biosynthesis pathway as compared to wild plants. In another study, Li et al. [187] recognized two differentially expressed leucoanthocyanidin dioxygenase genes (*RtLDOX/RtLDOX2*) rapidly upregulated in *Reaumuria trigyna* under drought and salinity stress, consistent with stress-related cis-elements located in the promoter region. Transgenic *Arabidopsis* overexpressing *RtLDOX2* showed a higher accumulation of flavonols and anthocyanin, suggesting that this gene functions as a multifunctional dioxygenase in the flavonoid pathway and converts dihydrokaempferol to kaempferol. They noted that transgenic plants via agrobacterium-mediated transformation showed higher tolerance against drought (150 mM and 300 mM mannitol for 15 days), salinity (75 mM and 100 mM NaCl for 10 days), and ultraviolet-B (30 min per day for 7 days) stresses by modulating the flavonoid's pathway and scavenging ROS.

7. Conclusions

Sessile plants develop various endogenous defense mechanisms to counter unfavorable conditions. Flavonoids are among the natural tools developed by plants to cope with abiotic stresses. This review encloses an overview of the functional roles of flavonoids in shaping a response to abiotic stress via the regulation of antioxidant systems, involvement in the signaling network, and modulation of physiological aspects of the plant. The biosynthesis of flavonoids and their accumulation in plants is triggered by abiotic stimuli and consequences in the modulation of stress response pathways. Flavonoids improve plants' tolerance to abiotic stress at physiological and biochemical levels by the improvement of antioxidant capacity, regulation of cellular redox, activation of stress-responsive TFs, osmoregulation, and involvement in the stress response signaling network as a signaling molecule. We also discussed that flavonoids regulate stress response in different parts of plants, including, stomata, pollen grain, thylakoid membrane, cell membrane, and nucleus. This review provides the current status of flavonoids' functional role in abiotic stress responses of plants and suggests flavonoids as a promising abiotic stress marker. Moreover, this review invites investigation of stress-specific flavonoids and the underlying exact mechanism of flavonoids' involvement in stress responses, which can be a promising tool for crop breeding programs. Moreover, there are contrasting reports on the accumulation or reduction of flavonoid compounds in plants under light and temperature stresses. These remain to be delicately investigated using comprehensive methods such as metabolomics.

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भारतीय स्वलतंत्रता समर में महिलाओ का योगदान

डॉ. प्रवीण कुमार झा

पोस्ट डॉक्टरल फेलो, आई सी एस एस आर

टेलीविज़न पत्रकार, मीडिया विशेषज्ञ और प्राध्यापक, दिल्ली विश्वविद्यालय

वर्तमान समय में महिलाओ की भागीदारी कार्यपालिका, न्यायपालिका, विधायिका और देश के चतुर्थ स्तम्भ प्रेस में भी है। महिलाये हमारे दैनिक जीवन का हिस्सा ही नहीं एक जरुरत भी है। भारत देश में सरकारी कार्य से लेकर शिक्षा, रोजगार आदि अनेक क्षेत्रो में महिलाए अपनी अग्रणी भूमिका निभा रही है। इतिहास गवाह है कि महिलाओं ने समय–समय पर अपनी बहादुरी और साहस का प्रयोग कर पुरुषों के साथ कंधे से कंधा मिला कर चली हैं, चाहे आज़ादी की लड़ाई हो या राजनितिक के हरेक मोर्चे पर महिलाओ ने सफलता का परचम लहराया है। विश्व के महान राष्ट्रों के आविर्भाव से पता चलता है कि आज़ादी के आन्दोलनों की शुरुआत और उन्हें शक्ति और सहयोग देने में महिलाओं का योगदान रहा है– भारत में भी ऐसा ही हुआ है। भारत में महिलाओं को वैदिक काल से ही महत्वपूर्ण स्थान दिया जाता रहा है। मनु ने कहा है जहां महिलाओं को सम्मान मिलता है, वहां ईश्वर का वास होता है और जिन परिवारों में महिलाओं का अपमान होता है, वे परिवार बर्बाद हो जाते हैं। वैदिक काल में समाज में स्त्रियों का स्थान बहुत ऊंचा था और उन्हें हर क्षेत्र में पुरुषों का बराबर का साझीदार माना जाता था। मैत्रेयी, गार्गी, सती अनसूया और सीता की कथा किसे नहीं मालूम है।

गौतम बुद्ध के इस कथन से ज्ञात होता है कि समाज में महिलाओं का सर्वोपरि स्थान है। महिलाएं समाज की आधी आबादी हैं। समाज की इकाई जहां परिवार होता है वहीं परिवार की धूरी स्त्री होती है। यह स्त्री जिस मानसिकता के अक्ष पर केन्द्रित होती है, परिवार उसी मानसिकता को आत्मसात करते हुए विकसित होता है। यही मानसिकता देश और समाज की दशा और दिशा निर्धारित करती है। यही कारण है कि विश्व को करूणा का पाठ सिखाने वाले गौतम बुद्ध किसी भी देश और समाज का मूल्यांकन उस समाज की महिलाओं की स्थिति के आधार पर करते हैं। राष्ट्रपिता महात्मा गांधी भी स्वतंत्रता आंदोलन में महिलाओं की महत्वपूर्ण भूमिका को रेखांकित करते हैं। उन्होंने परतंत्र भारत से आह्वान किया था कि देश को आजाद कराने के लिए माताएं, बहनें सामने आएं।

सर्वप्रथम स्वतंत्रता की जंग लड़ने वाली स्त्रियों में नवाब वाजिद अली शाह की पत्नी बेगम हजरत महल का नाम आता है। नवाब के नजरबंद होने के बाद बेगम हजरत महल ने दिनांक 7 जुलाई, 1857 से अवध का शासन अपने हाथ में लिया रायगढ़ की रानी अवंतीबाई भी ऐसा ही एक नाम है। रानी अवंती बाई ने अंग्रजों की नीतियों से चिढ़कर उनके विरुद्ध संघर्ष का ऐलान कर दिया और मंडला के खेटी गांव में मोर्चा जमाया। यहां

''खूब लड़ी मर्दानी वह तो झांसी वाली रानी थी।'' ''मैं अपनी झांसी नहीं दूंगी''। इस कथन का उद्घोष करने वाली रानी लक्ष्मी बाई ने अंग्रेजों की जमकर खबर ली थी। झांसी का नेतृत्व करते हुए रानी लक्ष्मीबाई तमाम विपरीत परिस्थितियों के होते हुए भी कर्तव्य–पथ से विमुख नहीं हुईं। सुभद्रा कुमारी चौहान की बेटी सुधा लिखती हैं – लक्ष्मणजी बड़े ही होशियार वकील थे। अंग्रेज सरकार और स्वतंत्रता संग्राम के समर्पित सिपाही तो जैसे एक म्यान में दो तलवारें का उदाहरण थे। वे बार–बार स्थापित होने का प्रयास करते और अंग्रेज सरकार उन्हें परोक्ष अथवा अपरोक्ष रूप से उखाड़ फेंकने का। घर बड़ी ही मुश्किल से चला करता था। सुभद्राजी लक्ष्मणजी की सच्ची सहधर्मिणी थीं। वे कविता तो करती ही थीं। बड़ी ही सरस, मधुर और सहज कविता, कहानी, संस्मरण का उन्होंने प्रणयन किया।

ऊषा मेहता, दुर्गा बाई देशमुख, अरूणा आसफ़ अली को भारत की आज़ादी के लिए लड़ने वाली एक सक्रिय कार्यकर्ता के रूप में पहचाना जाता है। ऊषा मेहता का कांग्रेस रेडियो भारत छोड़ो आंदोलन 1942 के दौरान कुछ महीनों तक काफ़ी सक्रिय रहा था। इस रडियो के कारण ही उन्हें पुणे की येरवाड़ा जेल में रहना पड़ा। दुर्गा बाई देशमुख महात्मा गांधी के सत्याग्रह आंदोलन में भाग लिया व भारत की आज़ादी में एक वकील, समाजिक कार्यकर्ता, और एक राजनेता की सक्रिय भूमिका निभाई। अरूणा आसफ़ अली ने एक कार्यकर्ता होने के नाते नमक सत्याग्रह में भाग लिया उन्होंने भारतीय राष्ट्रीय कांग्रेस की मासिक पत्रिका 'इंकलाब' का भी संपादन किया। सुचेता कृपलानी इंडियन नेशनल कांग्रेस में शामिल होने के बाद उन्होंने राजनीति में प्रमुख भूमिका निभाई थी। उन्होंने भारतीय संविधान सभा में 'वंदे मातरम' भी गाया था। जवाहरलाल नेहरू की बहन विजयलक्ष्मीं पंडित को सविनय अवज्ञा आंदोलन में भाग लेने के कारण उन्हें जेल में बंद किया गया था। कमला नेहरु ने असहयोग आंदोलन और सविनय अवज्ञा आंदोलन में उन्होंने बढ़–चढ़कर शिरकत की थी। सरोजिनी नायडू ने खिलाफ़त आंदोलन की बागडोर संभाली और अग्रेजों को भारत से भागने में अहम योगदान दिया। असम के सोनितपुर ज़िले के गोहपुर की कनकलता बरुआ भारत छोड़ो आंदोलन के दौरान मात्र 18 वर्ष की थी। स्थानीय लोग उन्हें 'बीरबाला' के नाम से जानते हैं। 20 सितंबर, 1942 को भारी संख्या में लोग गोहपुर पुलिस चौकी पर पर शांतिपूर्ण तरीके से प्रदर्शन करने के लिये पहुँच रहे थे। उनका उद्देश्य पुलिस चौकी पर लगे यूनियन जैक को उतार कर भारतीय झंडा फहराना था। कनकलता महिलाओं के समूह का प्रतिनिधित्व कर रही थीं। थाने के दरोगा के धमकी देने पर भी वो नहीं मानी और झंडा लेकर आगे बढ़ती रहीं। आखिरकार वो पुलिस की गोली का शिकार हुईं और शहीद हो गईं।

कल्पना दत्ता बंगाल में वामपंथी राजनीति तथा क्रांतिकारी गतिविधियों में सक्रिय थीं। वर्ष 1930 के चटगाँव शस्त्रागार लूट (Chittagong Armoury Raid) में वो सूर्य सेन (मास्टर दा) के साथ लड़ी थीं तथा वर्ष 1932 में उन्हें आजीवन कारावास की सज़ा सुनाई गई थी। वर्ष 1939 में जेल से बाहर आने के बाद द्वितीय विश्व युद्ध के दौरान सरकार ने उनके बाहर निकलने पर प्रतिबंध लगा दिया था तथा 24 घंटे के अन्दर गिरफ्तार करने का आदेश दिया। लेकिन वो भूमिगत तरीके से पार्टी तथा आज़ादी के लिये लगातार कार्य करती रहीं। राजकुमारी अमृत कौर ने भारत छोड़ो आंदोलन में महत्त्वपूर्ण भूमिका निभाई थी। वो पंजाब के कपूरथला राजघराने से संबंधित थीं तथा लंदन से पढ़ाई करने के बाद वो भारत लौटीं। भारत छोड़ो आंदोलन में वो लोगों के साथ मिलकर जुलूस निकालती और विरोध प्रदर्शन करती थीं। शिमला में 9 से 16 अगस्त के बीच उन्होंने प्रतिदिन जुलूस निकला

तथा पुलिस ने उनपर 15 बार लगातार निर्दयता से लाठीचार्ज किया।

अंततः सरकार ने उन्हें बाहर छोड़ना उचित नहीं समझा तथा कालका में उन्हें गिरफ्तार कर लिया गया। अनुसूयाबाई काले महाराष्ट्र की थीं परंतु इनका मुख्य कार्यक्षेत्र मध्यप्रदेश था। वर्ष 1920 में उन्होंने महिलाओं का एक संगठन भागिनी मंडल की स्थापना की। इसके अलावा वो अखिल भारतीय महिला सभा की सक्रिय सदस्य रहीं। वर्ष 1937 में हुए प्रांतीय चुनावों के बाद अनुसूयाबाई मध्यप्रदेश विधानमंडल की उपाध्यक्ष चुनी गईं लेकिन द्वितीय विश्वयुद्ध प्रारंभ होने और भारत को ज़बरन उसमें शामिल करने के बाद काँग्रेस के आह्वान पर उन्होंने फिर अपना पद छोड़ दिया। भारत छोड़ो आंदोलन के दौरान वो काफी सक्रिय रहीं। भारत छोड़ो आंदोलन के दौरान महाराष्ट्र के अश्ती तथा चिमूर में आदिवासियों के साथ किये गए सरकार के दमन के विरुद्ध उन्होंने आवाज़ उठाई। इसके अलावा अश्ती तथा चिमूर में हुए विद्रोह में 25 लोगों को हुई फांसी की सजा हुई थी जिन्हें उनके प्रयासों से बचाया जा सका।

महात्मा गांधी की जीवन संगिनी कस्तूरबा गाँधी की पहचान सिर्फ़ यह नहीं थी, आज़ादी की लड़ाई में उन्होंने हर कदम पर अपने पति का साथ दिया था। मैडम भीकाजी कामा ने आज़ादी की लड़ाई में एक सक्रिय भूमिका निभाई थी। दृढ़ विचारों वाली भीकाजी ने अगस्त 1907 को जर्मनी में आयोजित सभा में देश का झंडा फ़हराया था। 1890 में ऐनी बेसेंट थियोसोफिकल सोसाइटी, जो हिंदू धर्म और उसके आदर्शों का प्रचार–प्रसार करती हैं, की सदस्या बन गईं। भारत आने के बाद भी ऐनी बेसेंट महिला अधिकारों के लिए लड़ती रहीं। पेशे से डॉक्टर लक्ष्मी सहगल ने भारत के स्वतंत्रता संग्राम के साथ–साथ सामाजिक कार्यकर्ता के तौर पर प्रमुख भूमिका निभाई थी। श्रीमती लीलावती मुंशी आजादी के संघर्ष में भाग लेने के लिए वे तीन बार जेल गयीं। अपने लेखन और भाषणों से उन्होंने अनेक लोगों को प्रेरणा दीं। उनमें तारु दत्त, स्वरन्स कुमारी घोषाल, सरला देवी चौधरी और कामिनी बाई प्रमुख हैं। विश्व के सबसे बड़े लोकतंत्र भारत को इंदिरा गांधी के रूप में पहली महिला प्रधानमंत्री देने का श्रेय प्राप्त है। अपने पिता जवाहरलाल नेहरू के लिखे पत्रों के माध्यम से उन्होंने विश्व इतिहास का ज्ञान प्राप्त किया। 12 वर्ष की उम्र में उन्होंने लड़के और लड़कियों का एक चरखा संघ और वानर सेना का गठन किया।

1857 की क्रांति के बाद हिंदुस्तोन की धरती पर हो रहे परिवर्तनों ने जहां एक ओर नवजागरण की जमीन तैयार की, वहीं विभिन्न् सुधार आंदोलनों और आधुनिक मूल्यों और रौशनी में रूढ़िवादी मूल्यम टूट रहे थे, हिंदू समाज के बंधन ढीले पड़ रहे थे और स्त्रियों की दुनिया चूल्हे–चौके से बाहर नए आकाश में विस्ताकर पा रही थी। इस बात का इतिहास साक्षी है कि एक कट्टर रूढ़िवादी हिंदू समाज में इसके पहले इतने बड़े पैमाने पर महिलाएं सड़कों पर कभी नहीं उतरी थीं। 1895 में सिस्टर निवेदिता का लंदन में स्वामी विवेकानंद से मुलाकात हुई। स्वामी विवेकानंद के उदात्त दृष्टिकोण, वीरोचित व्यवहार और स्नेहाकर्षण ने निवेदिता के मन में यह बात पूरी तरह बिठा दी कि भारत ही उनकी वास्तविक कर्मभूमि है, प्लेग की महामारी के दौरान उन्होंरने पूरी शिद्दत से रोगियों की सेवा की और भारत के स्वतंत्रता आंदोलन में भी अग्रणी भूमिका निभाई। भारत की आजादी में विदेशी महिलाओं ने खूब इतिहास रचा है ''मैडलिन स्लेड'' जिन्हें गांधी जी व्यक्तिगत के जादू से इतनी प्रभावित हुई कि सात समंदर पार करके चली आई और यहीं की होकर रह गई। गांधी जी ने इन्हें मीरा बेन का नाम दिया था। मीरा बेन सादी धोती पहनती, सूत कातती, गांव–गांव घूमती।

आजादी की लड़ाई में महिलाओं ने न सिर्फ अंग्रेजों से जमकर लोहा लिया बल्कि क्रांति की जो अलख जगाई उसी से घबड़ाकर अंग्रेजों ने अपने कदम पीछे हटाए। 1857 की गदर में दो नाम बड़ी शान से लिए जाते हैं। पहला नाम बेगम हजरत महल जिन्होंने लखनऊ में क्रांति का झंडा बुलंद किया और दूसरी झांसी की रानी लक्ष्मी बाई का। इतिहास में और पीछे चलें तो एक और नाम सुनने को मिलेगा। वह नाम है वर्ष 1824 में फिरंगियों भारत छोड़ो का बिगुल बजाने वाली कित्तूर (कर्नाटक) की रानी चेनम्मा का। जिन्होंने रणचंडी का रूप धरकर अपने अदम्य साहस व फौलादी संकल्प की बदौलत अंग्रेजों के छक्के छुड़ा दिए।

लखनऊ में 1857 की क्रांति का नेतृत्व बेगम हजरत महल ने किया। अपने नाबालिग पुत्र बिरजिस कादर को गद्दी पर बिठाकर उन्होंने अंग्रेजी सेना का स्वयं मुकाबला किया। वीरांगनाओं की सूची को आगे बढ़ाए तो मुगल सम्राट बहादुर शाह जफर की बेगम जीनत महल का नाम भी सामने आएगा जिन्होंने दिल्ली और आस–पास के क्षेत्रों में स्वातंत्र्य योद्धाओं को संगठित किया और देश प्रेम का परिचय दिया। लखनऊ की तवायफ हैदरीबाई के यहां तमाम अंग्रेज अफसर आते थे और कई बार क्रांतिकारियों के खिलाफ योजनाओं पर बात किया करते थे। ऐसी ही एक वीरांगना ऊदा देवी थीं, ऊदा देवी ने पीपल के घने पेड़ पर छिपकर लगभग 32 अंग्रेज सैनिकों को मार गिराया। ऊदा देवी का जिक्र अमृतलाल नागर ने अपनी कृति 'गदर के फूल' में बकायदा किया है।

इसी तरह की एक वीरांगना आशा देवी थीं, जिन्होंने 8 मई 1857 को अंग्रेजी सेना का सामना करते हुए शहादत पाई। आशा देवी का साथ देने वाली वीरांगनाओं में रनवीरी वाल्मीकि, शोभा देवी, वाल्मीकि महावीरी देवी, सहेजा वाल्मीकि, नामकौर, राजकौर, हबीबा गुर्जरी देवी, भगवानी देवी, भगवती देवी, इंदर कौर, कुशल देवी और रहीमी गुर्जरी इत्यादि शामिल थीं। ये वीरांगनाएं अंग्रेजी सेना के साथ लड़ते हुए शहीद हो गईं। बेगम हजरत महल के बाद अवध के मुक्ति संग्राम में जिस दूसरी वीरांगना ने प्रमुखता से भाग लिया, वे थीं गोंडा से 40 किलोमीटर दूर तुलसीपुर रियासत की रानी राजेश्वरी देवी। राजेश्वरी देवी ने होपग्रांट के सैनिक दस्तों से जमकर मुकाबला लिया।

झांसी की रानी लक्ष्मीबाई ने महिलाओं की एक अलग टुकड़ी 'दुर्गा दल' बनायी हुई थी। इसका नेतृत्व कुश्ती, घुड़सवारी और धनुर्विद्या में माहिर झलकारीबाई के हाथों में था। झलकारीबाई ने कसम उठायी थी कि जब तक झांसी स्वतंत्र नहीं होगी, न ही मैं श्रृंगार करूंगी और न ही सिन्दूर लगाऊंगी। अंग्रेजों ने जब झांसी का किला घेरा तो झलकारीबाई जोशो–खरोश के साथ लड़ी। चूंकि उसका चेहरा और कद–काठी रानी लक्ष्मीबाई से काफी मिलता–जुलता था, सो जब उसने रानी लक्ष्मीबाई को घिरते देखा तो उन्हें महल से बाहर निकल जाने को कहा और स्वयं घायल सिहंनी की तरह अंग्रेजों पर टूट पड़ी और शहीद हो गयीं। झलकारीबाई का जिक्र मराठी पुरोहित विष्णुराव गोडसे की कृति 'माझा प्रवास' में भी मिलता है।

रानी लक्ष्मीबाई की सेना में जनाना फौजी इंचार्ज मोतीबाई और रानी के साथ चौबीस घंटे छाया की तरह रहने वाली सुन्दर–मुन्दर और काशीबाई सहित जूही और दुर्गाबाई भी दुर्गा दल की ही सैनिक थीं। पेशे से तवायफ अजीजनबाई ने यहां क्रांतिकारियों की संगत में 1857 की क्रांति में लौ जलायी। एक जून 1857 को जब कानपुर में नाना साहब के नेतृत्व में तात्याटोपे, अजीमुल्ला खान, बालासाहब, सूबेदार टीका सिंह और शमसुद्दीन खान क्रांति की योजना बना रहे थे तो उनके साथ उस बैठक में अजीजनबाई भी थीं।

इन क्रांतिकारियों की प्रेरणा से अजीजन ने मस्तानी टोली के नाम से 400 महिलाओं की एक टोली बनायी जो मर्दाना भेष में रहती थीं। कानपुर के स्वाधीनता संग्राम में मस्तानीबाई की भूमिका भी कम नहीं है। बाजीराव पेशवा के लश्कर के साथ ही मस्तानीबाई बिठूर आई थी। अप्रतिम सौन्दर्य की मलिका मस्तानीबाई अंग्रेजों का मनोरंजन करने के बहाने उनसे खुफिया जानकारी हासिल कर पेशवा को देती थी। नाना साहब की मुंहबोली बेटी मैनावती भी देशभक्ति से भरपूर थी। नाना साहब बिठूर से जाने के बाद मैनावती यहीं रह गयी।

जब अंग्रेज नाना साहब का पता पूछने पहुंचे तो मौके पर 17 वर्षीया मैनावती ही मिली। नाना साहब का पता न बताने पर अंग्रेजों ने मैनावती को जिन्दा ही आग में झोंक दिया। मध्यप्रदेश में रामगढ़ की रानी अवन्तीबाई, मुजफ्फरनगर के मुंडभर की महावीरी देवी ने 1857 के संग्राम में 22 महिलाओं के साथ मिलकर अंग्रेजों पर हमला किया। इतिहास गवाह है कि 1857 की क्रांति के दौरान दिल्ली के आस–पास के गावों की लगभग 255 महिलाओं को मुजफ्फरनगर में गोली से उड़ा दिया गया था। 1857 की गदर में भारतीय महिलाओं में गजब की देश की भक्ति देखने को मिली। कई मौकों पर आजादी की लड़ाई में पुरुषों से आगे निकल गई महिलाएं।

महिलाओ ने देश के स्वतंत्रता के संग्राम के हरेक कार्य में महत्वपूर्ण योगदान दिया है। महिलाओ के द्वारा अपने मताधिकार से लेकर देश को आजादी दिलाने में अपना सारस्व न्यौछावर करने की बात सभी क्षेत्रो में बढ़ चढ़ कर भाग लिया। भारतीय स्वतंत्रता समर की प्रकृत मूलतः पुरुष प्रधान थी और संभवतः यही कारण है कि आजादी के इस महासंग्राम में तमाम पुस्तकों, लेखों आदि में महिलाओं की सहभागिता और उनके योगदान के महत्त्व को यथोचित स्थान नहीं मिल सका है।

वास्तव में तत्कालीन पितृसत्तात्मक समाज में महिलाओं की दुनिया में घर की चारदीवारी के भीतर सीमित थी और उसे पुरुष की अनुगामिनी ही माना जाता था। फिर भी, भारतीय इतिहास के राष्ट्रीय आंदोलन में तमाम ऐसी महिलाओं के साहस, त्याग व बलिदान से भरा पड़ा है, जिन्होंने अपनी पारिवारिक भूमिका के साथ–साथ राष्ट्रवादी गतिविधियों में हिस्सेदारी की। ऐसी बहुत सारी महिलाओं ने अपनी वीरता, साहस और नेतृत्व–क्षमता का परिचय देते हुए भारत की स्वतंत्रता के आन्दोलन में पुरुषों के साथ कंधे से कंधा मिलाकर अंतिम समय तक संघर्ष में योगदान दिया। यहाँ तक गाँधी जी ने यह स्वीकार किया है कि महिलाओ के बिना आजादी का लड़ाई लड़ना संभव नहीं था। वैदिक काल के बाद भले ही नारी पुरुषो से अनेक क्षेत्रो में पीछे थी लेकिन स्वाधीनता आन्दोलन में असंख्य महिलाओ के भाग लेने के कारण यह आन्दोलन अपना मुकाम हासिल किया। महिलाओ ने देश के प्रति प्रेम की भावना का परिचय देते हुए उसे स्वतंत्रता दिलाने में सभी तरीको चाहे वह शांतिप्रिय या कान्तिकारी आंदोलनों हो अपनी सम्पूर्ण सहकार का परिचय दिया।

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12. नारी शक्ति और भारतीय राष्ट्रीय आंदोलन, अविनाश कुमार।
13. भारत छोडो आन्दोलन में महिलाओ की भूमिका, दृष्टि ब्लॉग।

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अभिव्यक्ति की स्वतंत्रता और सोशल मीडिया

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अभिव्यक्ति की स्वतंत्रता, वर्तमान शताब्दी की आवश्यकताओं में से है, और जिस समाज में अभिव्यक्ति और संचार माध्यमों की स्वतंत्रता न हो वह तानाशाही समाज होता है। यह बात स्पष्ट है कि अभिव्यक्ति की स्वतंत्रता का अर्थ, अपमान, उपहास और अराजकता नहीं है बल्कि अभिव्यक्ति की स्वतंत्रता का अर्थ सदैव अपने तार्किक व यथार्थवाद व्यवहार से हटकर सामने आता है। प्रश्न यह है कि अभिव्यक्ति की स्वतंत्रता के संबंध में विश्व जनमत को किन साक्ष्यों पर भरोसा करना चाहिए? 'जब भी बोलना वक्त पर बोलना, मुद्दतों सोचना मुख्तसर बोलना.' वाचिक परम्परा की इस सीख के साथ पत्रकारिता के पहले संवाददाता नारद, आद्य संपादक वेद व्यास, सर्वप्रथम लाइव टेलीकास्ट करने वाले महाभारत के संजय आदि से प्रारंभ होकर पत्रकारिता ने एक लंबा रास्ता तय किया है। कौटिल्य के अर्थशास्त्र, मुगलकाल के वाक्यानवीस तथा प्रथम स्वातंत्र्य समर (१८५७) काल में रोटी व कलम प्रतीक के बाद राजकीय मुनादी और सुदूर देहाती क्षेत्रों में ठेठ हरकारों या संदियों से गुजरते हुए पत्रकारिता अपने वर्तमान अत्याधुनिक व क्रांतिकारी स्वरूप 'ई जर्नलिज्म या वेब पत्रकारिता' तक आ पहुंची है। सूचना प्रोद्यौगिकी, तकनीकी खोज व अविष्कार तथा इसके रोज बढ़ते प्रयोग और इंटरनेट के विस्तार ने वेब पत्रकारिता के फलक को और फैलाया है। वैश्वीकरण के दौर में ज्ञान, दर्शन, अध्यात्म और रचनात्मक सृजन के मानदंडों के साथ अत्याधुनिक तकनीकों के तालमेल से पत्रकारिता का फैलाव क्रांतिकारी स्तर तक हो गया है। पलक झपकते ही समूचे संसार से रूबरू होने का सहज साधन बनकर उभरी है वेब पत्रकारिता या सोशल मीडिया।

सार्वकालिक सत्य है कि सूचना में शक्ति है। आज इंटरनेट के विस्तार के साथ ही यह शक्ति नित बड़ी संख्या में न्यूज पोर्टल, वेबसाइट, ब्लहग, कियहस्क, सोशल नेटवर्किंग साइट आदि के अस्तित्व में आने से बढ़ती जा रही है। इसमें जनसंवाद की अभिव्यक्ति का माध्यम भाषा है। भारतीय संविधान में स्वतंत्रता का अधिकार मूल अधिकारों में अभिव्यक्ति की स्वतंत्रता भी सम्मिलित है। इसमें १९ से २२ की धारा में नागरिकों को बोलने एवं अभिव्यक्ति की स्वतंत्रता सहित ६ प्रकार की स्वतंत्रता प्रदान करतीं हैं। अभिव्यक्ति का अर्थ विचारों के प्रकाशन से है। व्यक्तित्व के समायोजन के लिए मनोवैज्ञानिकों ने अभिव्यक्ति को मुख्य साधन माना है। इसके द्वारा मनुष्य अपने मनोभावों को प्रकाशित करता तथा अपनी भावनाओं को रूप देता है। किसी सूचना या विचार को बोलकर, लिखकर या किसी अन्य रूप में बिना किसी रोकटोक के अभिव्यक्त करने की स्वतंत्रता अभिव्यक्ति की स्वतंत्रता (तिममकवउ वि मस्त्रचतमेपवद) कहलाती है। अतः अभिव्यक्ति की स्वतंत्रता की हमेशा कुछ न कुछ सीमा अवश्य होती है। भारत के संविधान के अनुच्छेद १९(१) के तहत सभी को अभिव्यक्ति की स्वतंत्रता दी गयी है। इसी में मीडिया की स्वतंत्रता भी शामिल है, मीडिया की अभिव्यक्ति के लिए हमारे संविधान में कुछ अलग से नहीं है।

अभिव्यक्ति की स्वतंत्रता का अभिप्राय एक तो मीडिया या व्यक्ति के स्तर पर विचारों के द्वारा सूचनात्मक संवाद और दूसरा उसके मतों के प्रकाशन से है। इसमें कोई संदेह नहीं है कि सूचनाओं के स्वतंत्र प्रसार से सभी देश प्रगति के पथ पर आगे बढता है। प्रजातंत्र में 'प्रेस' को एक सचेतक कहा जाता है, जो समस्त राजनीतिक गलियारों की कड़ी निगरानी रखता है, प्रजातंत्र को सही दिशा देता है। भारतीय जनमत से सरकार को परिचित कराता है तथा दूसरी ओर, सरकार की नीतियों एवं कार्यक्रमों से वह जनता को परिचित कराता है । साथ ही सरकार की नीतियां एवं कार्यक्रम राष्ट्रीय एवं सामाजिक हित में हैं, तो प्रेस के माध्यम से सरकार को जनसमर्थन मिलता है।

हर दिन उन्नत होती तकनीक ने वेब पत्रकारिता के विकास को ऊँची उड़ान दी है. सोशल मीडिया के पालने में वेब पत्रकारिता का बखूबी विकास हो रहा है। सोशल मीडिया आज कंप्यूटर, टेबलेट और मोबाइल का उपयोग कर रहे लोगों की दिनचर्या का अभिन्न अंग है और खबर का प्रमुख स्रोत भी. मल्टीमीडिया के प्रयोग ने इसे और आकर्षक बनाया है। पिछले सालों में वेब जाल के पूरी दुनिया पर तेजी से फैलने के साथ ही खबरों का जाल भी मजबूत हुआ है। विज्ञापन जगत का हर खिलाड़ी इस लोकप्रियता का अपने हित में इस्तेमाल करने के लिए हर संभव प्रयास कर रहा है। इस प्रतियोगिता ने वेब पत्रकारिता का बाजार पहले से कहीं अधिक बड़ा और प्रभावशाली बना दिया है। ताजा उम्मीदों के मुताबिक २०१६ से २०१९ के बीच सोशल मीडिया पर वैश्विक विज्ञापन का खर्च ७२ प्रतिशत बढ़ेगा। २०१६ में जहां इंटरनेट पर कुल विज्ञापन का १६ प्रतिशत हिस्सा केवल सोशल मीडिया पर खर्च होता है, २०१९ में यह हिस्सेदारी बढ़कर २० फीसदी हो जाएगी। आज विज्ञापन का एक बड़ा हिस्सा अखबारों पर खर्च होता है, लेकिन २०२० तक सोशल मीडिया को अखबारों से अधिक विज्ञापन मिल सकते हैं। अमरीका का उदाहरण दें तो जानकारों का मानना है कि २०१७ में पहली बार डिजिटल स्पेस पर विज्ञापन का आंकड़ा टीवी पर दिए जाने वाले आंकड़े से आगे निकल जाएगा। इस बड़े बदलाव पर पूरी दुनिया के विशेषज्ञों की नजर है क्योंकि दूसरे देशों पर भी इस

ट्रेंड का असर रहेगा। साफ तौर पर अमरीका के डिजिटल बाजार का असर भारत पर भी पड़ रहा है. इंटरनेट एवं मोबाइल एसोसिएशन अहफ इंडिया (आईएमएआई) के मुताबिक भारत उपभोक्ताओं की संख्या की दृष्टि से अमरीका को पछाड़ कर विश्व का दूसरा सबसे बड़ा इंटरनेट उपभोक्ता देश बन गया है।

पश्चिमी संचार माध्यम अभिव्यक्ति की स्वतंत्रता के नाम पर अनैतिक व घृणित कार्यवाही का साक्षी रहा है। इस आधार पर पूरे विश्वास के साथ कहा जा सकता है कि इस प्रकार के प्रोपेगैंडे, अभिव्यक्ति की स्वतंत्रता के नाम पर अधिकतर घृणा के प्रचार और स्वतंत्रता के अपमान से समन्वित हैं। हाडवर्ड विश्व विद्यालय के शोधकर्ता और उत्तरी कैलीफोर्निया विश्व विद्यालय में धार्मिक शोध के ईरानी प्रोफेसर उम्मीद सफी का भी मानना है कि अपमान जनक फिल्मों और कार्टूनों को बनाकर अभिव्यक्ति की स्वतंत्रता का औचित्य पेश नहीं किया जा सकता और इस प्रकार के फिल्म निर्माता व कार्टूनिस्ट खुलकर घृणा को हवा दे रहे हैं।यह स्वतंत्रता माध्यम के चुनाव पर भी लागू होता है, जिसके जरिए व्यक्ति अपनी बात कहना चाहता है। एक व्यक्ति की बात को एक बड़े वर्ग तक पहुंचाने के लिए अखबार, रेडियो, टेलीविजन, मोबाइल और इंटरनेट जैसे कई संचार माध्यम है। यही कारण है कि मई २०१७ में भारतीय जनसंचार में मीडिया स्कैन द्वारा आयोजित सेमीनार के यज्ञ और कल्लूरी का विरोध वामपंथी संगठनो ने सोशल मीडिया पर जमकर किया। साहित्यकार बद्री नारायण के अनुसार, "आजकल लोग इन सोशल नेटवर्किंग साइट पर गाली में बात करते हैं. कोई किसी के बारे में कुछ भी लिख सकता है। ऐसी समस्या प्रिंट साहित्य में नहीं थी। कहने का तात्पर्य ये कि इस नई तकनीक का हिंदी को बिगाड़ने और बनाने दोनों ही रूपों में इस्तेमाल हो सकता है। इसलिए इंटरनेट पर सक्रिय हिंदी जगत को बहुत जिम्मेदार होने की जरुरत है।

२०१५ में सुप्रीम कोर्ट ने इंटरनेट कानून की धारा ६६। को रद्द कर दिया है, जिसके तहत सरकार सोशल मीडिया पर आपत्तिजनक कमेंट करने वालों को गिरफ्तार कर रही थी। सुप्रीम कोर्ट के मुताबिक यह धारा अभिव्यक्ति की आजादी के खिलाफ है। कोर्ट ने कहा कि यह धारा मूल अधिकार का उल्लंघन और असंवैधानिक है। अभिव्यक्ति की आजादी सर्वोपरि रहनी चाहिए। हालांकि सरकार के पास वेबसाइट ब्लहक करने का अधिकार बरकरार रहेगा। साल २०१२ में मुंबई में फेसबुक पर शिवसेना नेता बाल ठाकरे के खिलाफ कमेंट करने पर २ लडकियों को गिरफ्तार किया गया था। लड़कियों की गिरफ्तारी के बाद देशभर में विरोध जताया गया था। यूपी में एक मामला सामने आया था जिसमें एसपी नेता और अखिलेश सरकार में कैबिनेट मंत्री आजम खान के खिलाफ सोशल मीडिया पर कमेंट करने वाले एक लड़के को गिरफ्तार कर लिया गया था। असीम त्रिवेदी को सोशल मीडिया पर संसद, राष्ट्र चिह्न के खिलाफ आपत्तिजनक कार्टून बनाने के लिए गिरफ्तार किया था। ममता बनर्जी के कार्टून बनाने पर प्रोफेसर अंबिकेश महापात्रा को गिरफ्तार किया गया था।

सोशल मीडिया के तहत अभिव्यक्ति की आजादी सवाल पर भारत के गली-कूचों से लेकर सुप्रीम कोर्ट तक बहस जारी है। सुविख्यात ब्रिटिश जस्टिस लार्ड ब्रियन लेविसन ने सामाजिक अभिव्यक्ति के प्रश्न पर अपनी प्रबल प्रस्थापना पेश की थी, जिसे आज भी अनेक लोकतांत्रिक राष्ट्रों में एक शानदार कानूनी दिशा-निर्देश स्वीकार किया जाता रहा है, जिनमें भारत भी एक रहा है। ब्रिटेन में एक दौर आया था जबकि अभिव्यक्ति की आजादी का खुलकर दुरुपयोग प्रारम्भ हुआ और संगठित प्रेस से लेकर राजनीतिक दलों द्वारा साँस्कृतिक-सामाजिक और राजनीतिक हल्कों में स्थापित पराम्परागत मर्यादाओं का खुलकर उल्लंघन होने लगा। उस दौर में तकरीबन दो हजार पृष्ठों में अत्यंत विस्तार से जस्टिस लार्ड ब्रियन लेविसन ने लोकतंत्र में अभिव्यक्ति की स्वतंत्रता पर प्रकाश डाला, जिसकी रौशनी में इंगलैंड का समाज, संसद और कानून अत्यंत प्रभावित हुआ। विश्व पटल पर सोशल मीडिया के पदार्पण के तत्पश्चात अभिव्यक्ति की आजादी का अत्यंत ताकतवर पहलू दुनिया के सामने आया, क्योंकि इसने व्यक्तियों और ग्रुपों के विचारों के प्रसार-प्रचार को विलक्षण विस्तार प्रदान कर दिया। विश्व रंगमंच पर सोशल मीडिया ने शक्तिशाली रुप से स्थापित होकर संस्थागत संगठित मीडिया के एकाधिकार से विचारों के प्रसार-प्रचार को बाहर कर दिखाया। सर्वविदित है कि एक व्यक्ति हो तथा संगठित मीडिया कानूनी मर्यादाओं के जो कायदे कानून इन सभी पर लागू होते रहे हैं, वही सब सोशल मीडिया पर स्वतः ही लागू हो जाते हैं, इसके लिए अलग से किसी पृथक कानूनी प्रावधान की दरकार नहीं समझी गई। सोशल मीडिया की असीम प्रचार-प्रसार शक्ति से शासक वर्ग अत्यंत हैरान-परेशान हो उठा है, क्योंकि संगठित संस्थागत मीडिया को राजसत्ता की शक्ति से प्रभावित कर पाना अपेक्षाकृत आसान रहा, किंतु सोशल मीडिया को काबू कर पाना अत्यंत दुश्वार सिद्ध हो रहा है। इजिप्ट के तहरीर चौक पर जमा हुए इंकलाबी आवाम ने हुस्नी मुबारक को उसके अंजाम तक पंहुचा दिया। दिल्ली के जंतर-मंतर पर भ्रष्ट्राचार विरोधी अन्ना आंदोलन ने भ्रष्ट्राचार की दलदल में गले तक गर्क भारतीय शासकवर्ग के छक्के छुड़ा दिए। शक्तिशाली शासक वर्ग को प्रतीत होने लगा कि सोशल मीडिया की ताकत ने विशाल मध्यवर्ग को भ्रष्ट्राचार विरोधी अन्ना आंदोलन से एकाकार किया है, अतः वे एकजुट होकर सोशल मीडिया पर लगाम कसने के लिए अत्यंत तत्पर हो उठे।

भारत ऐतिहासिक एवं साँस्कृतिक पर गहन सामाजिक मर्यादाओं से सराबोर राष्ट्र रहा है। भारत के सबसे पूज्यनीय आदरणीय व्यक्तित्व को मर्यादा पुरुषोत्म राजा रामचंद्र के तौर पर जाना पहचाना गया। समाज अपनी समूची रीति-नीति और समस्त तौर तरीकों को उस ऐतिहासिक दौर से स्वयं तय करता आया है जबकि समाज के पटल पर राजसत्ता का उदय भी नहीं हुआ था। जीवंत आदिवासी समाज के परम्परागत सामाजिक कायदे कानून आज भी दौर की स्मृतियां ताजा कर देता जबकि समूचे समाज के लिए राजसत्ता नहीं वरन् समाज स्वयं अपने लिए सामाजिक कानूनी मर्यादा निर्धारित किया करता था। अब यह सामाजिक रिवायतें भारत के आदिवासी समाज और कहीं कहीं गाँव-देहात में अवशेष के तौर पर सुरक्षित रह गई है। तृणमूल कांग्रेस के डेरेक ओ ब्रायन ने एक पूरक प्रश्न में पूछा कि क्या उच्च पदों पर बैठे लोगों को इस तरह के ट्रोल्स को फहलो नहीं करने के लिए कोई परामर्श जारी किया गया है। उन्होंने आरोप लगाया कि मोदी ने सोशल मीडिया पर कुछ ऐसे ट्रोल फहलो किए हैं जिनमें घातक, जहरीली और द्वेष भरी बातें कही गई हैं। उन्होंने कहा कि सरकार को इस बारे में कुछ करना चाहिए।

गृह राज्यमंत्री ने इस पर कहा, 'भारत एक स्वतंत्र देश है और यहां अभिव्यक्ति की स्वतंत्रता है। हमारे संविधान में किसी पर कोई रोक लगाने का कोई प्रावधान नहीं है।' ब्रायन ने कहा, 'डिजिटल मीडिया पर कुछ ऐसे ट्रोल हैं जिनमें घातक, जहरीली और द्वेष भरी बातें कही जा रही हैं। प्रधानमंत्री डिजिटल मीडिया पर कुछ ऐसे अज्ञात लोगों को फहलो कर रहे हैं जिनमें द्वेष भरी बातें कही गई हैं। यद्यपि प्रधानमंत्री कुछ गलत नहीं लिख रहे हैं।'

लोकतांत्रिक देश में अभिव्यक्ति की स्वतंत्रता जितनी महत्वपूर्ण है उतनी ही है पारदर्शिता। सोशल मीडिया के आने से इस संवैधानिक अधिकार को एक नया स्वरूप मिला जिसे हम आज के जागरूक और बेबाक समाज के रूप में देख रहे है। हाल ही में हुई घटनाएं जिनमें दिल्ली का सामूहिक दुष्कर्म या बीते साल में अन्ना व रामदेव का जन आन्दोलन इसके उदाहरण है। यह साइबर क्रान्ति भारत में ही नहीं बल्कि सारे विश्व पटल पर हो रही है। नेशनल सिक्योरिटी एजेंसी की रिपोर्ट के अनुसार अमेरिकी विशेषज्ञों द्वारा देशों में की गई जासूसी के आधार पर भारत पांचवा सबसे ज्यादा जासूसी किया गया देश है, भारतीय विदेश विभाग ने इस सन्दर्भ में अमेरिका से जवाब तलब भी किया है। सोशल मीडिया के उपभोक्ता का विवेक, मनोदशा और उसकी सामाजिक, शैक्षणिक तथा वैचारिक पृष्ठभूमि निर्धारित करती है कि सोशल मीडिया पर उसकी अभिव्यक्ति कैसी होगी। यहाँ विभिन्न विचारों, सोच और समझवाले लोग हैं, जो अपने मन-मुताबिक अपने विचारो को अभिव्यक्त हैं। सोशल मीडिया के उपभोक्ता अलग-अलग राष्ट्रों, प्रांतों, अंचलों, धर्मों, भाषाओं, संस्कृतियों, रीति-रिवाजों आदि से आते हैं। सोशल मीडिया पर वे अपनी इस पृष्ठभूमि का प्रतिनिधित्व करते हैं। सोशल मीडिया पर अभिव्यक्ति का नियंत्रण सामान्यतः उसके उपभोक्ताओं के हाथों में ही है। सोशल मीडिया की यही विशेषता उसकी भाषा और विचारों को गढ़ने में महत्वपूर्ण भूमिका अदा करती है। यहाँ संपादक जैसी किसी संस्था का प्रभुत्व नहीं है, जो उसकी अभिव्यक्ति पर अंकुश लगाए, इसलिए यह संप्रेषक पर ही निर्भर है कि वह अपनी अभिव्यक्ति को किस स्वरूप में प्रकाशित और प्रदर्शित करता है।

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सहचर ई-पत्रिका...

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प्रकाशित अंक

सहचर ई-पत्रिका...

की संभावनायें प्रकट हुई। 1966 में पहला कम्प्यूटर नेटवर्क आरपा नेटवर्क के नाम से अमेरिका में विकसित किया गया। इंटरनेट की शुरूआत करने का श्रेय अमेरिकी रक्षा विभाग को जाता है जिसने एडवांस रिसर्च प्रोजेक्ट एजेंसी के माध्यम से टेलीफोन लाइन के प्रयोग से 1969 में पैकेट स्विच्ड नेटवर्क स्थापित किया। भारत में पहला कम्प्यूटर 1956 को भारतीय सांख्यिकी संस्थान (आईएसआई) कलकत्ता शाखा में लगाया गया और इंटरनेट की शुरूआत शिक्षा और अनुसंधान नेटवर्क के रूप में 1980 के लगभग हुई थी। प्रारंभ में यह सीमित संसाधनों और कम्प्यूटर प्रशिक्षितों की कमी के कारण भी अधिक गति से आम लोगों तक नहीं पहुंच सका। भारत का विदेश संचार निगम लिमिटेड ने आम लोगों के लिए इंटरनेट की सुविधा 15 अगस्त 1995 से उपलब्ध करवाई। कम्प्यूटर व इंटरनेट के अलावा पेजर, फैक्स, मोबाइल फोन इत्यादि संचार के माध्यमों का प्रयोग बढ़ा जिसे इंटरैक्टिव मीडिया कहा गया। भारत में मल्टीमीडिया के क्षेत्र में एनिमेशन इंडस्ट्री सबसे ज्यादा तेजी से उभरते क्षेत्रों में एक मानी जा रही है।

सोशल मीडिया की अवधारणा और विस्तार

धरती पर एक नये राष्ट्र का उदय हुआ जिसकी कोई भौगोलिक सीमाएं नहीं है। इस राष्ट्र का अस्तित्व केवल साइबरस्पेस में है और इसे 'सोशल मीडिया' कहा जाता है। सोशल मीडिया का आकार डिजिटल मीडिया में विद्यमान जीवन से भी बड़ा है, 'जो स्वयं डिजिटल कलाओं, विज्ञान प्रौद्योगिकी और मानव अभिव्यक्ति के लिए व्यापार, संचार, सामाजिक वार्तालाप और शिक्षा के रचनात्मक के रूप में परिभाषित है।' यह एक अद्भुत माध्यम है, जिसका अनुसरण और अनुकरण विश्वभर में किया जा रहा है। यह परस्पर मानव संपर्क को एक नये रूप, एक अद्भुत माध्यम को प्रेरित करता है, जिसे सोशल मीडिया नेटवर्किंग का नाम दिया गया है। सोशल मीडिया की अवधारणा और

संपादक

पिछला अंक (मुख्य पृष्ठ)

सहचर ई-पत्रिका...

की आज की स्थिति में पूरी तरह से परिवर्तन तो नहीं हुआ है किंतु यह कहा जा सकता है कि अब सूचना पर विकसित देशों का एकाधिकार नहीं रहा। एक तरफा सूचना के प्रवाह को लेकर यूनेस्को द्वारा आयोजित सम्मेलन में सूचनाओं के दो तरफा प्रवाह पर बनी सहमति इसमें निश्चय ही सहभागी रहा। मैकब्राइड आयोग की सिफारिसों के कारण विकासशील देशों को सूचना लेने और देने की स्वतंत्रता मिल पायी। वैश्विक परिदृश्य में विकसित और विकासशील देशों के बीच आर्थिक असमानता भी सूचना के एक तरफा प्रवाह का कारण था। 21वीं सदी को साइबर सदी के रूप में जाना जाता है । उसमें सोशल मीडिया ने भारतीय मीडिया जगत में अपना एक अलग मुकाम बना लिया है। इंटरनेट और मोबाइल आधारित एक ऐसी तकनीक जिसके माध्यम से संस्थाओं, समुदायों और लोगों के बीच परस्पर संवाद स्थापित किया जा सके, सोशल मीडिया कहलाती है। इसको मीडिया का नया संस्करण माना जा रहा है। परंपरागत रूप में मीडिया के अंतर्गत अभी तक एक तरफा संवाद हो रहा है। हालांकि अब यहां भी पाठकों और दर्शकों के बीच दोतरफे संवाद की प्रक्रिया ने तेजी पकड़ी है। आज दुनिया में यह तकनीक कई रूपों में प्रभावशाली माध्यम के रूप में कार्य कर रही है। इंटरनेट फोरम, वेब, सोशल ब्लॉग, माइक्रोब्लॉगिंग, विकीज, सोशल नेटवर्क्स, पोडकास्ट, फोटोग्राफ या पिक्चर्स, वीडियो, रेटिंग और सोशल बुकमार्किंग जैसे इसके उदाहरण है। प्रधानमंत्री मोदी जी ने डिजिटल इंडिया लॉन्च की है, जिसमें 2019 तक देश के सभी गावों को जोड़ने की योजना है।

सोशल मीडिया और सूचनाएं

सोशल मीडिया पूर्णत: डिजिटल माध्यम है। यह तकनीक आधारित साझेदारी है। बिना तकनीक और उपकरण के यहां सम्प्रेषण की कल्पना भी बेमानी है। इसीलिए कहा जा सकता है कि सोशल मीडिया के लिए कम्प्युटर या मोबाईल उपकरण अनिवार्य है। दरअसल सोशल मीडिया का उपयोगकर्ता यहां अपने-

ARCHIVES

- April 2019
- September 2018
- July 2018
- April 2018
- February 2018
- December 2017
- October 2017
- July 2017
- May 2017
- February 2017

सहचर ई-पत्रिका...

समझ आया कि केवल अपने मोबाइल या कंप्यूटर से कमेंट करने से कुछ नहीं होगा, सड़कों पर उतरना होगा। और लोग उतरे भी। दिल्ली के निर्भया कांड में भी लोग बड़ी संख्या में सड़कों पर उतरे मगर उनको सड़कों पर उतारने में भी सोशल मीडिया ने बड़ी भूमिका निभाई। चुनावों में तो सोशल मीडिया और नया मीडिया आवश्यक अंग और हथियार बन गए हैं। जो लोग कहते हैं कि आने वाला वक्त डिजिटल मीडिया का है वो जान लें कि आने वाला नहीं ये ही डिजिटल मीडिया का समय शुरू हो चुका है। यहाँ से आगे तमाम उतार-चढ़ावों के बाद भी इस सफर के बेहतर होने की ही उम्मीद है। क्योंकि यहाँ एकालाप नहीं है। बस देखना ये है कि शोर की बजाय संवाद हो।

सोशल मीडिया और अभिव्यक्ति

इसमें जनसंवाद की अभिव्यक्ति का माध्यम भाषा है। यह सच सोशल मीडिया की भाषा में काफी बदलाव देखने को मिला है। बाबूराव विष्णु पराडकर ने मीडिया की भाषा को आमजन, मजदूर व पानवाड़ी, अशिक्षित या कम शिक्षितों की भाषा बनाने पर विचार दिया था, लेकिन वे व्याकरण या शब्द रचना को बिगाड़ने नहीं देना चाहते थे। यह जरुरी है कि संवाद समस्त जन के पास पहुंचे लेकिन भाषा के साथ अन्याय न हो। यह सही है कि सोशल मीडिया की भाषा आमजन की भाषा होनी चाहिए, परन्तु आज का नया मीडिया खुद अपनी भाषा गढ़ रहा है। वरिष्ठ पत्रकार राहुल देव के अनुसार, सोशल मीडिया ने सार्वजनिक अभिव्यक्ति और एक बड़े समुदाय तक बिना रोक-टोक अपनी बात पहुंचाना संभव बनाकर करोड़ों लोगों को एक नई ताकत दी है।" वरिष्ठ टीवी पत्रकार रजत शर्मा के अनुसार, " सोशल मीडिया ने पिछले एक साल के भीतर 100 फीसदी की बढ़ोतरी दर्ज की है। यहां इनके यूजर्स की संख्या 2.5 करोड़ पहुंच चुकी है। जबकि बाहरी इलाकों में मीडिया यूजर्स की संख्या 12 करोड़ पहुंच चुकी है। लेकिन सोशल मीडिया अभी शैशव काल से गजर रहा है, इसका प्रभाव सीमित है।"

सहचर ई-पत्रिका...

कुछ तथ्य
600 मिलियन उपभोक्ता व्हाट्सएप पर हैं ।
500 मिलियन उपभोक्ता फेसबुक मैसेंजर पर हैं ।
468 मिलियन उपभोक्ता वीचैट पर हैं ।
100 मिलियन उपभोक्ता स्नेपचैट पर हैं।
639 मिलियन उपभोक्ता चीन के सोशल मीडिया ओजोन पर हैं।
100 मिलियन उपभोक्ता रूस के सोशल मीडिया वीकोंटके पर हैं।
3.65 बिलियन लोग स्मार्टफोन और टेबलेट के जरिए इंटरनेट का प्रयोग करते हैं।
7.2 प्रतिशत लोग भारत में इण्टरनेट पर हैं।
1.4 बिलियन लोग दुनिया मे फेसबुक उपभोक्ता हैं।
284 मिलियन लोगों के दुनिया भर में ट्वीटर एकाउण्ट हैं।
88 प्रतिशत लोग मोबाइल से ट्वीटर हैंडल चलाते हैं।
500 मिलियन लोग लगभग रोज ही ट्वीट करते हैं।
363 मिलियन दुनियाभर में गूगल प्लस के कुल उपभोक्ता हैं।
05 बिलियन हिट्स गूगल प्लस पर रोज आते हैं।
300 मिलियन कुल उपभोक्ता इंस्टाग्राम पर हैं।
70 मिलियन फोटो और विडियों इंस्टाग्राम पर रोज पोस्ट होते हैं।
53 प्रतिशत इंस्टाग्राम के उपभोक्ता 18 से 29 साल के बीच हैं।
347 मिलियन लोग लिंक्डइन पर रजिस्टर्ड हैं।
(स्त्रोत- कादम्बिनी जून 2016, वर्ष 56, अंक-08, "हमारी दुनिया और सोशल मीडिया)

संदर्भ सूची –

सहचर ई-पत्रिका...

विशेषाक, अगस्त 2015

प्रवीण कुमार झा

Posted in दसवाँ अंक, शोधार्थी

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राजभाषा हिंदी का स्वरूप – डॉ. ममता सिंगला »

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सहचर ई-पत्रिका...

सहचर ई-पत्रिका...

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परंपरागत संचार माध्यम और लोकनाट्य परंपरा

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सारांश

आधुनिक जनसंचार माध्यमों के पूर्व हमारे समाज में परम्परागत संचार माध्यम जैसे लोकनृत्य, लोक कथाओं, लोक गीत का लंबे समय तक प्रयोग होता रहा है। लोकनाट्यों का लोकजीवन से अत्यंत घनिष्ठ संबंध है। यही कारण है कि लोक से संबंधित उत्सवों, अवसरों तथा मांगलिक कार्यों के समय इनका अभिनय किया जाता है। नृत्य, संगीत, कथा-वार्ताएं सब कुछ भारतीय लोक से जुड़ी हुई है। लोक माध्यम जो परम्परागत लोक कलाएं जैसे भजन, कीर्तन, रामलीला, रासलीला, नौटंकी, कठपुतली आदि सदियों से हमारी संस्कृति में रचे बसे हैं। तेजी से बदलते परिवेश के बावजूद भी परम्परागत लोक माध्यमों की अपनी एक अलग छवि व पहचान है। आज भी समाज में जागरूकता के लिए बड़े स्तर पर इसका उपयोग हो रहा है।

प्रस्तावना

भारत बहुजातीय, बहुसांस्कृतिक, बहुरंगी देश है। अनेक लोक कलाएँ, लोकनाट्य रूप(ज्ञात और अज्ञात) इसके विभिन्न प्रान्तों में बिखरे पड़े हैं। परंपरागत संचार का यह माध्यम भारतीय बहुजातीय संस्कृति को आज भी हमारे समक्ष विद्यमान है। सृष्टि के उत्पत्ति के साथ ही प्रत्यक्ष और अप्रत्यक्ष रूप में संचार का विकास शुरू हो गया। ब्रम्हा ने सृष्टि के निर्माण के साथ देवो से संचार के कार्य का माध्यम नारद को चुना। जैसे जैसे युग बदला वैसे वैसे सभ्यता के विकास के साथ ही मुनष्य किसी न किसी रूप में संचार करता रहा है। मनुष्य एक सामाजिक प्राणी है। उसके लिए बिना किसी संचार के जीवित रहना असंभव है। हम परिवार, समाज एवं समूह में अपना जीवन व्यतीत करते हैं। इसमें ही स्थिति और आवश्यकतानुसार परस्पर संचार करते रहते हैं। जब आज की तरह टेलीफोन, इंटरनेट, सोशल मीडिया आदि की सुविधाएं नहीं थी, तब लोग चिट्ठी लिख कर अपना हाल-समाचार लोगों तक पहुँचाते और दूसरे का समाचार जानते थे। किसी भी सूचना, विचार या भाव को दूसरों तक पहुँचाना ही मोटे तौर पर संचार या कम्युनिकेशन कहलाता है। एक साथ लाखों-करोड़ों लोगों तक एक सूचना को पहुँचाना ही संचार या जनसंचार या मास कम्युनिकेशन मीडिया कहलाता है, और इस संचार व्यवस्था को सुचारू से चलाने का जो माध्यम कार्य करता है वह संचार माध्यम कहलाता है।

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पुराने समय में राजा के हरकारे पैदल या घोड़े की सवारी करते हुए राजा के संदेश राजधानी से दूसरी जगहों पर ले जाते और वहां से ले आते थे। आपने यह भी कई कहानियों में सुना होगा कि लोग कबूतरों के जरिए अपना संदेश भेजा करते थे। यही व्यवस्था बाद में एक सरकारी विभाग डाक-विभाग-बनाकर सबके लिए सुलभ कर दी गई थी। अब हर कोई एक निश्चित शुल्क देकर अपना संदेश एक स्थान से दूसरे स्थान तक आसानी से भेज सकता है। अब तो डाक व्यवस्था में इतने आधुनिक उपकरणों का इस्तेमाल किया जाने लगा है संदेश तार के जरिए पलक झपकते एक स्थान से दूसरे स्थान तक पहुंचा दिया जाता है। हर व्यक्ति अपने या अपने संबंधियों की सूचनाएं जानने के अलावा देश-दुनिया की खबरों के बारे में जानने का इच्छुक होता है। उसके आस-पास क्या हो रहा है, दुनिया में कहाँ क्या घटना घट रही है, सबकी जानकारी प्राप्त करना चाहता है। सूचनाओं की इसी भूख के चलते संचार माध्यमों का लगातार विकास और विस्तार होता गया। आज अखबार, रेडियो, दूरदर्शन, मोबाइल जैसे संचार माध्यम से सूचनाएं आसानी से उपलब्ध हो जाती है। आधुनिक जनसंचार माध्यमों के पूर्व हमारे समाज में परम्परागत संचार माध्यम जैसे लोकनृत्य, लोक कथाओं, लोक गीत का लंबे समय तक प्रयोग होता रहा है। कश्मीर से कन्या कुमारी तक फैले भू-भाग पर विकसित कर रहा मानव समाज भारतीय लोक है। हमारे कृषक, अर्थशास्त्र, ज्ञान, साहित्य, कला, नृत्य, संगीत, कथा-वार्ताएं सब कुछ भारतीय लोक से जुड़ी हुई है। लोक माध्यम जो परम्परागत लोक कलाएं जैसे भजन, कीर्तन, रामलीला, रासलीला, नौटंकी, कठपुतली आदि सदियों से हमारी संस्कृति में रचे बसे हैं। तेजी से बदलते परिवेश के बावजूद भी परम्परागत लोक माध्यमों की अपनी एक अलग छवि व पहचान है। आज भी समाज में जागरूकता के लिए बड़े स्तर पर इसका उपयोग हो रहा है।

उदेश्य – वर्तमान भारतीय परिदृश्य मे परंपरागत संचार में लोक नाट्य परंपरा का अध्ययन।

शोध विधि – इस शोध में विश्लेषणात्मक प्रविधि का प्रयोग किया गया है। साथ ही इस विषय के अध्ययन में द्वितीयक सामाग्री जैसे साहित्यवलोकन आदि से इसे मूर्त आधार प्रदान किया गया है।

लोक नाट्य परंपरागत संचार

संचार माध्यम के परंपरागत माध्यम में लोक नाट्य भी काफी प्राचीन और युग-युगान्तर से चली आ रही है और आज भी यह परंपरा विद्यमान है। डॉ.वशिष्ठ नारायण त्रिपाठी अपनी पुस्तक "भारतीय लोकनाट्य" की भूमिका में लिखते हैं –"लोककला रुपों की जातीय संस्कृति से गहरी निकटता रही है । ये कला रूप अलग-अलग क्षेत्रों में अपनी विशिष्टता के अनुरूप परस्पर भिन्न शैल्पिक निजता रखने के बावजूद अंतर्वस्तु के स्तर पर गहरे एकात्म होते हैं । लोकगीतों, कलाओं और लोकनाट्य रूपों के सन्दर्भ में इसे देखा जा सकता है ।" लोकनाटकों के उदय की पृष्ठभूमि के बारे में बलवंत गार्गी का मत है कि "संस्कृत नाटक विद्वानों, श्रेष्ठियों और दरबारियों के लिए था । इसकी भाषा बहुत गूढ़ और अलंकृत होती थी। यह जनसाधारण के जीवन में घुला-मिला रहा है। समय के साथ-साथ यह अपना रूप बदलता और बदलती हुई परिस्थितियों के अनुसार अपने-आपको ढालता रहा है।" भारत में नाट्य की परंपरा अत्यंत प्राचीन काल से चली आ रही है। भरत मुनि ने (ई.पू. तृतीय शताब्दी) अपने नाट्यशास्त्र में इस विषय का विशद वर्णन

किया है। नाट्यशास्त्र में वर्णित एक कथा से पता चलता है, देवताओं की प्रार्थना पर ब्रह्मा ने समस्त मानवों के मनोरंजनार्थ नाट्य की रचना की। शूद्रों के लिए वेदों के पठन-पाठन का अधिकार निषिद्ध था अत: पंचम वेद (नाट्य) की रचना अत्यंत आवश्यक प्रतीत हुई। इस देश में मुसलमानी शासन की प्रतिष्ठा के पश्चात् राजनीतिक एकसूत्रता नष्ट हो गई। मुसलमानी शासकों की प्रवृत्ति नाट्यकला की ओर उदासीन थी। फलत: उनके शासन में नाटकरचना तथा उसके अभिनय का ह्रास होने लगा। राजाश्रय के अभाव में इसका पतन स्वाभाविक ही था। संस्कृत साहित्य की नाट्यपरंपरा, जो हजारों वर्षों से अबाध गति से चली आ रही थी, सदा के लिए नष्ट हो गई। उत्तर भारत में भक्ति आंदोलन के प्रवर्तक गोस्वामी वल्लभाचार्य जी थे। इन्होंने कृष्णभक्ति का प्रचुर प्रचार किया। श्रीकृष्ण की बाललीलाओं का अभिनय मंदिरों, मठों तथा अन्य स्थानों में होने लगा, जिसको देखने के लिए श्रद्धालु जनता की भीड़ हजारों की संख्या में जुटने लगी। भगवान् कृष्ण की इसी प्रारंभिक लीला ने आगे चलकर 'रास लीला' का रूप धारण किया जो आज भी मथुरा तथा वृंदावन में बड़े प्रेम से की जाती है। उत्तर भारत में रामलीला का प्रचार गोस्वामी तुलसीदास जी की देन है। धीरे धीरे इन यात्राओं तथा कीर्तनों ने लाकनाट्य का रूप धारण कर लिया, जिसमें श्रीकृष्ण की लीलाएँ अभिनय के माध्यम से दिखलाई जाने लगीं। आज बंगाल में यात्रा या जात्रा तथा कीर्तन का प्रचुर प्रचार है। इस प्रकार उत्तर भारत में अनेक लोकनाट्यों का विकास हुआ जिनकी पृष्ठभूमि धार्मिक थी।

भारत के विभिन्न राज्यों में भिन्न-भिन्न प्रकार के लोकनाट्य प्रचलित हैं। उत्तर भारत में प्रचलित रामलीला और रासलीला, मध्यप्रदेश, विशेषतया मालवा प्रांत, में 'माँच' ('माँच' शब्द मंच का अपभ्रंश रूप है), राजस्थान में 'माँच' 'ख्याल' के रूप से प्रचलित है। इसका प्रारंभ 19वीं शताब्दी के उत्तरार्ध से माना जाता है। मालवा में माँचों की परंपरा अविच्छिन्न रूप से चली आ रही है। उत्तर प्रदेश के पश्चिमी जिलों में नौटंकी का बड़ा प्रचार है। हाथरस की नौटंकी बड़ी प्रसिद्ध है। इसे 'स्वाँग' या 'भगत' भी कहते हैं। आगरा में 'भगत' नामक लोकनाट्य का प्रचुर प्रचार है। ब्रजमंडल में खुले हुए रंगमंच पर नौटंकी के ढंग पर 'भगत' का अभिनय किया जाता है। भिखारी ठाकुर के नाटक 'बिदेसिया' शैली भारत ही नहीं बल्कि विदेशो में भी बड़ा ही लोकप्रिय है जिसे देखने के लिए हजारों की भीड़ एकत्र हुआ करती है। महाराष्ट्र में तमाशा, ललित, गोंधल, बहुरूपिया और दशावतार आदि लोकनाट्य मराठी रंगमंच के आधार हैं। 'यक्षगान' दक्षिण भारतीय लोकनाट्य का वह प्रकार है जो तमिल, तेलुगु तथा कन्नड़ भाषा भाषी क्षेत्र की ग्रामीण जनता में प्रचलित है। तेलुगु में इसे 'विथि' या 'विथि भागवतम्' कहते हैं। यक्षगान की परंपरा अत्यंत प्राचीन है। यह नृत्य नाट्य (डांस ड्रामा) है जिसमें गीतबद्ध संवादों का प्रयोग होता है। इसमें वर्णन का प्राधान्य होता है। इसकी कथावस्तु रामायण, महाभारत और भागवत से ली जाती है। 'विथि नाटकम्' या 'विथि भागवतम्' तेलुगु का लोकनाट्य है। इस नाटक में एक या दो ही पात्र रंगमंच पर आते हैं। स्त्रियाँ सामूहिक रूप से नृत्य करती हैं। नृत्य और अभिनय के द्वारा कृष्णलीला को 'विथि नाटकम्' का विषय बनाया गया है। इस प्रकार भारत के विभिन्न राज्यों में लोकनाट्य प्रचलित हैं जो बड़े ही लोकप्रिय हैं।

लोकनाट्यों का लोकजीवन से अत्यंत घनिष्ठ संबंध है। यही कारण है कि लोक से संबंधित उत्सवों, अवसरों तथा मांगलिक कार्यों के समय इनका अभिनय किया जाता है। विवाह के अवसर पर अनेक जातियों में यह प्रथा है कि स्त्रियाँ

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बारात विदा हो जाने पर किसी 'स्वाँग' या 'साँग' का अभिनय प्रस्तुत करती हैं जिसे 'भोजपुरी' प्रदेश में 'डोमकछ' कहते हैं। लोकनाट्यों की भाषा बड़ी सरल तथा सीधी सादी होती है जिसे कोई भी अनपढ़ व्यक्ति बड़ी आसानी से समझ सकता है। जिस प्रदेश में लोकनाट्यों का अभिनय किया जाता है, नट लोग वहाँ की स्थानीय बोली का ही प्रयोग करते हैं। ये लोग अभिनय के समय गद्य का ही प्रयोग करते हैं। परंतु बीच-बीच में गीत भी गाते जाते हैं। लोकनाट्यों के संवाद बहुत छोटे तथा सरस होते हैं। लंबे कथोपकथनों का इनमें नितांत अभाव होता है। लंबे संवादों को सुनने के लिए ग्रामीण दर्शकों में धैर्य नहीं होता। अत: नाटकीय पात्र संक्षिप्त संवादों का ही प्रयोग करते हैं। लोकनाट्यों का कथानक प्राय: ऐतिहासिक, पौराणिक, या सामाजिक होता है। धार्मिक कथावस्तु को लेकर भी अनेक नाटक खेले जाते हैं। बंगाल के लोकनाट्य 'जात्रा' और 'कीर्तन' का आधार धार्मिक आख्यान होता है। राजस्थान में अमरसिंह राठौर की ऐतिहासिक गाथा का अभिनय किया जाता है। केरल प्रदेश में प्रचलित 'यक्षगान' नामक लोकनाट्य का कथानक प्राय: पौराणिक होता है। लोकनाट्यों में प्राय: पुरुष ही स्त्री पात्रों का कार्य किया करते हैं परंतु व्यवसायी नाटक मंडलियाँ साधारण जनता को आकृष्ट करने के लिए सुंदर लड़कियों का भी इस कार्य के लिए उपयोग करती हैं। लोकनाट्यों के पात्र अपनी वेशभूषा की अपेक्षा अपने अभिनय द्वारा ही लोगों को आकृष्ट करने की चेष्टा करते हैं। इन नाटकों के अभिनय में किसी विशेष प्रकार के प्रसाधन, अलंकार या बहुमूल्य वस्त्र आदि की आवश्यकता नहीं होती। कोयला, काजल, खड़िया आदि देशी प्रसाधनों से मुख को प्रसाधित कर तथा उपयुक्त वेशभूषा धारण कर पात्र रंगमंच पर आते हैं। कुछ पात्र प्रसाधन के लिए अब पाउडर और क्रीम का भी प्रयोग करने लगे हैं। लोकनाट्य खुले हुए रंगमंच पर खेले जाते हैं। दर्शकगण मैदान में आकाश के नीचे बैठकर नाटक का अभिनय देखते हैं। किसी मंदिर के सामने का ऊँचा चबूतरा या ऊँचा टीला ही रंगमंच के लिए प्रयुक्त किया जाता है। कहीं कहीं काठ के ऊँचे तख्तों का बिछाकर मंच तैयार किया जाता है। इन रंगमंचों पर परदे नहीं होते। अत: किसी दृश्य की समाप्ति पर कोई परदा नहीं गिरता। नाटक के पात्रगण किस पेड़ या दीवाल की आड़ में बैठकर अपना प्रसाधन किया करते हैं, जो उनके लिए 'ग्रीनरूप' का काम करता है।

आज भी आंध्र प्रदेश में लोकनाट्य परंपरा की एक शैली का नाम की 'वीथि नाटकम' मिलता है और आधुनिक नुक्कड़ नाटक अथवा स्ट्रीट थिएटर को भी इसी नाम से जाना जाता है। मध्यकाल में सही रूप में लोक नाटकों से मिलती-जुलती नाट्य-शैली का जन्म और विकास यदि भारत के विभिन्न प्रांतों, क्षेत्रों और बोलियों-भाषाओं में लोक नाटकों के रूप में हुआ तो उसी के समांतर पश्चिम में भी चर्च अथवा धार्मिक नाटकों के रूप में इंग्लैंड, फ्रांस, जर्मनी और स्पेन आदि देशों में ऐसे नाटकों का प्रचलन शुरू हुआ जो बाइबिल की घटनाओं पर आधारित होते थे और मूलत: धर्म के प्रचार के लिए ही खेले जाते थे। परम्परागत संचार भारत में ग्रामीण संचार व्यवस्था के मूल में है। लोक भावनाओं की यदि सर्वाधिक सशक्त अभिव्यक्ति संभव है तो वह परम्परागत संचार के विभिन्न माध्यमों द्वारा ही हो सकती है। लोकगीत जैसे कजरी, बिरहा, चैती, निर्गुण आदि लोकनृत्य जैसे भागड़ा, भरतनाट्यम, गरबा आदि। लोकवाद्य जैसे शहनाई, सितार, तबला आदि, लोक सम्मेलन जैसे मेला, हाट, बाजार, उत्सव आदि। लोककलाएं जैसे

चित्रकारी, कसीदाकारी आदि एवं लोकनाट्य जैसे रामलीला, रासलीला आदि सभी परम्परागत संचार के वाहक हैं। दृश्य-श्रव्य माध्यमों में नुक्कड़ नाटक, नौटंकी, रामलीला, कृष्णलीला, कठपुतली आदि है। नाटक - नाटक का विकास नृत्य से हुआ है। नृत्य का भाव व विचार का विस्तार होने के पश्चात् वह नाट्यरूपों में परिवर्तित हो गया। नाटक आम जनमानस के लिए परम्परागत रूप से मनोरंजन एवं जागरूक करने का माध्यम रहा है। हिन्दी प्रदेशों में लोक नाट्य का विकास 15वीं शताब्दी के बाद हुआ है। विभिन्न प्रदेशों के अपनी संस्कृति की झलक लिए हुए अलग-अलग लोक नाटक है। उत्तर प्रदेश में नौटंकी, बंगाल में जाला, मध्य प्रदेश में मंच, कर्नाटक में यक्षगण, तमिलनाडु में थेरूकुढ़, महाराष्ट्र में तमाशा, गुजरात में भवई मुख्य रूप से परम्परागत नाटक है।

निष्कर्ष -- परम्परागत जनसंचार माध्यम ग्रामीणों के करीब होने के कारण लोक संचार माध्यम भी कहे जाते हैं। यह माध्यम ग्रामीणों की रोजमर्रा जीवनशैली से मेल खाते हैं। इनकी सबसे बड़ी खूबी यह है कि कोई व्याकरण या साहित्य न होने के बाद भी इनका विकास मौखिक या क्रियागत स्रोतों के माध्यम से होता रहता है। परम्परागत माध्यमों के द्वारा मूल्यों और विचारों का एक पीढ़ी से दूसरे पीढ़ी तक हस्तान्तरण हुआ है। आधुनिक माध्यम के बहुमुखी विकास के बावजूद भी हमारी लोक संस्कृति में रचे बसे परम्परागत माध्यमों के प्रभाव में कमी नहीं हुई है। आज भी दिल्ली विश्वविद्यालय के विभिन्न महाविद्यालयों में आयोजित ऐसी नुक्कड़ नाट्य प्रतियोगिताओं में जो लोक नाट्य आयोजित हो रही है, जो सचमुच में आपको बाहर-भीतर से झिंझोड़कर रख देते हैं और सोचने पर विवश करते हैं। भारतीय लोक नाट्य केवल समृद्ध ही नहीं है बल्कि बहुरंगी और गतिमान भी है । हिंदी पट्टी के नाट्य-रूपों के अतिरिक्त कश्मीर का 'जश्न', राजस्थानी का 'ख्याल',गुजरात का 'भवाई', बंगाल का 'जात्रा',असम का 'अंकिया नाट', महाराष्ट्र का 'तमाशा', आन्ध्र प्रदेश का 'वीथी भागवत', तमिलनाडु का 'थेरुकुट्टू', कर्नाटक का 'यक्षगान', केरल का 'कथकली' इत्यादि अन्य लोकनाट्य रूप हैं, जो भारतीय रंगमंच की उपलब्धि हैं । भारत में अनेकता में एकता की बात की जाती है, वह इन लोकनाट्यों में दिखायी देती है। यह एकता कथानक, प्रदर्शन, पूर्वरंग, अभिनय, दर्शक-प्रभाव आदि से बनती है। जहाँ तक इनकी प्रस्तुति का गणित है, तो वह भी अलिखित तौर पर लगभग एक जैसा दिखाई पड़ता है । दरअसल, "इन लोकनाट्यों के पात्र अपनी परंपरागत शैली में मंच पर अभिनय करते हैं, किन्तु कोई भी यथार्थवादी शैली अपनाने का प्रयास नहीं करता । यहाँ तक कि किस गीत के साथ कैसा अभिनय, संवाद या नृत्य होगा, यह रूढ़ हो गया है। परिणामतः लोकनाट्यों का सम्पूर्ण आनंद उनकी परंपरागत शैली में निहित है। दर्शकगण उसकी तड़क-भड़क की अपेक्षा उसके काव्य-पक्ष का रस लेते हैं साथ परंपरागत संचार के रूप में अपनी प्रयोजनीय भूमिका का निर्वहन कर रहे है।

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चंपारण जिले के स्थानीय कृषि आधारित उद्योगों पर वैश्वीकरण का प्रभाव

प्रो. ज्ञानतोष कुमार झा, डॉ. प्रवीण कुमार झा

वैश्वीकरण के परिणामस्वरूप भारत के कई राज्यों में विदेशी निवेश हुआ, व्यापारिक माहौल बने, रोजगार के अवसर पैदा हुए, ग्रामीण विकास को गति मिली। जहां तक बिहार की बात है, यहाँ भी वैश्वीकरण का सकारात्मक प्रभाव पड़ता दिख रहा है। इसके कारण अंतर्राज्यीय व्यापार को बढ़ावा मिला, वस्तुओं एवं सेवाओं की कीमत में कमी आयी, उत्पादन लागत कम हुई, बिहार की कृषि उत्पादन क्षमता में वृद्धि हुई, डेयरी उत्पादन बढ़ा है। बेतिया के रहने वाले सामाजिक कार्यकर्त्ता पंकज राय कहते हैं कि ''वैश्वीकरण का प्रभाव चंपारण पर भी पड़ा है। लोगों में रोजी-रोजगार बढ़ा है। वैसे सिद्धांत के आधार पर मैं वैश्वीकरण की आलोचना करता हूं। आलोचना का मुख्य कारण यह है कि विकास की जो नीति है वह अंतिम आदमी तक नहीं पहुँच रही है।

शोध सार

चंपारण जिला आजादी के समय महात्मा गांधी के सत्याग्रह आंदोलन के कारण इतिहास में दर्ज हो गया। लेकिन आजादी के बाद बिहार के इस जिले की सुध किसी ने नहीं ली। चंपारण जिला बिहार के पिछड़े क्षेत्रों में गिना जाता है। कृषि और स्थानीय कृषि आधारित उद्योगों पर कोई ध्यान नहीं दिया गया। चंपारण समय के साथ नहीं चला। वैश्वीकरण के तमाम सकारात्मक और नकारात्मक प्रभावों से चंपारण जिला अछूता नहीं रहा। समग्र विकास, कृषि, पशुपालन, दुग्ध, कपास, गन्ना आदि कृषि आधारित स्थानीय उद्योग सरकारी उपेक्षा तथा वैश्वीकरण के कारण प्रभावित हुए। चंपारण के विकास के लिए संसाधनों के अलावा सरकारी तथा गैर सरकारी संगठनों के प्रयास की आवश्यकता अनुभव की जा रही है। प्रस्तुत शोध पत्र में इसी परिप्रेक्ष्य में वैश्वीकरण के बाद चंपारण पर उसके प्रभाव के अवलोकन का प्रयास है।

कुंजी शब्द - कृषि, स्थानीय कृषि उद्योग, वैश्वीकरण, चंपारण, समग्र विकास।

शोध पत्र

प्रस्तावना - विश्व की पांचवीं सबसे तेज गति से उभरती हुई अर्थव्यवस्था के रूप में भारत की वैश्विक पहचान बनी है। वैश्वीकरण और उदारवादी व्यवस्था को अपनाने के बाद से भारत में विदेशी निवेश हुआ, भारत को वैश्विक अर्थव्यवस्था से सीधे जुड़ने का अवसर मिला। भारतीय चिंतकों ने वैश्वीकरण और उदारवाद को लेकर अपनी चिंताएं व्यक्त की थी, कम या ज्यादा उनकी चिंताएं सही साबित हुई। बहुराष्ट्रीय कंपनियों और उनके मूल देश ने विश्व भर की अर्थव्यवस्था को अपने अनुकूल बनाने के लिए वैश्विक संस्थाओं को मजबूर किया। छोटे और गरीब देशों की बहुत सी कंपनियां या तो बिक गयीं या बंद हो गयीं। वैश्विक पूंजीपतियों के आगे उनकी एक न चली। पूरे विश्व में उपभोगवाद, उपभोक्तावाद इन दो श्रेणियों की स्थापना का तथा उपभोक्तावादी संस्कृति को उखाड़ फेंकने का संघर्ष चल रहा था। अभय कुमार दूबे के अनुसार "गांधीवादियों का नाखुश होना स्वाभाविक था, क्योंकि भूमंडलीकरण गांव की जगह शहर और नागरिक की जगह उपभोक्ता की सत्ता को अंतिम तौर पर स्थापित करने के आग्रह के साथ सामने आया है।"[1] भारत वैश्वीकरण और उदारवादी व्यवस्था से स्वयं को अलग नहीं रख सकता था। विभिन्न विचारधारा के नेताओं ने वैश्वीकरण को लेकर अपनी राय रखी। कुछ उसके समर्थन में थे तो कुछ विरोध में। हालांकि इसके दुष्परिणाम को उसे भुगतना पड़ा, लेकिन इसके कुछ अच्छे प्रतिफल भी मिले। विदेशी निवेश बढ़ा जिससे रोजगार और विकास आदि के मार्ग खुले। रजनी कोठारी के अनुसार, "भूमंडलीकरण के केवल दो दावे ऐसे हैं जिनके आधार पर वह कुछ बेहतर करने का दावा करता है, पहला, उसके कारण हथियारों की होड़ कमजोर पड़ जाएगी और दूसरा, अर्थशास्त्र और

प्रौद्योगिकी को मिला कर एक ऐसा भूमंडलीय बाजार बनेगा जिससे किस्म-किस्म की अर्थव्यवस्थाएं खुद जोड़ लेंगी।"[2]

अतीत वर्तमान का सहयात्री है और भविष्य वर्तमान का सबसे अधिक चेतनशील हिस्सा है। वैश्वीकरण वर्तमान समय का सर्वाधिक प्रासंगिक शब्द है। वैयक्तिक जीवन से लेकर सामाजिक जीवन के हर क्षेत्र पर इसका प्रभाव अच्छा अनुभव किया जा रहा है। लेकिन वैश्वीकरण को लेकर अभी तक न तो सामान्य जन में, न ही बौद्धिक जगत में कोई स्पष्ट छवि बन पायी है, लेकिन यह कहा जा सकता है कि वैश्वीकरण का तात्पर्य एक ऐसे विश्व से है जिसमें राष्ट्रीय सीमाओं और दूरियों से परे एकीकृत आर्थिक, राजनीतिक, सामाजिक और सांस्कृतिक प्रक्रियाएं होंगी। भूमंडलीकरण की अवधारणा को लेकर उपजी अस्पष्टता पर नीरज जैन लिखते हैं कि "भूमंडलीकरण के लिए वैश्वीकरण, विश्वायन, विश्वीकरण, ग्लोबलाइजेशन, जगतीकरण, नव साम्राज्यवाद, नव उपनिवेशवाद, नव उदारवाद जैसे शब्दों का बहुधा इस्तेमाल किया जाता रहा है।"[3]

वैश्वीकरण की वास्तविक शुरुआत आधुनिक काल में विशेषकर औद्योगीकरण के बाद हुई जिसने विश्व को समेटकर एक वैश्विक गांव का रूप देने की कोशिश की। 1991 में सोवियत संघ के विघटन तथा भारतीय अर्थव्यवस्था के खुलने से यह प्रक्रिया तीव्र तो हुई ही, भारत भी इस वैश्विक ग्राम का एक महत्त्वपूर्ण सदस्य बन गया। डॉ. बी. एल.फड़िया ने वैश्वीकरण की व्याख्या करते हुए कहा है, "भूमंडलीकरण, आर्थिक उदारीकरण, निजीकरण, बाजारोन्मुख अर्थव्यवस्था, निगमीकरण, प्रतिस्पर्धात्मक और खुली अर्थव्यवस्था जैसे नारे गूंजने लगे।"[4] अर्थशास्त्री एस. के. मिश्र वैश्वीकरण को स्पष्ट करते हुए कहते हैं कि, 'भारत में वैश्वीकरण शब्द का प्रयोग आम तौर पर देश की अर्थव्यवस्था को विश्व अर्थव्यवस्था के साथ एकीकृत रूप में देखने के लिए किया जाता है।'[5] जवाहर लाल कौल के अनुसार 'वैश्वीकरण विश्व के विभिन्न देशों के बीच आर्थिक सम्बन्धों, सहयोग और विनिमय को व्यापकता तथा गहराई देने की प्रक्रिया को कह सकते हैं।'[6] उद्योगपति लॉर्ड स्वराज पॉल भूमंडलीकरण को परिभाषित करते हुए कहते हैं कि, 'भूमंडलीकरण केवल व्यवसाय व व्यापार नहीं है, यह मस्तिष्क के ऐसे संगम के रूप में है जहां विचार व प्रतिभा बेरोकटोक एक-दूसरे राष्ट्र की सरहदों में आ-जा सकते हैं।'[7] कुमुद शर्मा के अनुसार, 'वैश्वीकरण एक ऐसी पूँजीवादी प्रक्रिया के रूप में भी देखा जा रहा है, जिसके आगे राष्ट्रीय सरकारें जनहित के लिए कोई कदम उठाने में असमर्थ हो जाती हैं। वे अंतर्राष्ट्रीय बाजार के नियम और शर्तों में बंध जाती हैं।'[8] डॉ. आर. ए. शर्मा के अनुसार, ''वैश्वीकरण एकरूपता एवं समरूपता की वह प्रक्रिया है जिसमें सम्पूर्ण विश्व सिमट कर छोटा हो जाता है। एक देश की सीमा से बाहर अन्य देशों में वस्तुओं एवं सेवाओं का लेन-देन करने वाले अंतर्राष्ट्रीय निगमों अथवा बहुराष्ट्रीय निगमों के साथ देश के उद्योगों की संबद्धता भूमंडलीकरण या वैश्वीकरण है।'[9] भूमंडलीकरण को किसी सर्वसामान्य परिभाषा में नहीं बांधा जा सकता। इसकी एक सरल परिभाषा दी गई है कि तकनीकी और संचार क्रांति ने विश्व को समेट कर एक विश्व ग्राम अर्थात् ग्लोबल विलेज में परिवर्तित कर दिया है। जिस विश्व ग्राम की कल्पना मार्शल मैक्लूहन ने की थी वह भारत में वैदिक काल से ही विद्यमान है। ऋग्वेद में ''विश्वं पुष्टं ग्रामे अस्मिन् अनातुरम्'' कहा गया है।[10] भारतीय विचारकों नें विश्व को परिवार माना जबकि अन्य विदेशी विचारकों ने इसे ग्राम जैसी ईकाई तक ही सीमित कर दिया।

भारत में वैश्वीकरण और उदारीकरण के आगमन के साथ ही मीडिया का विकास और विस्तार और तेज गति से हुआ। वैश्वीकरण की प्रक्रिया को सूचना क्रांति के कारण गति मिली। अनुभव यह किया गया है कि वैश्वीकरण के माध्यम से इन कम्पनियों ने अपना प्रभा मंडल ऐसा फैलाया कि तीसरी दुनिया के देशों की निर्भरता इन पर बढ़ती जा रही है। औद्योगिक विकास भी तभी हो सकता है जब कृषि में समृद्धि हो। पूर्व प्रधानमंत्री चौधरी चरण सिंह ने 1979 में प्रकाशित पुस्तक 'भारत की अर्थनीति व गांधीवादी रूपरेखा' में एक लेख लिखा था, जिसके अंश आज भी प्रासंगिक हैं' हमें केवल खाद्यान्न ही नहीं, कृषि से प्राप्त होने वाले कच्चे माल का भी आयात करना पड़ा। मिसाल के लिए, कपड़ा, भोजन के बाद मनुष्य के लिए सबसे अधिक आवश्यक वस्तु है, उसके उत्पादन के लिए आवश्यक कच्चा माल भी हमें बाहर से मंगाना पड़ा।'[11]

बिहार जैसे प्राकृतिक रूप से समृद्ध राज्य को संपूर्ण भारत में गरीब राज्य या बीमारू राज्य के रूप में देखा जाता रहा है। बिहार खराब सड़कों के लिए कुख्यात या बदनाम रहा है । यहाँ विभिन्न विचारधाराओं की सरकारें बनीं, पांच-पांच वर्ष तक का शासन रहा, लेकिन बिहार अपनी जगह पर कदमताल करता रहा। कुछ संवेदनशील सरकारों ने बिहार के विकास के लिए काफी प्रयास किये हैं, लेकिन वह अपर्याप्त है। चंपारण जिला आजादी के समय महात्मा गांधी के सत्याग्रह आंदोलन के कारण इतिहास में दर्ज हो गया। आजादी के बाद इस चंपारण की सुध किसी ने नहीं ली। चंपारण जिला बिहार के पिछड़े क्षेत्रों में गिना जाता है। कृषि और स्थानीय कृषि आधारित उद्योगों पर कोई ध्यान नहीं दिया गया। चंपारण समय के साथ नहीं चला। वैश्वीकरण के तमाम सकारात्मक और नकारात्मक प्रभावों से चंपारण जिला अछूता नहीं रहा। समग्र विकास, कृषि, पशुपालन, दुग्ध, कपास, गन्ना आदि कृषि आधारित स्थानीय उद्योग सरकारी उपेक्षा तथा वैश्वीकरण के कारण प्रभावित हुए। चंपारण के विकास के लिए संसाधनों के अलावा सरकारी तथा गैर सरकारी संगठनों के प्रयास की आवश्यकता अनुभव की जा रही है।

चंपारण के कृषि आधारित प्रमुख उद्योग

चंपारण की मिट्टी उपजाऊ और जलोढ़ मिट्टी है, जो समतल स्थलरूप सिंचाई के लिए उपयुक्त है। बिहार के चंपारण जिले की रेतीली-दोमट मिट्टी अनाज, दालें, फल और सब्जियों के साथ-साथ औषधीय और सुगंधित पौधों को उगाने के लिए अनुकूल है। चंपारण नियमित आधार पर कृषि अनुसंधान में उभरती प्रगति के साथ कृषि और संबद्ध व्यवसायों में व्यावसायिक प्रशिक्षण आयोजित करने के लिए अनिवार्य जिलों में फ्रंट लाइन विस्तार शिक्षा के लिए अग्रणी केंद्रों में से एक साबित हुआ है। चंपारण में लोगों की आय का मुख्य स्रोत कृषि है। कुछ कृषि आधारित उद्योग यहां फले-फूले हैं और सफलतापूर्वक चलाए जा रहे हैं। कुछ चावल मिलें भी सफलतापूर्वक चलाई जा रही हैं और उपज को जिले के बाहर विभिन्न स्थानों पर बेचा जा रहा है। उपलब्ध प्राकृतिक और कृषि उत्पादों पर आधारित कुटीर उद्योग स्थानीय जरूरतों को पूरा करते हैं जैसे गुड़ (कच्ची चीनी), टोकरी, रस्सी, चटाई बुनाई आदि। प्रसंस्करण एवं धुलाई हेतु जल की पर्याप्त उपलब्धता होने के कारण यहाँ कृषि कार्य पर्याप्त मात्रा में होता है। कृषि आधारित उद्योगों में चीनी, डेयरी, बेकरी, साल्वेंट निष्कर्षण, कपड़ा, डेयरी संयंत्रों, चावल मिलों, दाल मिलों, कृषि औजार, बीज उद्योग, सिंचाई उपकरण, उर्वरक, कीटनाशक आदि उद्योग प्रमुख हैं। इस वर्ग के उद्योग कृषि क्षेत्र द्वारा उत्पादित कच्चे माल पर निर्भर होते हैं। इनके उत्पादों में मुख्यतः उपभोक्ता सामान शामिल हैं। औद्योगिक उत्पादन में योगदान तथा रोजगार निर्माण की दृष्टि से कृषि-आधारित उद्योगों का महत्वपूर्ण स्थान है। बिहार में चीनी उद्योगों के प्रमुख केंद्र चम्पारण ही है। पश्चिमी चंपारण में मझौलिया, बेतिया के चनपटिया, नरकटिया गंज, बगहा, हरि नगर, लौरिया और पूर्वी चंपारण में मोतिहारी, सुगौली, चकिया चीनी मिलें स्थित हैं। प्रधानमंत्री सूक्ष्म खाद्य प्रसंस्करण उद्योग उन्नयन योजना के तहत 'वन डिस्ट्रिक्ट वन प्रोडक्ट स्कीम' के लिए पश्चिम चंपारण का चयन किया गया है। ताकि आत्मनिर्भर भारत, आत्मनिर्भर बिहार कार्यक्रम के तहत वहाँ 'वोकल फॉर लोकल' को बढ़ावा दिया जा सके। इसके लिए बागवानी मिशन को नोडल विभाग बनाया गया है। 'वन डिस्ट्रिक्ट वन प्रोडक्ट' के तहत गन्ना आधारित उद्योग लगाने पर उद्यमियों को 10 लाख तक का अनुदान सरकार देगी। सहायक निदेशक उद्यान विवेक भारती ने बताया की लागत की 35 फ़ीसदी राशि सरकार अनुदान के रूप में वहन करेगी। इसमें सारी प्रक्रियाएं ऑनलाइन होगी। उद्यमियों को बैंकों का चक्कर नहीं लगाना पड़ेगा। इस योजना के तहत गन्ना आधारित उद्योग के विकसित होने की यहां असीम संभावना है। क्योंकि पश्चिम चंपारण में लगभग दो लाख हेक्टेयर में गन्ने की खेती होती है। गन्ने से गुड़, चॉकलेट आदि उद्योग को विकसित किया जाएगा। इसको लेकर जिला प्रशासन की ओर से क्षेत्र में जागरूकता अभियान भी चलाया जाएगा। वहीं इस तरह के उद्योग विकसित होने पर किसानों की रूचि गन्ना उत्पादन की ओर बढेगी। इससे मजदूरों के पलायन पर रोक लगेगी साथ ही पश्चिम चंपारण का विकास होगा।[12]

बिहार के मुख्यमंत्री श्री नितीश कुमार के साथ सुगौली में किसानों से हुए संवाद में बेलई के किसान हरिशंकर प्रसाद कहते हैं कि सीएम की पहल से पिछले 20 साल से परेशान किसानों का खुशहाल जीवन लौट आया है। किसान धर्मेन्द्र कुमार नायक कहते हैं कि अब बेटी की शादी की चिंता यहां के किसानों को नहीं रही, क्योंकि गन्ना का उत्पादन करने पर उन्हें समय पर भुगतान हो रहा है। हरसिद्धि के मटियरिया निवासी सत्यानारायण प्रसाद कहते हैं कि गन्ना मंत्री किसानों को ईंख की नवीनतम शोध से लेकर इसके बेहतर उत्पादन के बारे में बताते रहते हैं। उन्होंने लोगों को रिंग व स्टैंड विधि की जानकारी देकर बेहतर उत्पादन लेने का गुर बताया है। कुमार शिवशंकर मांग करते हैं कि चकिया व मोतिहारी चीनी मिल भी खुलवाई जाय व बैंक केसीसी से भ्रष्टाचार को दूर किया जाय। अनुदान की आधी राशि बैंक व दलाल हड़प ले रहे हैं। लौकरिया के किसान विजय कुमार सिंह ने कहा कि चीनी मिल चालू होने से अब किसान गन्ने की खेती की ओर मुड़े हैं।'[13]

चंपारण के स्थानीय कृषि उद्योगों पर वैश्वीकरण का प्रभाव

वैश्वीकरण के परिणामस्वरूप भारत के कई राज्यों में विदेशी निवेश हुआ, व्यापारिक माहौल बने, रोजगार के अवसर पैदा हुए, ग्रामीण विकास को गति मिली । जहां तक बिहार की बात है, यहाँ भी वैश्वीकरण का सकारात्मक प्रभाव पड़ता दिख रहा है। इसके कारण अंतर्राज्यीय व्यापार को बढ़ावा मिला, वस्तुओं एवं सेवाओं की कीमत में कमी आयी, उत्पादन लागत कम हुई, बिहार की कृषि उत्पादन क्षमता में वृद्धि हुई, डेयरी उत्पादन बढ़ा है। बेतिया के रहने वाले सामाजिक कार्यकर्त्ता पंकज राय कहते हैं कि 'वैश्वीकरण का प्रभाव चंपारण पर भी पड़ा है। लोगों में रोजी-रोजगार बढ़ा है। वैसे सिद्धांत के आधार पर मैं वैश्वीकरण की आलोचना करता हूं। आलोचना का मुख्य कारण यह है कि विकास की जो नीति है वह अंतिम आदमी तक नहीं पहुँच रही है। सरकार की तरफ से पंचायत में पैक्स नाम की संस्था खुली है जो बेईमानी से भरी है। पूरे बिहार में कुल 9 चीनी मीलें हैं जिनमें जिनमें छह चीनी मील चंपारण में ही हैं। मोतिहारी चकिया और चनपटिया कि चीनी मिलें बंद हैं। खेती में सब्जी और मक्का की खेती बड़ी है, लेकिन उसके लिए एक निश्चित बाजार नहीं है। यही समस्या चंपारण की कृषि आधारित उद्योगों की है।'[14] मोतिहारी के रहनेवाले और टाइम्स ऑफ़ इंडिया के वरिष्ठ पत्रकार चंद्रभूषण पाण्डेय का कहना है, ''हम लोग भारत और नेपाल सीमा-क्षेत्र में बसे हुए हैं, जहां यातायात की सुविधा बहुत कम है। यातायात की सुविधा हो तो कम आमदनी में भी अच्छा जीवन जिया जा सकता है और रोजगार का सृजन कर सकता है। छोटे किसान फल और अनाज का उत्पादन कर रहे हैं, तो उसका उचित मूल्य नहीं मिल रहा है। साथ ही, सही समय पर उनका

उत्पाद बाहर नहीं जा रहा है और बिचौलिए इसका लाभ उठाते रहे हैं। भूमंडलीकरण के प्रभाव से उनकी आमदनी बढ़ जानी चाहिए थी। कुटीर उद्योग से उत्पादित चीजों का बढ़िया मूल्य मिलना चाहिए था,लेकिन यहां के लोगों को वह लाभ नहीं मिल रहा है।''[15]

चंपारण के वरिष्ठ पत्रकार आशुतोष झा का मानना है कि ''भूमंडलीकरण का प्रभाव निश्चित रूप से चंपारण पर पड़ा है। सड़क, रेलवे लाइन के क्षेत्र में विस्तार हुआ है तथा नये स्कूल व कॉलेज खुले हैं। यहां तक कि गाँधी जी के नाम से केंदीय विश्वविद्यालय भी चंपारण की धरती पर खुला है। स्थानीय कृषि उद्योगों की बात की जाए, तो सुगौली चीनी मिल जो बंद पड़ा था उसको एचपीसीएल के द्वारा दुबारा से संचालित किया गया है।''[16] यही कारण है कि भारत के आर्थिक विकास में बिहार महत्वपूर्ण भूमिका निभा रहा है। वर्ष 2016-17 में बिहार का जीडीपी 10.3 प्रतिशत रहा है। यह भारत के सभी राज्यों के जीडीपी में 14 वें स्थान पर था। पूर्वी चंपारण के हरसिद्धि और बांका प्रखंड में एचपीएसीएल गैस वाटलिंग प्लांट लगाया गया। स्थानीय कृषि उत्पादों को बाजार की तलाश बनी रही, किसानों को उनकी उपज का सही मूल्य नहीं मिल पाया तथा बाढ़ और सूखा ने किसानों की कमर तोड़ दी। रही सही कसर सरकारी उपेक्षा ने पूरी कर दी।

निष्कर्ष - चंपारण जिला कृषि आधारित उद्योगों के कारण काफी समृद्ध क्षेत्र के रूप में जाना जाता रहा है। वैश्वीकरण, उदारीकरण के बाद से भारत के विभिन्न राज्यों में कृषि, उद्योग तथा स्थानीय लघु उद्योगों को अपने उत्पाद को वैश्विक बाजार में पहुंचाने का अवसर मिला वहीं इसका दूसरा पहलू भी था जो काफी भयानक साबित हो रहा है। बहुराष्ट्रीय कंपनियों के आगे कमजोर अर्थव्यवस्था वाले या गरीब देशों के छोटे उद्योगों तथा भारत के पिछड़े राज्यों के उत्पादों के लिए बाजार में पर्याप्त अवसर नहीं मिला, जैसे बड़ी मछली छोटी मछलियों को निगल जाती है ठीक वैसा ही हाल छोटे उद्योगों के साथ भी हुआ। बिहार इससे अछूता नहीं रहा। चंपारण जैसे कई अन्य जिलों को भगवान भरोसे छोड़ दिया गया जिससे ये सभी क्षेत्र और अधिक पिछड़ते चले गए। वैश्वीकरण के दौर में चंपारण में कृषि आधारित उत्पादों का व्यापार काफी कमजोर साबित हुआ। हालांकि इस क्षेत्र में उद्योग और व्यापार की असीम संभावनाएं व्याप्त हैं।

वर्तमान में प्रत्येक जिले में भारतीय कृषि अनुसंधान परिषद व राज्य कृषि विश्वविद्यालयों द्वारा कृषि विज्ञान केन्द्र अथवा ज्ञान केन्द्रों की स्थापना की गई है। इन केन्द्रों पर कार्यरत वैज्ञानिक समय-समय पर कृषि आधारित उद्योगों के लिए तकनीकी प्रशिक्षण देते हैं। खाद्य प्रसंस्करण विभाग द्वारा फल व सब्जियों के मूल्य-संवर्धन व परीक्षण को प्रोत्साहित करने के लिए साहित्य व पैम्फलेटों के निःशुल्क वितरण के साथ-साथ प्रशिक्षण भी दिया जाता है। इसके अलावा, केन्द्र सरकार के विभिन्न मंत्रालयों, राज्य सरकारों द्वारा भी कृषि-आधारित उद्योगों के बारे में युवाओं को प्रशिक्षण दिया जाता है। इस प्रकार कई ऐसे कृषि-आधारित उद्योग हैं, जिनमें थोड़ी-सी मेहनत एवं प्रशिक्षण प्राप्त करके ग्रामीण स्तर पर स्वरोजगार आरम्भ किया जा सकता है। उपरोक्त योजनाओं व जानकारी के आधार पर कोई भी ग्रामीण बेरोजगार यह निर्णय कर सकता है कि कृषि-आधारित उद्योगों में से अपनी परिस्थिति के अनुसार वह कौन से उद्योग को अपनाकर अपनी आजीविका चलाने के साथ-साथ लाभ भी कमा सकता है। इसके अतिरिक्त इन उद्योगों की शुरुआत करने से पहले किन-किन बिन्दुओं पर विचार करना आवश्यक है। सरकार द्वारा कौन-कौन सी योजनाएं, सुविधाएं व अनुदान उपलब्ध कराए जा रहे हैं, आदि जानकारियों का लाभ उठाकर ग्रामीण बेरोजगार व्यक्ति स्वरोजगार की तरफ उन्मुख हो सकता है।

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गरीबी व ग्रामीण विकास की उपेक्षा और मीडिया

(बिहार के चंपारण जिले के विशेष संदर्भ में)

भारत औपनिवेशिक राज्य था अंग्रेजों के शासन काल में विकास की जो परिपाटी बनी थी वह आजादी के बाद के कई दशकों तक दिखाई देता है, यानि नगरीय विकास को ही विकास का वास्तविक मानक माना गया। कहीं न कहीं गांवों की उपेक्षा की गयी। दुनिया की नजर भारत की विशाल जनसंख्या और उसके बाजार पर है। इस बाजार के बल पर भारत का विकास तेजी से हो सकता है। 2020 तक भारत विकसित देशों की श्रेणी में खड़ा हो जायेगा। अब तक अपनाए गए विकास के शहरी मॉडल के कारण गरीबी, बेरोजगारी, भुखमरी, अशिक्षा आदि गांव के हिस्से छोड़ दिया गया। आज भारत के दो रूप दिखायी पड़ते हैं– एक गरीब भारत तथा दूसरा अमीर भारत। यानि शहरी भारत और ग्रामीण भारत। नीति नियंता शायद यह भूल गए थे कि बिना ग्रामीण विकास के भारत के विकसित होने की कल्पना नहीं की जा सकती। भारत कृषि प्रधान देश आज भी है। अधिकांश आबादी कृषि या उससे संबंधित रोजगार से जुड़ी है। पंचवर्षीय योजनाओं में गांवों को ध्यान में रखकर नीतियां तो तय की गयीं लेकिन उनका अनुपालन समुचित ढंग से नहीं किया गया। लिया है। बिहार के चंपारण जिले के गांवों की कहानी इससे अलग नहीं है। देश का नेतृत्व करने वाले नेता, प्रशासनिक अधिकारी, साहित्यकार, शिक्षाविद् आदि देने वाली इस उर्वर भूमि की सर्वाधिक उपेक्षा की गई। लघु उद्योग या तो बंद हो चुके हैं या बंदी की कगार पर है, कृषि में घाटे के कारण अनाज उत्पादन प्रभावित हो रहा है, नौजवान रोजगार के लिए दूसरे राज्यों में पलायन करने को मजबूर हैं। मीडिया में ग्रामीण विकास से संबंधित खबरों की उपेक्षा की गयी यह कहना अतिश्योक्ति नहीं होगी। गांवों की खबरें तभी जगह पाती हैं जबकि किसान आत्महत्या कर लेता है या बहुत बड़ी दुर्घटना घट जाए।

गरीबी उन्मूलन के नाम पर बातें बहुत की गयीं लेकिन न तो गरीबी कम हुई और न ही गरीबों के जीवन में कोई सुधार आया। आज करोड़ों ऐसे लोग हैं जिन्हें दो वक्त की रोटी ढंग से मिल सके। शेष चीजें जैसे, कपड़े, घर, पानी की सुविधा, शिक्षा, स्वास्थ्य आदि उसके लिए सिर्फ कान में घुलने वाले शब्द ही लगते हैं। सरकारें गरीबों को ध्यान में रख कर हजारों योजनाएं बनाती हैं लेकिन उसके समुचित क्रियान्वयन के अभाव में गरीबी लाइलाज बीमारी की तरह बढ़ती ही गई। रंगराजन समिति के आंकड़ों के अनुसार करीब 30 करोड़ लोग गरीब हैं। गरीबों की जरूरतें बड़ी हैं उनकी संख्या बड़ी है किन्तु उनकी अपनी आय उन्हें पूरा करने तथा राज्य को विवश कर पूरा कर सकने की ताकत या क्षमता अपेक्षाकृत कमजोर है।

आर्थिक विकास का सबसे अधिक सर्वमान्य संकेतक तय भौगोलिक सीमा के भीतर और निश्चित अवधि में मूल्यों पर आधारित वास्तविक सकल घरेलू उत्पाद यानि जीडीपी की औसत वार्षिक वृद्धि होती है। आजादी के बाद, निम्न स्तर की समानता के दुश्चक्र को तोड़ना एक बड़ी चुनौती थी। आर्थिक वृद्धि के विकास के दूसरे चरण 1950–81 की अवधि के दौरान सार्वजनिक क्षेत्र के उपक्रमों के गठन और नियंत्रण लाइसेंस प्रणाली और उच्च करों से आर्थिक क्षेत्र में सामान्यतया और समाजवादी तरीके से आत्मनिर्भरता प्राप्त करने का प्रयास किया गया। 2014 का आम चुनाव विकास के मुद्दे पर ही लड़ा गया। राज्य का स्वरूप विकास के स्वरूप पर एक बहुत खास प्रभाव डालने वाला कारक बना रहेगा। भूमंडलीकरण

का हमारी विकास नीतियों और उनके द्वारा मिले नतीजों पर गहरा असर पड़ रहा है। आयात की खुली छूट, आयात शुल्क में कमी तथा विदेशी कंपनियों के भारत में बढ़ते निवेश के कारण विनिर्माण क्षेत्र में गिरावट आयी है। खेती में लोगों की रूचि और उससे प्राप्त मुनाफा घट रहा है। कृषि में जमीन भी घट रही है। कोलिन क्लार्क के अनुसार, किसी देश में आर्थिक विकास की प्रक्रिया जैसे–जैसे आगे बढ़ती है, कार्यशील जनसंख्या की संलग्नता का अनुपात प्राथमिक व्यवसायों में घटकर क्रमशः द्वितीयक एवं तृतीयक व्यवसायों में बढ़ता जाता है। रोस्टोव के अनुसार, आर्थिक विकास की प्रक्रिया पांच अवस्थाओं से गुजरकर अपनी चरम सीमा पर पहुंचती है। ये पांचों अवस्थाएं– परंपरागत, पूर्व उत्थान काल, स्वयं स्फूर्ति की अवस्था, परिपक्वता की अवस्था और अधिकाधिक उत्पादन एवं उपभोग की अवस्था। नोबेल पुरस्कार विजेता राबर्ट लुकास ने कहा था कि, जब आप आर्थिक विकास के बारे में सोचना शुरू करते हैं, तो किसी अन्य विषय के बारे में सोचना कठिन होता है। एक प्रगतिशील व समृद्ध अर्थव्यवस्था के लिए सरकार का सक्षम, दक्ष, पारदर्शी होना और सुशासन के लिए प्रतिबद्ध रहना बेहद जरूरी होता है। यही कारण है कि शीर्ष स्तर पर पहुंचने से पहले दुनिया की अर्थव्यवस्थाओं ने गवर्नेंस स्ट्रक्चर को कुशल और पारदर्शी बनाने पर अधिक जोर दिया।

ग्रामीण विकास की वस्तुस्थिति – भारत की आजादी के 68 वर्षों के बाद भी गांवों के विकास पर समुचित ध्यान नहीं दिया गया। हमारे देश के करीब 6 लाख गांवों की गलियां कच्ची हैं, मिट्टी, धूल, घास–फूस, कीचड़, कंकड़–पत्थर और अनेक तरह की गंदगी से अटी रहती हैं। 2011 की जनगणना के अनुसार देश के कुल 24.39 करोड़ परिवारों में से 17.91 करोड़ परिवार गांवों में रहते हैं। इसमें से 10.69 करोड़ परिवार वंचितों की श्रेणी में सूचीबद्ध किए गए हैं जिनकी हालत दयनीय है। इनमें से 5.37 करोड़ परिवार भूमिहीन हैं, जो दिहाड़ी मजदूरी के भरोसे जीवन यापन करते हैं। यही नहीं ग्रामीण क्षेत्र के 2.5 करोड़ परिवार एक कमरे के कच्चे मकान में रहते हैं। ग्रामीण भारत के 73 प्रतिशत परिवार की कुल मासिक आय 5 हजार रूपये से भी कम है। 10 हजार रूपये से अधिक की आय वाले ग्रामीण परिवारों का प्रतिशत 8 है। पांच हजार रूपये प्रतिमाह से कम आय पर गुजारा करने वाले परिवारों की राज्यवार प्रतिशत में स्थिति इस प्रकार से है – ओडिसा में 88 प्रतिशत, प0 बंगाल 82 प्रतिशत, झारखंड 77, बिहार 70, छत्तीसगढ़ 91, उ0प्र0 72, म0प्र0 84, उत्तराखंड 60, पंजाब 58, हरियाणा 59, जम्मू–कश्मीर 67 तथा हिमाचल प्रदेश में 53 प्रतिशत।

चंपारण जिले में ग्रामीण विकास की चुनौतियां – पूर्वी चंपारण और प0 चंपारण बिहार के दो जिले हैं। ऐतिहासिक दृष्टि से महत्वपूर्ण भारत और नेपाल की सीमा से लगा यह क्षेत्र भारतीय स्वतंत्रता आंदोलन के समय बहुत चर्चित जिला था। महात्मा गांधी जी ने अपने सत्याग्रह का आरंभ यहां से कर अंग्रेजों के सामने मुश्किलें खड़ी कर दी थी। कृषि आधारित उद्योगों के दम पर चंपारण का व्यापार चलता है। किंतु आजादी के बाद से यहां के हालात खराब होते गए। देश के बाकी गांवों की तरह ही यहां भी गरीबी और ग्रामीण विकास दोनों की उपेक्षा की गई। तमाम लघु एवं कुटीर उद्योग बंद हो गए। बाढ़ एवं सूखे जैसी प्राकृतिक आपदाओं ने यहां के किसानों का हाल बुरा कर दिया है। लोग पलायन को मजबूर हुए।

ग्रामीण क्षेत्र के प्राथमिक, माध्यमिक, इण्टरमीडिएट कालेजों में शिक्षकों की कमी तथा नियुक्त शिक्षकों की अनुपस्थिति, बदहाल प्राथमिक स्वास्थ्य केंद्र, सरकारी अस्पतालों में डाक्टरों तथा दवाओं का अभाव, कच्ची गलियां, समाप्त हो चुकी सड़कें किसी भी प्रकार के विकासात्मक कार्यों के राह में रोड़ा बनने के लिए पर्याप्त कारण है। इसके पीछे ठेकेदार, सरकारी अधिकारी व नेताओं की मिली भगत ही कारण है। आखिर ऐसा क्यों होता है कि महीने भर पहले बनी सड़कें या तो गड्ढों में बदल जाती हैं या पहली बरसात में ही उखड़ जाती हैं। इतना ही नहीं कई सड़कें तो केवल कागजों पर ही बन जाती हैं और उनका पैसा भी भुगतान हो जाता है। गांवों में आज भी स्वच्छ पेयजल की सुविधा सरकार उपलब्ध नहीं करा पायी है। बहुत से ऐसे गांव आज भी हैं जहां लोग तालाबों, पोखरों या नदियों के जल से काम चलाते हैं। चंपारण

जिले में बिजली की उपलब्धता एक बड़ी समस्या है। इससे सबसे ज्यादा छोटे उद्यमी, किसान ही प्रभावित होते है। सिंचाई के लिए मशीनों को चलाने के लिए समय पर बिजली न मिलने से फसलों की उत्पादकता पर बुरा प्रभाव पड़ता है। फसलों के सही मूल्य किसानों को मिले इसकी व्यवस्था आज तक नहीं हो पायी है। गन्ना किसानों का भुगतान न होने के कारण उनका बहुत नुकसान हुआ। कर्ज में फंसे किसानों की मजबूरी का फायदा उठाते दलालों के जाल में फंस कर किसान अपनी फसल औने–पौने दाम पर बेचने को मजबूर होते हैं। समय पर खाद की आपूर्ति न होने के कारण फसल की उत्पादकता प्रभावित होती है, किसानों को ज्यादा पैसे दे कर बाजार से खाद खरीदना पड़ता है। खेतों में रासायनिक खादों के अंधाधुंध प्रयोग से जमीन की उर्वरा शक्ति समाप्त हो रही है, भू–जल प्रदूषित हो रहा है। भूमिगत जल में आर्सेनिक की बढ़ी हुई मात्रा कई गंभीर बिमारियों का कारण बन रही है।

गांव के गांव वीरान से होते जा रहे हैं। हालात तो यहां तक पहुंच चुके हैं कि किसी किसी गांव में दो–चार परिवार ही बचे हुए हैं। ये वो लोग हैं जो पैतृक भूमि से जुड़े रहने तथा जीवन यापन के काम चलाऊ साधन उपलब्ध होने या फिर मजबूत आर्थिक स्थिति वाले ही हैं। स्व–रोजगार के लिए उत्पादित माल के लिए बाजार न मिलने और उससे होने वाले घाटे से डर कर परंपरागत कामों को भी छोड़ कर शहरों में मजदूरी करने, रिक्शा चलाने या किसी फैक्ट्री में काम करने को तैयार हो जाते हैं। ग्रामीण अर्थव्यवस्था में सुधार के संदर्भ में गांधी जी के विचार आज भी प्रासंगिक हैं। अपने लेख में उन्होंने कहा था कि, ग्रामोद्योग की योजना के पीछे मेरी कल्पना तो यह है कि हमें अपनी रोजमर्रा की आवश्यकताएं गांवों की बनी चीजों से ही पूरी करनी चाहिए और जहां तक मालूम हो कि अमुक चीजें गांवों में मिलती ही नहीं हैं वहां हमें यह देखना चाहिए कि उन चीजों को थोड़े परिश्रम और संगठन से बना कर गांव वाले उनसे कुछ मुनाफा कमा सकते हैं या नहीं। मुनाफे का अंदाज लगाने में हमें अपना नहीं किंतु गांव वालों का ख्याल रखना चाहिए।

चंपारण जिले में ग्रामीण विकास और मीडिया – बिहार में सैकड़ों की संख्या में समाचार पत्र–पत्रिकाएं प्रकाशित होते हैं। राष्ट्रीय व स्थानीय टीवी चौनल और रेडियो देखे व सुने जाते हैं। सोशल मीडिया पर भी लोग सक्रिय हैं। मीडिया समाज जागृति, शिक्षा, मनोरंजन का सर्वसुलभ माध्यम है। आज सुदूर गांवों तक समाचार पत्रों की पहुंच है, लोगों की बढ़ती क्रय शक्ति से टीवी दर्शकों की बढ़ती संख्या, सबसे ज्यादा पहुंच वाला माध्यम रेडियो, मोबाइल फोन, स्मार्ट फोन तथा जहां तक कम्प्यूटर व इंटरनेट पहुंचा है वहां–वहां सोशल मीडिया की पहुँच है। आजादी के पहले मीडिया मिशन थी, जन सरोकारों के लिए लड़ने वाला मजबूत माध्यम था। आज इसका स्वरूप थोड़ा जन सरोकारी और ज्यादा व्यावसायिक होता दिख रहा है। इसके पीछे का बहुत बड़ा कारण मीडिया का बाजार भी है। मीडिया का वास्तविक बाजार शहरों तक ही केंद्रीत है। गांवों से न तो उतने विज्ञापन मिलते हैं और न ही प्रसार तथा पाठकों की संख्या अधिक होती है। आज का मीडिया विज्ञापनों के सहारे ही चल रहा है।

यही कारण है कि उसका सारा ध्यान गांवों की बड़ी आबादी को छोड़ कर शहरों की आबादी पर रहता है। गांव की खबरें अखबरों, चौनलों तथा रेडियो में जगह पाने के लिए तरसती रहती हैं। दैनिक जागरण, अमर उजाला, हिंदुस्तान, प्रभात खबर आदि अखबारों के विभिन्न संस्करण चंपारण से प्रकाशित होते हैं, तथा टाइम्स आफ इंडिया, हिन्दुस्तान टाइम्स, इंडिया टुडे, पांचजन्य, फ्रंट लाइन आदि मैगजीन दिल्ली से प्रकाशित होती हैं। न्यूज नेशन, डीडी न्यूज, इंडिया न्यूज, एबीपी, एनडीटीवी आदि चौनलों तथा रेडियो के संवाददाता चंपारण में नियुक्त होते हैं। फेसबुक और टिव्टर जैसी सोशल मीडिया साइट्स से जुड़े लोग आस–पास की घटनाओं को अपडेट करते रहते हैं। लूट, डकैती, हत्या, दुर्घटना या अन्य अपराध से संबंधित खबरों की भरमार अखबारों में मिलती हैं। रेडियो या टीवी चौनलों में किसी गांव की खबर तभी जगह पाती है जबकि बाढ़ या भयंकर सूखे की स्थिति हो, किसानों ने आत्महत्या कर ली हो या खाप पंचायतों के फरमान का बतंगण बनाना हो या ऑनर किलिंग का मामला प्रकाश में आता है।

मीडिया का ही प्रभाव है कि राजनीतिक दलों को जन सरोकारों से संबंधित मसलों को लेकर प्रचार सभाओं में अपना दृष्टिकोण और एजेंडा रखना पड़ रहा है। स्वास्थ्य सेवाएं, खाद्य सुरक्षा, भुखमरी, गरीबी, कुपोषण, बेरोजगारी, सिचाई के साधनों की समस्या, पीने के पानी की समस्या, पौष्टिक भोजन की समस्या, खाद व बीज की समस्या, किसानों को कृषि तकनीकों की जानकारी का अभाव और मंहगे उपकरण तथा भू–अधिग्रहण आदि को खबरों और लेखों के जरिये गंभीरता से उठाया है। खेत, खलिहान, जंगल, तालाब, पोखरे, नदियां, बिजली, सड़क, पानी, घर, शिक्षा, स्वास्थ्य, रोजगार, गरीबी आदि मामलों को लेकर मीडिया ने कभी अभियान नहीं चलाया। जबकि पिछले कुछ महीनों में अखबारों ने शहरों के फुटपाथों, पार्कों, सड़क जाम, अस्पतालों की वयवस्था को लेकर न केवल पूरे पेज की खबर बनाया बल्कि इसे अभियान के रूप में लगातार चलाया।

केंद्र में नरेंद्र मोदी सरकार ने सांसदों से एक गांव को गोद लेने तथा आदर्श गांव के रूप में विकसित करने का आग्रह किया था। मीडिया जब तक सांसदों ने गांव गोद नहीं लिया था तब तक खबरें प्रकाशित करती रही, जब सांसदों ने अपने गांवों के नाम तय कर दिए उसके बाद से मीडिया साल भर बाद फिर सक्रिय हुई और उनकी बदहाली और अब तक कोई काम शुरू न किए जाने की खबरें प्रकाशित कर अपने कर्तव्य की इतिश्री कर ली। हालांकि समाचार पत्रों ने इस प्रकार के मामलों में संवेदनशीलता दिखायी है। समय–समय पर ग्रामीण विकास तथा किसानों से संबंधित मुद्दों पर न केवल खबरें प्रकाशित कीं बल्कि उसका फालोअप भी देते रहे। मामले के निपटारे तक दबाव बनाने का काम अखबारों ने किया। जिसके सकारात्मक परिणाम देखने को मिले हैं।

वैश्वीकरण के प्रभावों के चलते तथा नित आधुनिक प्रौद्योगिकीयों के आने के कारण पत्रकारिता एक उद्योग का रूप ले चुका है। बीच के कालखंड में इस मीडिया से गांव और गरीब खो गए से लगते थे, लेकिन अब यह अपने चेहरे को चमकाने तथा सरोकारों वाली पत्रकारिता को महत्व देने के कारण ग्रामीण विकास से संबंधित खबरों को महत्व देने लगी है। लेकिन वह भी अपर्याप्त है। शहरों जैसी व्यवस्था जब तक गांवों में नहीं पहुँचेगी तब तक देश के समावेशी विकास तथा विकसित भारत की कल्पना करना संभव नहीं है। भारत की गरीब जनता भूख, कुपोषण, मंहगाई, बेरोजगारी, अति जनसंख्या, मंहगी होती खेती, गांवों में मूलभूत सुविधाओं का अभाव, गांवों से शहरों की ओर पलायन आदि अनेकों समस्याओं से जूझ रही है। सरकारी योजनाओं में व्याप्त भ्रष्टाचार ने मामले को गम्भीर बना दिया है। गरीबों, किसानों, महिलाओं, कुपोषण व भुखमरी तथा दैनिक जीवन को चलाने के लिए धन की आवश्यकता हेतु पेंशन आदि अनेकों लाभकारी योजनाओं की जानकारी आम आदमी को नहीं होती है। इन मदों में व्यय करने के लिए निर्धारित धन या तो सरकार के खाते में वापस हो जाता है या फिर बंदरबांट होती है। प्रश्न यह उठता है कि केंद्र सरकार व राज्य सरकार की अनेकों कल्याणकारी योजनाओं के होते हुए भी गरीब निरंतर गरीब होता जा रहा है।

देशभर में आम आदमी के जीवन में व्यापक परिवर्तन क्यों नहीं हो रहा है ? भ्रष्टाचार, घोटाले, खाद्यान्न संकट, कुपोषण, खराब भण्डारण व भूख से मौत का मामला हो या किसानों द्वारा आत्महत्या करने का मामला हो, मीडिया ने पूरी संवेदना के साथ प्रमुखता से खबरों को प्रकाशित करके सरकार पर प्रत्यक्ष–अप्रत्यक्ष रुप से दबाव बनाने का काम किया तथा जनता को अपने अधिकारों को प्राप्त करने के लिए प्रेरित किया। चंपारण जिले में विकास के नाम पर टूटी सड़कें, उखड़ी हुई गलियां, सड़कों के नाम पर बड़े–बड़े गड्ढे, स्कूल, अस्पताल, नहरें, हैंडपंप, यातायात, बिजली, पीने का साफ पानी, पक्के घर, रोजगार के अवसर, गंदगी आदि गंभीर समस्याएं मौजूद हैं। चंपारण में न केवल गरीबी बल्कि गांवों का विकास यदि इसी प्रकार से उपेक्षित किया जाता रहा तो विकसित भारत का सपना सच कैसे होगा।

संदर्भ ग्रंथ–

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Article

Digital Media and Women's Political Participation in India

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Shipra Raj[1]

Abstract

Digital platforms have opened up new avenues of political participation for women across the globe, including India. The digital media facilitated by the Internet has revolutionised the social and political landscape. It is argued that digital tools like social media platforms have democratised women's political participation in India. The digital platforms have provided accessibility to women to raise their voices on these platforms through social and political mobilisation as well as community building. Cyberspace has offered newer forms of participation for women in India. From Nisha Susan-led Pink Chaddi campaign in 2009 to another women-led movement, #MeToo, which gained momentum in 2018, women in India have utilised the digital space to raise their voices against sexual violence, oppression and gender-based discrimination. Building on the large scholarship on media, democracy and participation, in this article, I look at how digital media has offered newer forms of political participation in India. Looking at the wide literature on this subject, I also discuss how digital media has led to the construction of feminist counter-publics in India. It is not that digital media has only offered the spaces to women to counter or challenge the dominant discourse; these spaces have also become hotbeds of trolling and online harassment.

Keywords

Women, digital activism, political participation, digital media

Introduction

The digital media facilitated by the Internet enormously impacts the political sphere. The advent of digital platforms has generated extraordinary interest in the relationship between media and politics. The study of the relationship between the

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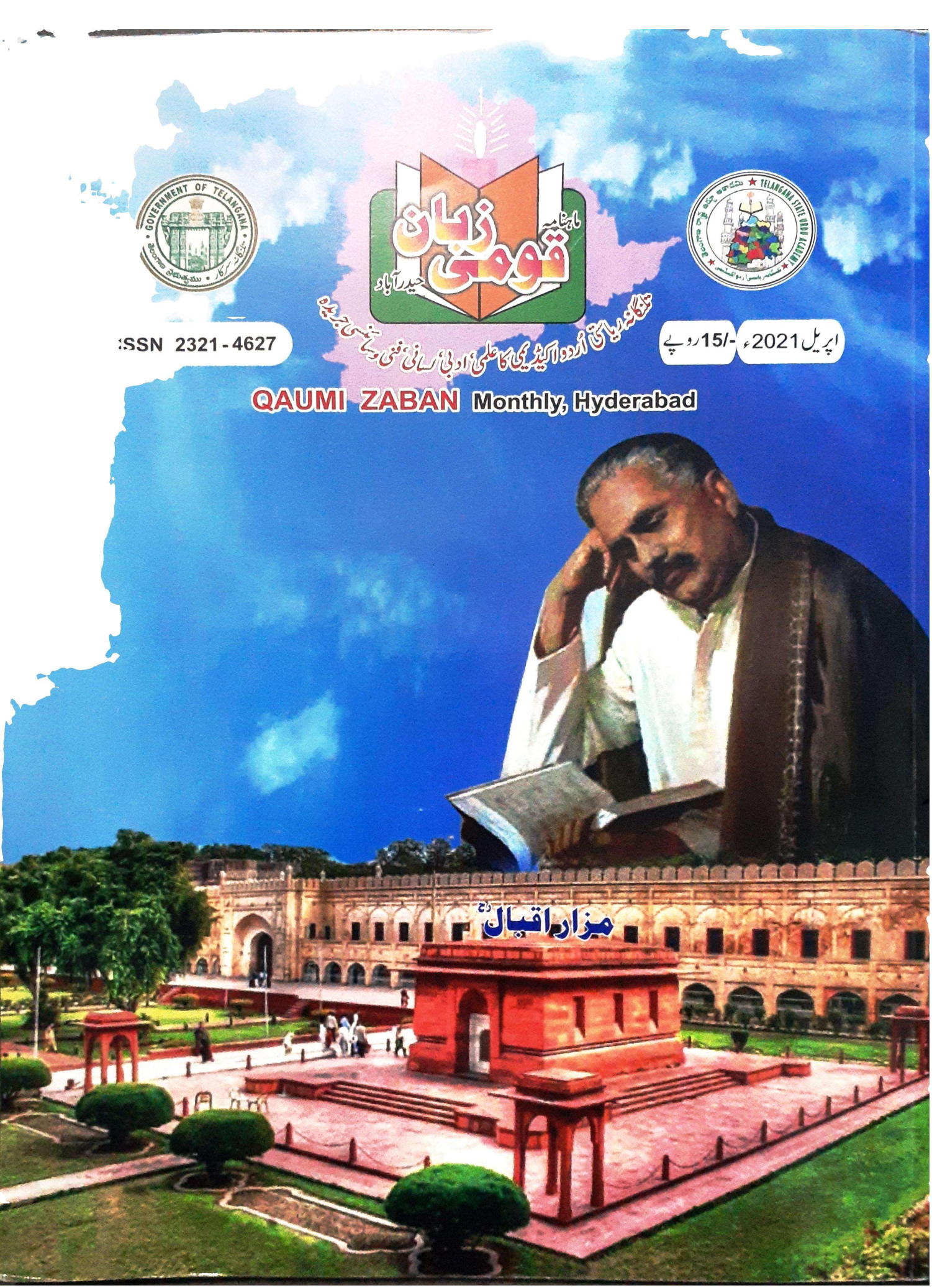

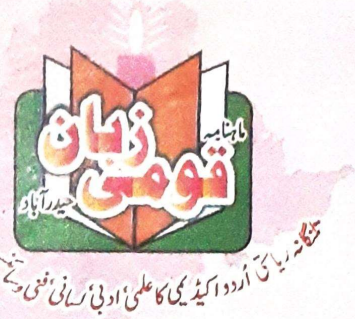

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☆

''قومی زبان'' میں شائع شدہ مضامین میں اظہار کردہ خیالات سے ادارہ کا متفق ہونا ضروری نہیں ہے۔

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قرینہ

oOo

سری سین کمار بھارتی

''بارش سنگ'' کسانوں کے حالات ومسائل کی ایک انوکھی داستان

تو قادر و عادل ہے مگر تیرے جہاں میں
ہیں تلخ بہت بندۂ مزدور کے اوقات
اقبالؔ

کہتے ہیں کہ کسی ملک کی خوشحالی کا اندازہ لگانا ہوتو اس ملک کی زراعت اور کاشتکاروں کی فلاح و بہبودی اور اس ملک کے کسان کو دیکھیں۔ اگر کسان خوشحال ہے تو سمجھیں ملک خوشحال ہے۔ واقعی کسانوں کی ترقی سے ہی ملک کی ترقی ممکن ہے۔ کیوں کہ ہندوستان ایک زرعی ملک ہے اور آج بھی عوام کی اکثریت زراعت کے شعبے سے منسلک ہے۔ کسان انداتا ہے اور ہمیشہ سے ہی ملک میں کسانوں کا تعاون رہا ہے۔ عالمگیریت کے دور میں ایسا لگتا تھا کہ اس کی صورتحال بہتر ہوگی لیکن آج کے بازاروادی دور میں وہ حاشیے پر چلا گیا ہے۔ آزادی کے اتنے سال گزر جانے کے بعد بھی کسانوں کو انصاف نہیں مل رہا ہے۔ اس کی فصل ایک معاشرتی پریشانی بن چکی ہے۔ وہ قرض تلے دبا ہوا ہے۔ کھاد، بجلی اور پانی کے مسائل سے پریشان ہے۔ کئی جہتوں پر اس کا استحصال کیا جارہا ہے۔ وہ بے شمار مسائل سے گھرا ہوا ہے۔ کبھی قدرتی آفات تو کبھی حکومت کی پالیسیاں اُس کی پریشانی کا سبب بنتی ہیں۔ فصل کی معقول قیمت نہ ملنا بھی آج ایک سنگین مسئلہ بن چکا ہے۔ اچھے بیجوں کی دستیابی اور تقسیم کی عدم مساوات کے مسئلے نے بھی کسانوں کا جینا مشکل کردیا ہے۔

این۔سی۔آر۔بی رپورٹ کے مطابق اب تک تین لاکھ سے زائد کسان خودکشی کر چکے ہیں۔ کسانوں کی خود کشی پورے ملک کے لیے باعث تشویش مسئلہ بن گئی ہے۔ کسانوں کی فلاح و بہبود کے لیے اسکیمیں یا تو فائیلوں میں بند ہوجاتی ہیں یا سرکار کے نمائندوں تک ہی رہ جاتی ہیں۔ سرکار کی اسکیمیں ویسے بھی کارگر نہیں رہی ہیں پھر بھی جو اسکیمیں بنائی گئیں اس کا عمل درآمد صحیح ڈھنگ سے نہیں ہو پاتا ہے۔ نتیجتاً کھیتی کے نئے طریقوں کے تئیں معلومات کا فقدان اور بجلی، کھاد اور زرعی آلات کی قیمتوں میں اضافے کی وجہ سے کسان کھیتی سے لاگت کی قیمت بھی نہیں نکال پا رہا ہے۔ آج کسانوں کے سامنے ناخواندگی، غریبی، فاقہ کشی اور خودکشی جیسے بہت سارے مسئلے کھڑے ہیں۔ ملک کی غالباً آدھی فیصد سے زائد آبادی حکومت اور سماج دونوں کے یہاں حاشیے پر ہے۔ بہرکیف یہاں کسانوں اور مزدوروں کی ناگفتہ بہ حالت کو اردو ادب کے تناظر میں دیکھنا مقصود ہے۔ اردو ادب بالخصوص ترقی پسند دور میں ادیبوں نے کسانوں، مزدوروں اور متوسط لوگوں کی خارجی زندگیوں میں پیدا شدہ مسائل کو ہی موضوع بنایا ہے۔ اگر ہم آزادی کے بعد کے اردو ادب کی بات کریں تو ہمیں ایسے ناول بھی ملتے ہیں جنھوں نے اپنے ناولوں میں کسانوں اور مزدوروں کے مسائل کو ہی موضوع بنایا ہے۔ ان میں حیات اللہ انصاری کا ''لہو کے پھول''، عصمت چغتائی کا ''معصومہ''، قرۃ العین حیدر کا ''آگ کا دریا''، عبد اللہ حسین کا ''اداس نسلیں''، شوکت صدیقی کا ''خدا کی بستی'' راجندر سنگھ بیدی کا ''ایک چادر میلی سی'' قاضی عبد الستار کا ''شکست کی آواز'' اور جیلانی بانو کا ناول ''بارش سنگ'' وغیرہ

مضامین

قابل ذکر ہیں۔ یہاں ہماری مراد جیلانی بانو کے ناول ''بارش سنگ'' سے ہے۔

جیلانی بانو کا شمار عہد حاضر کے مشہور و معروف خواتین فکشن نگاروں میں ہوتا ہے۔ان کی تخلیقات کا کینوس وسیع ہے۔وہ اپنے عہد کا اچھا شعور رکھتی ہیں اور فنی پختگی سے اپنے مشاہدات کو اپنی تخلیقات میں پیش کرتی ہیں۔ جیلانی بانو کی شخصیت، فکر وفن کے متعلق مشرف علی ایک جگہ لکھتے ہیں:

''جیلانی بانو ہمہ جہت شخصیت کی مالک ہیں۔ان کی شخصیت [redacted] کے گھر کے ادبی ماحول، اس عہد کی [redacted] سیاسی و سماجی فضا نے اہم رول ادا کیا ہے۔انہوں نے اپنے مطالعے، مشاہدے اور تجربے سے اپنے فکر وفن کو نیا آہنگ و وقار بخشا، اپنا مزاج، لہجہ اور اسلوب خود تراشا۔وہ جس ماحول و معاشرے کو اپنے ناولوں اور افسانوں کا موضوع بناتی ہیں اس کی حقیقی عکاسی کرتی ہیں۔ حقیقت پسندی، حالات و مسائل سے نبرد آزما ہونے کا حوصلہ موثر انداز میں ان کے یہاں موجود ہے۔ ان کا نقطۂ نظر حقیقت پسندانہ ہے۔ ان کے یہاں فکر وفن کا حسین امتزاج پایا جاتا ہے۔''[1]

''بارش سنگ'' جیلانی بانوں کا ایک شاہکار ناول ہے جو 1985ء میں منظر عام پر آیا۔یہ ناول تلنگانہ کسان تحریک کے پس منظر میں لکھا گیا ہے۔حیدرآباد کے جاگیردار طبقے کے ظلم و جبر اور معاشی استحصال کے خلاف تلنگانہ کسان تحریک کا جنم ہوا۔اس تحریک کا آغاز کمیونسٹ پارٹی کے بینر تلے ہوا۔ جاگردار طبقہ کے ظلم و جبر سے تنگ آکر غریب کسانوں و مزدوروں نے بغاوت کا پرچم بلند کیا جسے تاریخ تلنگانہ تحریک سے جانتی ہے۔اس ناول میں ملک کی آزادی سے قبل اور بعد کے کچھ برسوں تک حیدرآباد کے دیہی علاقوں میں رہنے والے غریب کسانوں، مزدوروں اور عورتوں کے حالات و مسائل کی جیتی جاگتی تصویریں پیش کی گئی ہیں۔ناول 'بارش سنگ' میں جیلانی بانو نے طبقاطی فرقہ، سماجی نا انصافی، جاگیردرانہ نظام کی خرابیاں اور ان کی عیاشیوں کو اس طرح پیش کیا ہے کہ جس سے اس دور کے نہ صرف جاگیردارانہ نظام بلکہ سیاسی و سماجی ماحول کی بھی بڑی تلخ اور سچی تصویر سامنے آجاتی ہے۔

اس ناول کی ابتداء آندھرا پردیش کے چکٹ پلی نامی گاؤں سے ہوتی ہے جہاں غریبی اور ساہوکاروں، جاگیرداروں کے ظلم و جبر کا راج ہے۔ قانون اور مناسب انتظام کی کوئی سہولت عوام کو حاصل نہیں ہے۔اس گاؤں کے مقدر میں صرف اندھیرا ہی اندھیر ہے۔اس گاؤں میں کسانوں اور مزدوروں کی ترجمانی کرنے والا مستان کا خاندان ہے جو غربت، جہالت اور بھوک کی زندگی بسر کر رہا ہے۔مستان اپنے کنبہ کا پیٹ پالنے اور زندگی کی بنیادی ضروریات کو پورا کرنے کے لیے اپنے گاؤں کے ساہوکار وینکٹ ریڈی کے یہاں مزدوری کرنے پر بے بس ہے۔ مستان کا بیٹا سلیم اس ناول کا مرکزی کردار ہے جو پڑھا لکھا نہیں ہے لیکن اس غلامانہ ذہنیت سے اسے سخت نفرت ہے اور

مضامین

وہ اپنے گھر والوں کی اس حالت پر کڑھتا رہتا ہے۔سلیم وینکٹ ریڈی سے سخت نفرت کرتا ہے جس کے رہن کی وجہ سے اس کا کنبہ معاشی تنگ دستی کا شکار ہے۔سلیم کے کنبہ کی خستہ حالی کی تصویر ناول کے اقتباس میں دیکھئے:

''سلیم کے دادا کے پاس سوا ایکڑ کھیت تھے جو اس کے چھ بیٹوں میں بٹے۔پھر ان بیٹوں کی شادیاں ہوئیں۔ان کی ضرورتیں بڑھیں۔سلیم کے دادا نے ہر بہن کی شادی پر ایک کھیت وینکٹ ریڈی کے باک کے پاس رہن رکھا۔اور جب اس کی دادی مری تو وہ پانچ سو روپے کے عوض ایک برس کے لیے خود ریڈی کے یہاں رہن ہو گیا۔ایک برس پہاڑ ہو گیا ۔کاٹے نہ کٹتا ___اس کی بیوی چھوٹے بچوں کو لے کر کام کرتی ،مگر پھر بھی وہ ساہوکار کا پیسہ واپس نہ کر سکے۔رہن کی میعاد بڑھتی گئی۔بچے ہوئے کھیت بھی رہن رکھ کر احمد بی نے گھر کا خرچ چلایا۔پھر مراد کی شادی کا وقت آیا تو مراد کو بھی تین سو روپے کے لیے وینکٹ ریڈی کے ہاں رہن ہونا پڑا۔'' ۲

دیکھا جائے تو یہ صرف مستان کے کنبہ کا دکھ درد نہیں ہے بلکہ گاؤں کے ہر غریب کسان،مزدور کا دکھ درد ہے جو جاگیردرانہ نظام کے معاشی لوٹ کھسوٹ سے دو چار ہے۔ان غریب کسان اور مزدوروں کے پاس ان کے بچے ہی سب کچھ ہیں جو بغیر کسی خرچ کے مل جاتے ہیں۔بچپن سے ہی اپنے والدین کے ساتھ محنت مزدوری کرنے لگتے ہیں۔اتنی محنت ومشقت کے کرنے کے باوجود بھی انہیں دو وقت کی روٹی نصیب نہیں ہوتی ہے۔وہ جاگیرداروں اور ساہوکاروں کا بچا ہوا جھوٹا کھانا کھا کر زندگی بسر کرنے پر مجبور ہوتے ہیں۔یہ غریب بے بس ومجبور کسان اور ان کے بچے ان کے بچے ساہوکاروں کے ہر حکم کو ماننا اور پورا کرنا اپنا اہم فریضہ سمجھتے ہیں۔ناول سے ایک اقتباس ملاحظہ ہو:

''مستان خوشی کے مارے سر اونچا کر کے گاؤں میں چلتا۔بڑی بھاگیاوان ہے میری بیوی،گیارہ بچوں کی ماں ہے.... غریب کسان کے ہاں تو بچے ہی دولت ہیں،جو بغیر کسی خرچ کے مفت میں مل جاتے ہیں۔تین چار برس تک وہ ماں کی جان کو جونک کی طرح چوستے رہتے،پھر دوسرے بہن بھائیوں کے ساتھ دانا دُنکا چن کر پیٹ بھر لینا سیکھ جاتے۔ان کی پیٹ بھر کھانے اور تن ڈھانکنے کی کسی کو فکر نہیں ہوتی ہے۔آٹھ دس برس کے ہوتے ہی وہ ماں باپ کا ہاتھ بٹانے کھیتوں پر جاتے ہیں۔اگر باپ رہن ہے تو اس کے ساتھ ساہوکار کا کام کرنا ان پر بھی فرض ہو جاتا ہے۔'' ۳

ان غریب کسانوں کے پاس تھوڑی بہت زمین ہے لیکن ان کی معاشی حالت اس قدر خراب ہے کہ وہ زراعت کے لیے بنیادی چیزیں بھی مہیا نہیں کر پا رہے ہیں۔اس کے لیے انہیں جاگیردروں اور ساہوکاروں سے بیج وغیرہ قرض لینا پڑتا ہے۔جس کے بدلے اپنی محنت ومشقت سے تیار کی ہوئی فصل کا آدھا سے زیادہ حصہ قرض اور سود کی ادائیگی میں دینا پڑتا ہے۔بس یہیں تک نہیں فصل خراب ہونے پر انہیں زمینوں سے بھی ہاتھ دھونا پڑتا ہے۔

مضامین

''ہر سال وینکٹ ریڈی بیج دینے پراماں سے تو تکار کرتا تھا۔ایک پائیلی بیج کے بدلے پانچ پائیلی اناج واپس کرنا پڑتا تھا۔تو اب بچا کیا ___ مشکل سے دو ڈھائی تھیلے جو پہلی جوار ہوتی تھی۔کیوں کہ ان کے کھیت میں گوبری پڑتی 'نہ پانی دیا جاتا تھا۔پودے زمین سے اٹھتے میں جھک جاتے تھے۔جیسے وینکٹ ریڈی کے سرسبز شاداب پودوں کو دیکھتے ہی باوا کی طرح ماتھا ٹیک دیتے ہوں۔'' ۴

وینکٹ ریڈی، ساہوکار اور مہاجن ، صابر میاں مذہبی رونما اور دلاور خاں جاگیرداروں کا نمائندہ ہے۔یہ تینوں گھرانے چکٹ پلی گاؤں کے غریب کسانوں ،مزدوروں کی مختلف طریقوں سے استحصال کرتے ہیں۔وقت پر قرض نہ چکانے پر ان کسانوں ، مزدوروں کی بہن بیٹیوں کی عزت و آبرو بھی لوٹ لیتے ہیں۔اگر کوئی شخص اس ظلم و جبر کے خلاف آواز اٹھانے کی کوشش کرتا ہے تو اگلے دن اس کی لاش کسی کھیت میں پائی جاتی ہے یا کسی جھوٹے مقدمے میں پھنسا کر اسے پھانسی کی سزا دے دی جاتی ہے اور اس کے گھر والوں کو بھی مصیبت کا سامنا کرنا پڑتا ہے۔ان کسانوں،مزدوروں کی عورتیں بھی اپنے اوپر ہونے والے ظلم و جبر کو اپنی مقدر کا لکھا ہوا سمجھ کر برداشت کرتی ہیں کیوں کہ وہ بغاوت کے انجام سے بخوبی آگاہ ہیں۔اس ناول میں نرسیا نامی کردار ہے جو اپنی بھابی کی عزت و آبرو کے لیے تحصیلدار سے لڑ بیٹھتا ہے۔پھر کیا نرسیا کی پہلے پٹائی ہوتی ہے،سر مونڈکر،منہ پر کالک لگائی جاتی ہے اور گدھے پر بیٹھا کر پورے گاؤں میں گھمایا جاتا ہے۔اس ظلم و جبر سے متعلق ناول سے اقتباس ملاحظہ ہو:

''حکومت کا علان ہوا کہ سارے تحصیلدار اور تعلقدار اپنے مستقر پر ٹھہرے رہیں اور کسانوں کی بغاوت کو سختی سے کچل دیا جائے۔اب گاؤں کی لڑکیوں اور بہو بیٹیوں کی شامت نہ تھی کہ راتوں کو شراب پینے کے بعد ان تحصیلداروں کو عورت کے بغیر نیند نہ آتی تھی۔اس لیے گاؤں کے پولیس پٹیل اور تحصیل کے چپراسی آدھی رات کو چھاتی سے لپٹے ہوئے بچوں کو چھڑا کے ماؤں کو پکڑ کے لے جاتے تھے۔ تحصیلداروں،تعلقداروں اور جاگیرداروں کو کوئی عورت پسند آجائے تو گاؤں والوں کا فرض تھا کہ چپکے سے اسے حوالے کردیں۔اس بات کی خبر کانوں کان کسی کو نہیں ہونی چاہیے۔ ورنہ اس گھر کے مردوں کا سر اور ساہوکار کی جوتی۔'' ۵

آخر کار غریب کسان ،مزدور ظلم و ستم ، معاشی استحصال اور عزت و آبرو کی پامالی سے اس قدر تنگ آجاتے ہیں کہ ان کے صبر کا پیمانہ چھلک جاتا ہے اور وہ متحد ہوکر جاگیردرانہ نظام کے خلاف آواز بلند کرنے لگتے ہیں اور اپنے حق وانصاف کے لیے عملی جدوجہد کرنا شروع کردیتے ہیں۔ان لوگوں کی اس جد و جہد میں کمیونسٹ پارٹی بھر پور ساتھ دیتی ہے۔کمیونسٹ پارٹی کی قیادت میں اس عوامی تحریک جاگیردرانہ نظام کی نیندیں حرام کر دیتی ہے۔جاگیردار اور ساہوکار تلنگانہ تحریک کے چھاپہ مار دستوں کے طوفان سے کانپ جاتے ہیں۔جاگیردارانہ نظام اس تحریک کو کچلنے کی بھر پور کوشش کرتی ہے لیکن کچلنے میں ناکام

مضامین

رہتی ہے اور تلنگانہ تحریک کی عوامی مقبولیت روز بروز بڑھتا جاتا ہے۔ تلنگانہ تحریک کے چھاپہ دست اپنی جان کی بازی لگا کر اور مسلح بغاوت سے کئی گاؤں پر قبضہ کر لیتے ہیں اور جاگیردار طبقے کے ذریعے ناجائز طریقے سے قبضہ کی ہوئی زمینوں کو غریب کسانوں اور مزدوروں میں تقسیم کر دیتے ہیں۔

''گاؤں والوں کی برہمی اب حکومت کے لئے ایک بڑا خطرہ بن چکی تھی۔ نلگنڈہ اور اس کے آس پاس کے کئی گاؤں چھاپہ ماروں کے قبضہ میں تھے۔ کسانوں کی سرکشی بڑھتی جارہی تھی۔ سارے ہندوستان میں کمیونسٹ پارٹی کا زور بڑھ رہا تھا۔ وہ کانگریس کے ساتھ دیش کو آزاد کرانے کی جدوجہد میں ساتھ دے رہی تھی اور تلنگانے میں جاگیرداری کے خاتمے کے لئے عملی جدوجہد کر رہی تھی۔ تلنگانے کی اس گڑبڑ نے ہندوستان کی تمام ریاستوں اور رجواڑوں میں کھلبلی مچادی تھی۔'' [۶]

بہر کیف جیلانی بانو نے اس ناول میں اپنے تجربے، مشاہدے اور حقیقت پسندانہ نقطۂ نظر سے غریب کسانوں اور مزدوروں کے حالات و مسائل کی بڑی خوبصورتی کے ساتھ تصویر کشی کی ہے۔ غریب کسانوں کا یہ المیہ اس عہد کے ہندوستان کے غالباً سبھی ریاستوں کے غریب کسانوں اور مزدوروں کا المیہ ہے۔ آج بھی ہندوستان کے غریب کسانوں و مزدوروں کے حالات و مسائل میں کوئی خاطر خواہ تبدیلی رونما نہیں ہوئی ہے۔ آج بھی کسان اور مزدور زندگی کی بنیادی ضرورتوں روٹی، کپڑا اور مکان کے لیے کمر توڑ محنت و مشقت کے باوجود دوسرے کا محتاج ہے۔

* * *

حوالہ جات

۱۔ مشرف علی، ''جیلانی بانو کی ناول نگاری کا تنقیدی مطالعہ''، ایجوکیشنل پبلشنگ ہاؤس دہلی، ۲۰۰۳ء ص ۲۳

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۳۔ ایضاً۔۔۔۔۔۔۔۔۔۔، ص ۲۰

۴۔ ایضاً۔۔۔۔۔۔۔۔۔۔، ص ۱۰

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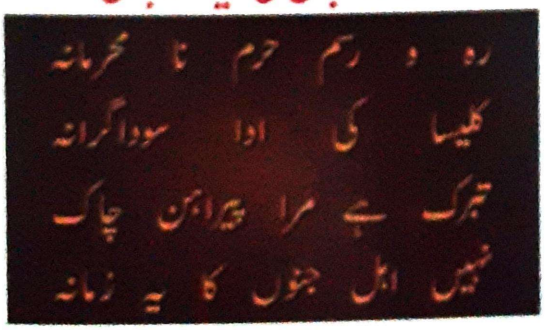
۶۔ ایضاً۔۔۔۔۔۔۔۔۔۔، ص ۱۱۹

سری سین کمار بھارتی
ریسرچ اسکالر، شعبۂ اردو
یونی ورسٹی آف حیدرآباد ۵۰۰۰۴۶
رابطہ 8 9 5 7 0 8 9 5 5 1

مضامین

علامہ اقبال کی ایک رباعی



2019 اور 2020 کے کول پر لئی گئیں چند اہم تصاویر

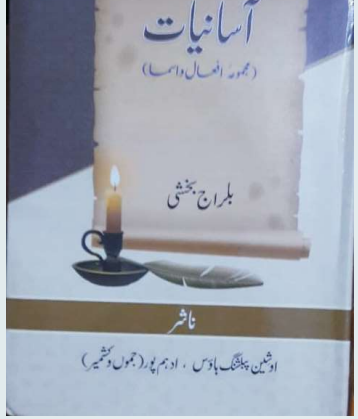
اردو میں 'اماوس میں خواب' کے لیے حسین الحق کو ساہتیہ اکادمی ایوارڈ

بال ساہتیہ پرسکار 'فخر وطن' کے لیے حافظ کرناٹکی کو

یووا پرسکار میں اپنی بات کا مفہوم دوسرا چاہوں' کے لیے ثاقب فریدی کو

اردو کے لیے اسلم مرزا اور ہندی کے لیے آلوک گپت

سمیت 19 مترجمین ایوارڈ سے سرفراز



مستند ہیں۔شاعر ہیں،ناقد ہیں مترجم اور افسانہ نگار بھی۔ان کے افسانوں کا مجموعہ 'ایک بوند زندگی' کو ادب کی دنیا میں قابل قدر نگاہ سے خاص و عام نے سراہا ہے۔'آسانیات' ان کی تازہ ترین کتاب ہے۔جو اپنی نوعیت کی منفرد کتاب ہے۔بقول مصنف '.....افعال و اسما کے اس مجموعے کی ترتیب کا یہی محرک تھا کہ مطلوبہ لفظ بہ آسانی مل جائے۔'

سبق اردو

مارچ،۲۰۲۱

چیف ایڈیٹر

دانش الٰہ آبادی

ایڈیٹر، پرنٹر، پبلشر: ڈاکٹر محمد سلیم | سرنامہ : عادل منصوری | جلد : ۵ | شمارہ : ۱۲

موبائل:9696486386 | سرورق : دانش الٰہ آبادی | Net Banking:SABAQ -E-URDU(MONTHLY)

واٹس ایپ:9919142411 | کمپوزنگ : دانش الٰہ آبادی، اہل قلم | IFSC BARB 0 GOPI BS A/C28240200000214

sabaqeurdu@gmail.com | مطبع: عظیم انڈیا پریس، گوپی گنج، بھدوہی | Bank of Baroda, Branch: Gopiganj

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جوگندر پال کی علمی وادبی خدمات

(5ویں برسی کے موقع پر بطور خراج۔ وفات 22/اپریل/2016)

سری سین کمار بھارتی

جوگندر پال کی شخصیت تعارف کی محتاج نہیں ہے۔ اردو فکشن کی دنیا میں جوگندر پال موضوعات، ہیئت، تلازمات، تخلیقی جہات اور تکنیک کے حوالے سے منفرد مقام رکھتے ہیں۔ ان کی ولادت 5 ستمبر 1925 کو سیالکوٹ میں ہوئی۔ ان کے والد صاحب کا نام لعل چند سیٹھی اور والدہ صاحبہ کا نام مایا دیوی تھا۔ جوگندر پال کے والدین معمولی پڑھے لکھے تھے۔ آمدنی کے وسائل بھی کم تھے اور گھر میں تعلیمی ماحول بالکل نہیں تھا لیکن جوگندر پال کو زیور تعلیم سے آراستہ کروانے کے مشتاق تھے۔ اس لیے انہوں نے جوگندر پال کو گنڈا سنگھ ہائی اسکول سیالکوٹ میں داخلہ کروایا۔ 1936ء میں جوگندر پال نے چھٹی جماعت اور 1941 میں دس ویں جماعت کے امتحانات پاس کیے۔ والدین کی مالی حالت کمزور ہونے کے سبب اس اسکول میں فیس معاف تھی۔ اسی وجہ سے جوگندر پال کو کبھی کبھی شرمندہ بھی ہونا پڑتا تھا۔ ایک مرتبہ اسکول کے سیکنڈ ہیڈ ماسٹر نے انہیں اسی بنیاد پر آگے کی ڈیسک سے اٹھا کر پیچھے بیٹھا دیا۔ استاد کی اس قدر بے رخی نے ان کے دل پر گہرا اثر چھوڑا۔ یہ معمولی سی بات ایک حادثے کی طرح ان کے دل پر نقش ہوگئی۔ جوگندر پال نے اس کا ذکر خود ایک جگہ کیا ہے۔

''ایک دن ہمارے سیکنڈ ہیڈ ماسٹر ''خوش شکل اور خوش پوش نئے لڑکوں کے ساتھ ہماری کلاس میں وارد ہوئے اور چاروں طرف نگاہ دوڑا کر مجھ پر اپنی آنکھیں روک لیں.... تم یہ پہلا ڈیسک خالی کرو جگندر اور آخر میں جا کر بیٹھو تمہاری فیس معاف ہے۔ تمہاری جگہ پر لکشمن بیٹھے گا'' 1

جوگندر پال ایک اچھے طالب علم تھے۔ دسویں جماعت کا امتحان پاس کرنے کے بعد انہوں نے میرے کالج (Murray College) سیالکوٹ میں بی اے میں داخلہ لیا اور 1945 میں بی اے فائنل کیا۔ والدین کی غربت کی وجہ سے کالج کی پڑھائی کا خرچہ خود محنت و مزدوری کر کے اٹھاتے تھے۔ چھٹیوں میں وہ کہیں نہ کہیں مزدوری کر کے یا طلبہ کو ٹیوشن کرا کے تھوڑا روپیہ کما لیتے تھے۔ بی اے کے آخر سال گرمی کی چھٹیوں میں انہوں نے سیالکوٹ میں ملٹری پیراشوٹ فیکٹری میں کلرک کی حیثیت سے کام کیا۔ وہاں جوگندر پال کو ساٹھ روپے ماہوار ملتے تھے۔

جوگندر پال کالج کی تعلیم ختم کرنے کے بعد چند ماہ تک بیکار گھومتے رہے۔ بعد میں اپنے ماموں کے کہنے پر کسی دوسرے رشتہ دار کے یہاں امرتسر آ کر ان کے آفس میں کام کرنے لگے۔ تین مہینے کے بعد کسی وجہ سے جوگندر پال کو آفس سے نکال دیا گیا۔ پڑھائی کو آگے جاری رکھنے کا بھی یہی سبب بنا 1942 میں انہوں نے میرے کالج میں ایم اے انگریزی میں داخلہ لیا۔ ابھی ڈگری مکمل نہ ہو پائی تھی کہ 1947ء میں تقسیم ہند کا المیہ پیش آیا۔ چنانچہ سیالکوٹ (پاکستان) کو خیر آباد کہہ کر وہ ہمیشہ کے لیے ہندوستان چلے آئے اور پنجاب یونیورسٹی سے 1955ء میں ایم اے انگریزی کا امتحان پاس کیا۔

جوگندر پال کے والدین کے جسمانی اور مالی حالت کچھ بہتر نہیں تھے۔ وہ اکثر بیمار رہتے تھے۔ اس لیے تعلیم کے دوران جوگندر پال نے مختلف نجی کمپنیوں میں عارضی طور پر کام کرنا شروع کر دیا۔ وہ والدین پر بوجھ نہیں بننا چاہتے تھے۔ جوگندر پال کو اپنی غریبی کا شدید احساس بھی تھا۔ مشہور افسانہ نگار (رتن سنگھ نے اس کا بیان یوں کیا ہے:

''ننھا جوگندر پال منہ میں گھلتی ہوئی برفی کی مٹھاس کے ساتھ اپنے آپ کو قصور وار سا مانتا۔ غریب باپ کے پیسے سے پڑھتے ہوئے جوگندر پال کو ایسا لگتا جیسے وہ کوئی گناہ کیے جا رہا ہو'' 2

بی۔ اے کی تعلیم کے بعد جوگندر پال 1946 میں سیالکوٹ کی ایک کمپنی میں اکاؤنٹس کلرک ہوئے۔ وہ ذمہ داری بہ حسن و خوبی نبھائے۔ اس ملازمت پر ان کے والدین بہت خوش تھے۔ وہ اپنے دوستوں اور رشتہ داروں کو بڑے فخر سے بتاتے تھے کہ ہمارا جوگندر پال سرکاری نوکری کرتا ہے اور پورے ساٹھ روپے مہینے پاتا ہے لیکن جب 1947 میں ملک آزاد ہوا اور تقسیم کا واقعہ پیش آیا تو جوگندر پال اپنا وطن ترک کر کے ہندوستان چلے آئے۔ یہاں آ کر پھر روزی روٹی کی فکر ستانے لگی ان کے والد نے انبالہ میں دودھ کا بیوپار کرنا شروع کیا۔ جوگندر پال کو بھی ان کے ساتھ دودھ بیچنے کا کام کرنا پڑا۔ 1948 میں جوگندر پال کی شادی افریقہ سے تعلق رکھنے والی لڑکی سے ہوئی۔ شادی کے کچھ عرصے بعد یہ دونوں افریقہ چلے گئے جہاں انہوں نے 1949ء میں کینیا ایجوکیشن ڈپارٹمنٹ کے ''ڈیوک گلاسٹر اسکول'' میں جوگندر پال بطور استاد مقرر ہوئے۔ اس ادارے سے انہیں 507 شلنگ ماہانہ تنخواہ ملتی تھی۔ جوگندر پال اپنی محنت اور قابلیت کی سبب اس شعبہ میں مختلف عہدوں پر فائز رہے۔ انہوں نے ایجوکیشن آفیسر کے فرائض بھی انجام دیئے۔

1963ء میں (British) برٹش گورنمنٹ نے کینیا کی آزادی کا

اعلان کیا اور اس میں یہ طئے ہوا کہ جو چاہے اپنی ملازمت نئی حکومت کے ساتھ جاری رکھے یا پنشن پر ریٹائرڈ ہو جائے۔ جوگندر پال کو اپنے وطن آنے کا سنہرا موقع ملا۔ 1964ء 14 سال بعد ہندوستان واپس لوٹ آئے۔ ہندوستان آنے کے بعد جوگندر پال نے یہ ارادہ کیا کہ پیشہ وری سے الگ ہو کر ادب کی خدمت کریں گے لیکن آمدنی کے وسائل کم ہونے کے ناطے روزی روٹی کے چکر میں ادھر اُدھر بھٹکنے لگے۔ سلیمان ادیب کے مشورہ پر انہوں نے عثمانیہ یونیورسٹی حیدرآباد میں لکچرر کی درخواست دی۔ لیکن کامیاب نہ ہوئے۔ جوگندر پال اسی پریشانی کے عالم میں تھے کہ ان کی ملاقات سروستی بھون کالج اورنگ آباد کی گورننگ کونسل کے جنرل سکریٹری جی ایم شراف سے ہوئی۔ وہ جوگندر پال کو بخوبی طور سے جانتے تھے اور ان سے خاصا متاثر بھی تھے اور جوگندر پال کو اپنے کالج میں ملازمت کے لیے دعوت دی اس طرح سے جوگندر پال 1964 میں حیدرآباد کو خیرآباد کہہ کر وہ اورنگ آباد چلے گئے۔ سرسوتی بھون کالج کے شعبہ انگریزی میں پہلے پروفیسر اور پھر صدر شعبہ کی خدمات انجام دیں۔ 1965 میں اس کالج کے پرنسپل بن گئے۔ وہ پرنسپل کی عہدہ پر تیرہ سال فائز رہے اور اپنی لیاقت وصلاحیت کی بنا پر طلبہ اور اساتذہ دونوں میں بہت مقبول رہے۔

1978 میں ایک دن اچانک برطانیہ کی جانب سے ایک تار موصول ہوا کہ آپ کی پنشن کی رقم میں اضافہ کر دیا گیا ہے۔ پنشن کی رقم اتنی تھی جتنی کالج کی تنخواہ ہوتی تھی۔ چنانچہ یہ سوچ کر کہ صرف پنشن ہی ضروریات زندگی کے لیے کافی ہے۔ اس ادارہ کی ملازمت سے سبکدوش ہو کر اپنی باقی عمر علم وادب کے لیے صرف کر دیا۔ اپنی تمام مصروفیات سے فارغ ہو کر کل وقتی ادیب کی حیثیت سے اردو ادب کی خدمت کے لیے مصروف ہو گئے اور یہ سلسلہ آج بھی جاری و ساری ہے۔

جوگندر پال کی ادبی زندگی کا آغاز اس وقت ہوا جب ان کی عمر سترہ برس کی تھی۔ یہ 1943ء کے آس پاس کا زمانہ تھا۔ آزادی کی جنگ اپنے عروج پر تھی۔ پنڈت جواہر لعل نہرو مہاتما گاندھی' ابوالکلام آزاد عوامی رہنما آزادی کی جنگ زور وشور سے لڑ رہے تھے۔ پورے ملک میں افراتفری کا بازار گرم تھا۔ انگریزی حکومت کی جڑیں ہلنے لگیں تھی۔ انگریزوں نے اپنی طاقت کے بل بوتے پر تحریک آزادی کو کچلنے کے لیے ہندوستان کے لوگوں پر طرح طرح ظلم و ستم ڈھا رہے تھے۔ اس کا نتیجہ یہ نکلا کہ ہندوستانیوں کے دلوں میں انگریزوں کے لیے نفرت مزید بڑھ گئی۔ اس بات سے ہر انسان واقف ہے کہ ادب سماج کا آئینہ ہوتا ہے۔ اس لیے اس دور میں تخلیق ہونے والے ادب میں تحریک آزادی کے اثرات بھرپور دکھائی دیتے ہیں۔ اس زمانے کا شاید ہی کوئی ادیب یا شاعر ہوگا جس کے یہاں اس تحریک کے نقوش نہ ملتے ہوں جوگندر پال بھی اس تحریک سے دور نہ رہ سکے۔

جوگندر پال کے تخلیقی سفر کا آغاز شعر گوئی سے ہوا۔ لیکن ان کا اصل میلان افسانے کی طرف تھا۔ بچپن سے ہی ان کے دل میں کہانی لکھنے کی آرزو پنپ رہی تھی۔ لہٰذا وہ بہت جلد ہی کہانی کی طرف راغب ہو گئے اور پھر پیچھے مڑ کر نہیں دیکھا۔ چنانچہ ان کی ادبی زندگی کا آغاز صحیح معنوں میں افسانہ نگاری سے ہوا۔ میں پہلے بھی اس بات کا ذکر کر چکا ہوں کہ جوگندر پال ایک غریب گھرانے میں پیدا ہوئے تھے۔ مگر انہیں پڑھنے لکھنے کا شوق بچپن سے ہی تھا۔ وہ پریم چند' کرشن چندر' راجندر سنگھ بیدی' عصمت چغتائی' منٹو' احمد ندیم قاسمی' غلام عباس' ممتاز مفتی وغیرہ جیسے افسانہ نگاروں کی کہانیاں خصوصیت کے ساتھ پڑھتے تھے اور ان کہانیوں کے علاوہ رسائل و جرائد بھی پڑھتے تھے۔ ان اہل قلم کاروں کی تخلیقات اور رسائل و جرائم کے مطالعہ نے انہیں ایک کہانی کار بننے کا شوق پیدا کیا۔

جوگندر پال کے لکھنے کا سلسلہ دوران تعلیم سے ہوا۔ کالج میں پہنچنے کے بعد انہوں نے محبت اور غریبی کی موضوع پر ''تعبیر'' کے عنوان سے کالج میگزین کے لیے ایک کہانی لکھا۔ یہ کہانی ان کی پہلی کہانی تھی جو ایک میگزین میں چھپی تھی۔ اس کہانی کو جب انہوں نے کالج کے ایک جلسہ میں سنایا تو ان کے اساتذہ نے خوب سراہا اور حوصلہ افزائی کی۔ جوگندر پال میگزین میں کہانی دیکھ کر اور اپنے اساتذہ کی تعریف سن کر بہت خوش ہوئے۔

1945 جوگندر پال کی پہلی تصنیف ''تیاگ سے پہلے'' شاہد دہلوی کے مشہور رسالہ ''ساقی'' میں شائع ہوئی۔ پال اس وقت 17 برس کے تھے۔ جوگندر پال اس سے پہلے چند کہانیاں لکھ چکے تھے لیکن ان کی یہ پہلی کہانی تھی۔ جو کسی مشہور رسالہ میں شائع ہوئی جس کو جوگندر پال اپنی پہلی کہانی مانتے ہیں۔ جو اب دستیاب نہیں ہے۔ اس کہانی کے ذریعے جوگندر پال کی ادبی زندگی کا آغاز ہوا۔ ماہنامہ ''ساقی'' میں اپنی کہانی چھپا ہوا دیکھ کر بہت خوش رہے۔ ان کی تصنیف وتالیف کا سلسلہ یوں ہی جاری وساری رہا۔ مگر ایک افسانہ نگار کی حیثیت سے مقبول نہ ہو سکے۔ اس کی بڑی وجہ ان کی غربت تھی۔ پال کے والد صاحب دمہ بیماری میں مبتلا تھے۔ اس کے باوجود سخت سے سخت محنت کرتے۔ یہ دیکھ کر پال کو برداشت نہیں ہو پاتا۔ لہٰذا کہانی لکھنے کا شوق اور دوسری طرف مالی حالت کو بہتر بنانے کی فکر ستانے لگی اور وہ سب کچھ چھوڑ چھاڑ کر اپنے والد صاحب کے کاروبار میں ہاتھ بٹانے لگے۔

ہند اور پاک کے بٹوارے کے بعد جوگندر پال اپنے والدین کے ساتھ جب سیالکوٹ سے پنجاب کے شہر انبالہ آئے تو یہاں بھی انہیں روزی روٹی کی فکر ستانے لگی جس کی وجہ سے پڑھنا لکھنا بند کر دیا تھا لیکن جب ان کی شادی افریقہ میں ہوئی تو وہاں پہنچ کر روزی روٹی کے مسئلہ کا حل نکل آیا۔ ہوا یوں کہ وہ ایک اسکول میں استاد ہو گئے جس کی وجہ سے انہیں وہاں پڑھنے لکھنے کا خوب شاندار موقع ملا۔ افریقہ میں پال نے میپاساں، چیخوف اور ٹالسٹائے جیسے مشہور معروف افسانہ نگاروں کا بہت باریکی سے مطالعہ کیا۔ ان مطالعے سے جہاں ان کے تخیل میں بلندی اور شعور میں وسعت پیدا ہوئی وہیں ان کے اندر کا دبا ہوا فنکار جاگ پڑا۔ بات یہاں تک پہنچی کہ انہوں نے ملازمت کے ساتھ ساتھ کہانیاں بھی لکھنا شروع کر دی۔ جوگندر پال اپنی ادبی زندگی کے آغاز کے تعلق سے ایک جگہ کچھ یوں لکھتے ہیں:

''میری ادبی زندگی کا آغاز کینیا میں ہوا اور کچھ ہی مدت کے بعد یہ محسوس ہونے لگا کہ لکھنا میرے اب مقصد حیات بن گیا ہے۔ اس کے بغیر میں نہ

رہ سکوں گا۔'' 3

1961ء میں جب ان کا پہلا افسانوی مجموعہ ''دھرتی کا کال'' منظر عام پر آیا تو جوگندر پال اس وقت ایک افسانہ نگار کی حیثیت سے جانے لگے۔ پال صاحب نے اس مجموعہ میں جتنی کہانیاں لکھی ہیں سب میں افریقہ کے ماحول کا عکس نظر آتا ہے۔ جوگندر پال کے کل نو افسانوی مجموعے ہیں جن کا تعلق سیاست، تہذیب اور اخلاقیات سے ہے۔ ذیل میں ان مجموعوں کی فہرست دی جاتی ہے۔

نمبر	سن	افسانوی مجموعے	ادارے
1	1961ء	''دھرتی کا کال'' (11 افسانے)	حالی پبلشنگ ہاؤس
2	1962ء	''میں کیوں سوچوں'' (12 افسانے)	داستانِ اردو امرتسر
3	1969ء	''رسائی'' (8 افسانے)	نصرت پبلشرز لکھنو
4	1970ء	''مٹی کے ادراک'' (13 افسانے)	لاجپت رائے اینڈ سنز، دہلی
5	1977ء	''لیکن'' (20 افسانے)	اردو پبلشرز لکھنو
6	1978ء	''بے محاورہ'' (24 افسانے)	کیلاش پبلشرز اورنگ آباد
7	1981ء	''بے ارادہ'' (25 افسانے)	زم زم بک ٹرسٹ دہلی
8	1989ء	''کھلا'' (25 افسانے)	موڈرن پبلشنگ ہاؤس دہلی
9	1996ء	''کھودو بابا کا مقبرہ'' (17 افسانے)	ایضاً

جوگندر پال کے افسانوں کے چار مجموعہ انتخاب بھی چھپ چکے ہیں۔ پہلا انتخاب جوگندر پال کے منتخب افسانے کے عنوان سے 1987 میں شائع ہوا اس میں اکیس افسانے شامل ہیں۔ دوسرا انتخاب ''جوگندر پال کے افسانوں کا انتخاب'' کے عنوان سے 1994 شائع ہوا۔ اس میں تیرہ افسانے اور کچھ افسانچے بھی شامل ہیں۔ تیسرا انتخاب جس میں اٹھارہ افسانے اور اکیاون افسانچے شامل ہیں جو بستیاں کے عنوان سے 2000ء میں شائع ہوا اور چوتھا انتخاب ''جوگندر پال کی کہانیاں'' کے عنوان سے 2005 میں شائع ہوا۔

جوگندر پال صرف ایک افسانہ نگار ہی نہیں ہیں بلکہ ایک ناول نگار کی حیثیت سے بھی مقبول ہیں۔ انہوں نے افسانے کے ساتھ ہی ساتھ ناول کو بھی اپنے اظہار کا وسیلہ بنایا ہے۔

''ایک بوند لہو کی'' یہ ناول جوگندر پال کا پہلا ناول ہے جو 1962 میں کراچی سے شائع ہوا۔ اس ناول کو انہوں نے اس وقت لکھا جب وہ افریقہ میں رہ رہے تھے۔ ''نادید'' ان کا دوسرا ناول ہے جو 1983 میں دہلی سے شائع ہوا اور تیسرا ناول ''خواب راؤ'' 1991ء میں ایجوکیشنل پبلیشنگ ہاؤس سے شائع ہوا۔

جوگندر پال کی چار افسانچوی مجموعے بھی ہیں۔ پہلا ''سلوٹیں'' 1975ء، دوسرا کتھا نگر 1986ء، تیسرا ''پرندے'' 2000ء اور چوتھا ''نہیں رحمٰن بابو'' کے عنوان سے 2005ء میں منظر عام پر آیا۔

جوگندر پال کئی ادبی اداروں اور انجمنوں سے وابستہ رہے۔ ذیل میں ان کی تفصیلات درج ہیں۔

1۔ مہاراشٹرا اردو اکادمی کی ایگزیکٹیو کونسل کا ممبر رہے۔
2۔ سرسوتی بھون کالج اورنگ آباد سے تقریباً 14 سال تک جڑے رہے۔
3۔ مراٹھواڑہ یونیورسٹی کی اکیڈیمک کونسل کے رکن رہے۔
4۔ نیشنل اردو کونسل کے ممبر رہے ہیں
5۔ کل ہند انجمن ترقی پسند مصنفین کے صدر رہے۔
6۔ کونسل فار ڈاپرموشن آف اردو کی ایگزیکٹیو کمیٹی کے رکن رہے۔
7۔ انجمن اردو ہند کی مجلس عملہ کے ممبر رہے۔

جوگندر پال ہندوستان اور پاکستان کے بے شمار اردو رسالے سے جڑے رہے۔ ان رسائل میں ماہنامہ ''آج کل'' دہلی ماہنامہ ''شاعر'' ممبئی'' ملاپ'' نئی دہلی، ''آندھرا پردیش'' حیدرآباد، ''نیا دور'' لکھنو، ''فنون'' لاہور، ماہنامہ ''انشاء'' کلکتہ، ''نقش'' کراچی، ''سہارا'' نئی دہلی، ''افکار'' کراچی، ماہنامہ ''چہارسو'' راولپنڈی، ''پرواز ادب'' پٹنہ اور ''شب خون'' خصوصاً قابل ذکر ہیں۔

* * *

حوالہ جات

1۔ جوگندر پال، بے اصطلاح، تخلیق کار پبلشرز، نئی دہلی، ص 165
2۔ رتن سنگھ، جوگندر پال کی کہانی، مشمولہ ''جوگندر پال ذکر و فکر و فن'' مرتب ارتضیٰ کریم، ص 111
3۔ ڈاکٹر مول راج کے نام ایک خط میں جوگندر پال نے ان خیالات کا اظہار کیا ہے۔

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تحریک ادب

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چیک یا ڈرافٹ اور انٹرنیٹ بینکنگ
کے ذریعے زرِ رفاقت ان نمبروں اور پتوں پر ارسال کریں۔

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تخلیق کے ساتھ اپنا فون نمبر یا ای۔میل اور اگر ممکن ہو تو دونوں ہی درج کرنے کی زحمت فرمائیں۔ عنایت ہوگی۔ مراسلت کا پتہ

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- اس شمارہ کی مشمولات میں اظہار کیے گئے خیالات و نظریات سے ادارے کا متفق ہونا ضروری نہیں۔
- متنازعہ فیہ تحریر/تقریر کے لیے صاحب قلم خود ذمہ دار ہے۔
- تحریک ادب سے متعلق کوئی بھی قانونی چارہ جوئی صرف الہ آباد کی عدالت میں ممکن ہوگی۔

جاوید انور مدیر تحریک ادب نے مہاویر پریس، وارانسی سے چھپوا کر اردو آشیانہ ۱۶۷، آفاق خان کا احاطہ، منڈواڈیہہ بازار، وارانسی سے شائع کیا۔

ترتیب

جوگندر پال کے افسانوں میں خواتین کے مسائل

سری سین کمار بھارتی (ریسرچ اسکالر، شعبہ اردو، حیدرآباد یونیورسٹی)

جوگندر پال جدیدیت کے ایک معتبر نمائندہ افسانہ نگار ہیں۔ ان کے تخلیقی اظہار کی خصوصیت یہ ہے کہ فطرت اور کائنات سے ان کی گہری وابستگی ہے جو ان کے فن کو عظمت عطا کرتی ہے۔ لیکن اس کے باوجود عصری زندگی کے سائنسی، سیاسی، سماجی، معاشرتی اور دیگر مسائل بھی اُن کے تخلیقی عمل کا حصہ ہیں۔ جوگندر پال نے اپنے افسانوں میں جن انسانی جذبات و احساسات اور جن سیاسی و سماجی حالات کو پیش کیا ہے، ان کا تعلق کسی معاشرے یا کسی ایک عہد سے نہیں بلکہ ہر معاشرے اور ہر عہد سے ہے۔ دراصل اُن کی تخلیقات کا کینوس انسان کی پوری زندگی ہے۔ جوگندر پال کی افسانہ نگاری سے متعلق ڈاکٹر وہاب اشرفی اپنے ایک مضمون میں لکھتے ہیں:

> ''وہ اصحاب جو افسانے کو ابھی تک زندگی کی محض ایک قاش سمجھتے آئے ہیں اور جنہیں ہر لمحہ اس میں اچانک اور ایک واضح نقطۂ عروج کی تلاش رہتی ہے، انہیں جوگندر پال کے افسانے سخت عذاب معلوم ہوں گے اور ان کی فضا خاصی جہنمی۔'' ا؎

جوگندر پال کی کہانی میں حقیقت بیانی نظر آتی ہے۔ پال نے فکری اور فنی دونوں سطحوں پر نئے نئے تجربات کر کے زندگی کے ازلی و ابدی مسائل و حالات کے اظہار کے ساتھ ساتھ معاشرے کی تغیر پذیر صورتوں پر سے پردہ کشائی بھی کی ہے۔ جوگندر پال کے یہاں علامت، تجرید، تمثیل اور اینٹی اسٹوری ہر طرح کے تخلیقی پیرائے ملتے ہیں جن سے اُن کے اظہار و بیان میں تنوع اور تہہ داری پیدا ہوئی ہے۔ جوگندر پال کا پہلا افسانوی مجموعہ 'دھرتی کا لال' ۱۹۶۱ء میں منظر عام پر آیا۔ 'میں کیوں سوچوں' ۱۹۶۲ء میں، 'رسائی' ۱۹۶۹ء میں، 'مٹی کے ادراک' ۱۹۷۰ء میں، 'لیکن' ۱۹۷۷ء میں، 'بے محاورہ' ۱۹۷۸ء میں، 'بے ارادہ' ۱۹۸۱ء میں، 'کھلا' ۱۹۸۹ء میں، 'کھودو بابا کا مقبرہ' ۱۹۹۴ء میں اور منی کہانیوں کے مجموعے 'سلوٹیں' ۱۹۷۵ء میں، 'کتھا نگر' ۱۹۸۶ء میں شائع ہوئے ہیں۔

جوگندر پال کے افسانوں میں جہاں زندگی کے بہت سارے موضوع ملتے ہیں وہیں انھوں

نے عورتوں کے مسائل کو بھی اپنے افسانوں میں موضوع کے طور پر اپنایا ہے۔ جوگندر پال نسائی ادیب نہیں ہیں پھر بھی ان کے یہاں عورتوں کی زندگی سے جڑے مسائل کا بیان بہت موثر انداز میں ملتا ہے ۔بے بسی، لاچاری، جنسی استحصال، نفسیاتی کشمکش، مردوں کا ظالمانہ رویہ، عورتوں کے تئیں سماج میں غلط نظریات، مرد اور عورت کی سماجی نابرابری، بے سہارا، تنہائی، مایوسی، بے چینی وغیرہ جیسے موضوعات اُن کے یہاں ملتے ہیں۔

افسانہ ''بکریاں'' جوگندر پال کا ایک شاہکار افسانہ ہے جو ان کے افسانوی مجموعہ ''کھودو بابا کا مقبرہ'' میں شامل ہے۔ جوگندر پال نے اس افسانے میں اتر پردیش کے دور دراز پہاڑی علاقے سے تعلق رکھنے والے سیدھے سادے لوگوں کے جنسی استحصال کو موضوع بنا کر پیش کیا ہے۔ کیشو اور کنتی ایک پہاڑی علاقے کے رہنے والے ہیں۔ روزی روٹی کی تلاش میں شہر کا رُخ کرتے ہیں۔ اور نینی تال میں پہنچ کر ایک ٹورسٹ ہوٹل میں کام کرنے لگتے ہیں۔ مگر ان ہوٹلوں میں کام کرنے والی عورتوں کی صورتِ حال یہ ہے کہ دن بھر تو انھیں دیگر کاموں میں مصروف رکھا جاتا ہے اور رات کو ان سے جنسی دھندا کروایا جاتا ہے۔ رئیس اور امیر لوگوں کے ہاتھوں ان کی عصمت دری کی جاتی ہے۔ ایک اقتباس ملاحظہ ہے:

> ''جاپانی سوداگر جب رات کو جام پہ جام چڑھائے جا رہا تھا تو کنتی خوب سجی دھجی، فنگر چپس کی پلیٹ لیے اس کے پاس آ پہنچی اور وہ نشے میں دھوت آلوؤں کی انگلیوں کی بجائے اُس کی انگلیاں مُنہ کی طرف بڑھائے چلا گیا، پھر جو ہونا تھا وہی ہوا۔'' ۲؎

یہ مسئلہ صرف کنتی کا ہی نہیں ہے، بلکہ ان تمام بے بس لاچار اور مفلسی کی ماری ہوئی عورتوں کا بھی ہے جو اپنی زندگی کی بنیادی ضروریات کو پورا کرنے کے لیے گاؤں سے شہر کی طرف آتی ہیں اور ہوٹلوں میں امیروں کے بستر کی زینت بن جاتی ہیں۔ پال کا یہ افسانہ ایک ایسی ثقافت کی ترجمانی کرتا ہے جہاں افلاس اور ضروریاتِ زندگی اخلاقی قدروں پر نظر آتی ہے۔ انسان مفلسی میں اس قدر گر جاتا ہے کہ وہ اپنی اولاد کا سودا کر دیتا ہے۔ بالکل کیشو اور کنتی کی طرح غریبی سے نجات پانے کے لیے اپنی بیٹی ''پوری'' اور بکری ''لکھی'' کے دام لگا دیتے ہیں۔ کیشو اپنے بوڑھے باپ سے مخاطب ہو کر اپنی بیٹی پوری کے تعلق سے بات کرتا ہے: اقتباس ملاحظہ ہو:

''''لکھنؤ کا ایک بہت بڑا سیٹھ ہمارے ہوٹل میں اترا ہوا ہے، سیٹھانی کو گھر کے کام کاج کے لیے ایک لڑکی چاہیے، پوری کو وہ اپنی بیٹی بنا کے رکھیں گے''

''ہم اِدھر کا اسے نوکر بنا کر رکھے ہیں؟''

''بات کو سمجھتے کیوں نہیں بابا؟ کھانا پینا کپڑا لتا۔ سب کچھ مفت دیں گے، اور ساڑھے پانچ سو روپلی تنخواہ''

''مائی باپ کا بیٹی تنکھا دیوے ہیں کیسوا؟۔۔۔۔۔باقی تیری مرجی''

''میری مرضی کی بات نہیں بابا، چار پیسے جمع کر لے گی تو اس کی شادی کھلے ہاتھ ہو جائے گی''''۳؎

پال نے اس افسانے میں جہاں عورتوں کی جنسی استحصال کے مسئلے کی طرف توجہ دلائی ہے، وہیں انھوں نے سماج میں پھیلے ''جہیز'' جیسے فرسودہ رسم ورواج کی طرف بھی اشارہ کیا ہے۔

''بکریاں'' ایک علامتی افسانہ ہے۔ اس افسانے میں پال نے یہ دکھانے کی کوشش کی ہے کہ عورت ایک بکری کی مانند ہے جسے چند روپیوں کی خاطر کسی کے بھی ہاتھوں بیچ دیا جاتا ہے۔ اس افسانے میں 'پوری' (گنتی کی بیٹی) اور 'لکھی' (بکری) دونوں بیچ دی جاتی ہیں۔ 'لکھی' ہوٹل کے کچن کے لیے بیچ دی جاتی ہے اور 'پوری' لکھنؤ کے سیٹھ کے ہاتھوں بیچ دی جاتی ہے۔ دونوں (پوری، لکھی) میں مشترکہ بات یہ ہے کہ دونوں کے گوشت کو نوچ نوچ کر کھایا جائے گا۔ ایک کا گوشت اگر ہوٹل میں کھانا کھانے والے کھائیں گے تو دوسرے کا گوشت سیٹھ لوگ اپنی حوس کی بھوک مٹانے کے لیے نوچ نوچ کر کھائیں گے۔

''دادیاں'' بھی جوگندر پال کا ایک خوبصورت افسانہ ہے۔ جس میں اُنھوں نے بوڑھی دادی کی تنہائی اور اس کے اکیلے پن کی داستان بیان کی ہے۔ دادی اپنے گھر میں بالکل اکیلے رہتی ہے۔ اس کا پوتا رام چند اس کے ساتھ رہتا تھا مگر جب اسے سرکاری مکان مل گیا تو وہ اپنی بیوی کے ساتھ وہاں چلا جاتا ہے۔ دادی تنہا رہ جاتی ہے مگر اس کے اکیلے پن میں ماضی کی یادیں اس کا سہارا بن کر اس کے ساتھ رہنے لگتی ہیں۔ یہ افسانہ زندگی کے اس حصے کی عکاسی کرتا ہے جسے پیری کہتے ہیں۔ یعنی اس عمر میں بڑھاپے کی مار تو اُس (دادی) کو جھیلنا ہی پڑتی ہے، تنہائی سے بھی کبھی کبھی جھوجھنا پڑتا ہے۔ دادی بھی ڈھلتی عمر اور تنہائی کے کرب کو جھیلنے کے لیے لڑکپن اور جوانی کی یادوں کو سہیلیوں کی طرح اپنے پاس بلا کر یادوں کے گہوارے میں اپنی زندگی کے ایک ایک دن گزار رہی ہے۔ مذکورہ افسانے میں پال نے دادی کے ذریعے عورتوں کی نفسیات کا بھرپور نقشہ کھینچا ہے۔ ایک عورت جب تن تنہا رہتی ہے تو اُس کے اندر تنہائی اور اکیلے پن کا کرب کس طرح اُس کی نفسیات کو متاثر کر دیتا ہے، اس کی مکمل عکاسی پال نے مذکورہ

افسانے میں کی ہے۔جس کی تائید قمر رئیس نے یوں کی:

''دادیاں میں بوڑھی دادی کا جو امیٹ کردار ہے جو پنجاب کے رواجوں اور ETHOS کی موہنی مورت ہے۔وہ اپنی ڈھلتی عمر اور تنہائی کے کرب کو اس طرح جھیلتی ہے کہ اپنے بچپن ،لڑکپن اور جوانی کی مورتیوں کو سکھی سہیلیوں کی طرح اپنے پاس بلا لیتی ہے۔وہ اپنی یادوں کے گہوارہ میں قید اپنے ساتھ اپنا بڑھاپا کاٹتی ہے۔''

۴؎

''جادو'' پال کا ایک شاہکار افسانہ ہے جو ان کے افسانوی مجموعہ'' بے ارادہ''میں شامل ہے۔ اس افسانے میں جوگندر پال نے جنسی استحصال اور انسان کے نامساعد صورت حال کو موضوع بنا کر پیش کیا ہے۔ پال نے اس افسانے میں ایک غریب عورت کی زندگی کو موضوع بنایا ہے جس کا نام بھابو ہے۔ بھابو کو جب اپنی غریبی سے نجات پانے کے لیے کوئی دوسرا راستہ دکھائی نہیں دیتا۔تو پیٹ کی بھوک مٹانے کی خاطر جسم فروشی کو اپنا مقدر بنا لیتی ہے۔اسی دوران بھابو کی بطن سے ایک لڑکا پیدا ہو جاتا ہے۔یہی لڑکا جب بڑا ہوتا ہے اور اپنی ماں کی جسم فروشی سے باخبر ہو جاتا ہے تو اسے کو چھوڑ کر چلا جاتا ہے۔اور بھابو پیٹ کی خاطر امیروں کے گھروں کی خاک چھانتی پھرتی ہے۔امیر لوگ اُس غریب، مجبور اور لاچار پر طرح طرح کے الزام لگاتے ہیں ۔یہاں تک کہ اسے بدنظر قماش سمجھ کر اس کی رسوائی کی جاتی ہے۔ اقتباس ملاحظہ ہو:

''میری بیوی کو ایک پڑوسن نے تنبیہ کر رکھی ہے کہ بھابو پر نگاہ رکھیو۔پوری جادوگرنی ہے پچھلے گھر سے بھی انھوں نے اسی لیے نکالا تھا کہ ان کا بچہ ہر وقت بیمار رہنے لگا تھا۔مگر جب سے اُسے نکالا گیا ہے کیا مجال ہے جو اُسے چھینک بھی آئی ہو۔'' ۵؎

یہاں تک کہ لوگ بھابو سے بات چیت کرنا پسند نہیں کرتے۔اپنے اکیلے پن کی وجہ سے بھابو کو یہ عادت ہو چکی ہے کہ وہ اکثر تنہائی میں بے جان چیزوں سے باتیں کر کے دل بہلا لیا کرتی ہے۔وہ اپنے سینے کا درد دنیا کو دکھانا تو چاہتی ہے مگر کوئی اس کی بات سننے کو راضی نہیں ہوتا یا یہ کہ اس کا دکھ کسی کو نظر ہی نہیں آتا۔درد میں اتنی شدت ہے جسے دیکھ کر پتھر بھی بولتے ہیں۔اقتباس دیکھیے:

''میں پتھر کا پتھر دیوار سے جڑا تھا اور پھوٹ کر دیکھے جا رہا تھا کہ
اپنی جان چھڑک کر بھابو نے ایک بے جان شے میں جان ڈال دی
ہے۔۔۔۔۔ مجھ میں بھی!'' ۶؎

یہ حقیقت ہے کہ بھابو کی طرح نہ جانے کتنے ہی لوگ اس دنیا میں ایسے ہوں گے جن کے پاس اپنا کچھ بھی نہیں ہے۔ یہاں تک کہ انھیں اپنے جسم پر بھی اختیار نہیں۔ وہ بے نام ہی اس دنیا میں آتے ہیں اور گمنامی کے اندھیرے میں زندگی بسر کر کے چلے جاتے ہیں۔ بقول جوگندر پال:

''آپ ٹھیک کہتے ہیں ہمارے ملک میں کم سے کم ایک چوتھائی
آبادی بے نام ہے۔ وہ لوگ ہیں ہی نہیں۔'' ۷؎

اس طرح سے دیکھا جائے تو افسانہ ''جادو'' نہ صرف بھابو کی زندگی کی ترجمانی کرتا ہے، بلکہ یہ ان تمام لوگوں کی داستان بن جاتا ہے جن کے پاس اپنا کوئی وجود ہی نہیں ہے اور سماج جنھیں نفرت و حقارت کی نظر سے دیکھتا ہے۔ یہاں تک کہ انھیں انسانی حقوق سے بھی محروم رکھا جاتا ہے۔ یہ۔ پال نے بھابو کے کردار کے ذریعے نچلے طبقے کی زندگی کو اس پر اثر انداز سے بیان کیا ہے کہ قاری کو ان لوگوں سے ہمدردی ہو جاتی ہے۔ افسانہ ''مہابھارت'' پال کے افسانوی مجموعہ ''مٹی کا ادراک'' میں شامل ہے۔ یہ افسانہ آج کی 'دروپدی' کی بے بسی اور لاچاری کی کہانی ہے۔ زمانے کی ستم ظریفی دروپدی کو طوائف بننے پر مجبور کر دیتی ہے۔ پھر وہ بھگوان سے ہر دن یہی دعا مانگتی ہے کہ اگلے زمانے کی دروپدی کی طرح آپ میری بھی لاج رکھ لینا۔ لیکن دعا مانگتے ہوئے اس کے ذہن میں ہمیشہ یہ خیال خلل ڈالتا رہتا ہے۔ اقتباس دیکھیے:

''تمہارا تو دھندا ہی جسم بیچنے کا ہے پھر لاج کیسی؟'' ۸؎

اس خیال کو ذہن سے نکالتے ہوئے دروپدی بھگوان سے پھر مخاطب ہوتی ہے:

'' اگر آبرو بنی رہی تو جسم بیچنے سے کیا ہوتا ہے؟ میری تو یہی دعا ہے
کہ پردے میں میرا دھندا چلتا رہے اور آبرو سے روٹی ملتی رہے۔''
۹؎

دروپدی کی پسندیدہ کتاب ہندوں کا دھارمک گرنتھ ''مہابھارت'' ہے۔ وہ اسے روز پڑھتی ہے، اسے پورا اعتماد ہے کہ ''مہابھارت'' کی دروپدی کی طرح کوئی میری بھی عزت ضرور بچائے گا۔ مگر

افسوس اس کے نصیب میں ایسا کوئی نہیں جو اس کی آبرو کی رکھوالی کر سکے۔ایک دن اُس کا جسم فروشی کا دھندا بے نقاب ہو گیا اور یہ خبر پورے محلے میں پھیل گئی۔لوگوں نے اسے نفرت بھری نگاہوں سے دیکھنا شروع کر دیا۔آخر وہ اپنی مجبوری اور بے بسی کا قصہ کسے سناتی۔اُس کو سننے اور اُس کی مدد کے لیے کوئی آمادہ ہی نہیں تھا۔سوال اٹھتا ہے کہ اگر وہ جسم نہیں بیچتی تو اپنا اور اپنے بچے کا پیٹ کیسے بھرتی۔اقتباس ملاحظہ ہے:

''محلے والوں کو پتہ چل گیا ہے کہ پیشہ
کرتی ہوں۔یہ سمجھتے کہ غریب، بے سہارا
عورت بے کار کیسے رہ سکتی ہے؟ بے چاری پیشہ
نہ کرے تو اپنے بچے کو بڑا کیسے کرے'' ۱۰؎

جوگندر پال نے افسانہ ''مہابھارت'' میں آج کی دروپدی اور اگلے یُگ کی دروپدی کا تقابل کرتے ہوئے اس حقیقت کی طرف اشارہ کیا ہے کہ قدیم بھارت کی دروپدی کے پانچ خاوند تھے اور یہ پانچوں اس کے ساتھ تھے اور اس کا بھگوان بھی اُس کے ساتھ تھا۔مگر آج کی دروپدی کو اتنا بھی نہیں معلوم کہ اس کے کتنے خاوند ہیں۔آخر وہ اپنی مدد کے لیے کس کو پکارے اور کون آئے گا؟ وہ سوچتی ہے کہ وہ ایک دھندے والی ہے، اس لیے بھگوان بھی اس سے خفا ہو گئے ہیں۔یہی وجہ ہے کہ آج وہ خود کو تنہا محسوس کر رہی ہے۔اس کے ذہن میں اب بار بار یہی خیال گھوم رہا ہے۔اقتباس دیکھئے:

''میں اکیلی اپنی آبرو کی یہ مہابھارت کیسے جیت سکتی ہوں۔'' ۱۱؎

یہ بالکل حقیقت ہے کہ آدمی شیطانیت اور درندگی کا شکار ہو کر تمام انسانی قدروں کو بھول چکا ہے۔آج وہ کھلے عام بے سہارا عورتوں کی عصمت پر نظر رکھا ہوا ہے اور ایسا کرنے کے بعد انھیں خود پورے سماج کے سامنے ننگا کر کے تباہ و برباد کر دیتا ہے۔''مہابھارت'' صرف دیکھنے میں ایک عام کہانی معلوم ہوتی ہے۔لیکن اس کے بنیادی موضوع پر غور کرنے کے بعد یہ پتا چلتا ہے کہ یہ انسانیت کا المیہ ہے۔اس افسانے کے طنزیہ جملے ذہن کو جھنجھوڑ دیتے ہیں اور سوچنے پر مجبور کر دیتے ہیں کہ بے سہارا اور بے بس لوگ کب تک اس طرح کے استحصال کا شکار ہوتے رہیں گے۔

افسانہ ''اپنا اپنا'' بھی جوگندر پال کا ایک خوبصورت افسانہ ہے۔یہ افسانہ ان کے افسانوی مجموعہ ''کھلا'' میں شامل ہے۔پال نے اس افسانے میں مرد و عورت کی سماجی نابرابری کے ساتھ ساتھ

انسان کے اندر پنپتے ہوئے شیطانیت کے جذبے کو طنز کا نشانہ بنایا ہے۔ یہ ایک مرد اور عورت کی کہانی ہے۔ دونوں جنسی دھندا کرتے ہیں۔ جب سماج میں ان کا یہ پوشیدہ راز ظاہر ہو جاتا ہے تو لوگ عورت کو بدچلن، طوائف، رنڈی، ویشیا اور Prostitute سمجھ کر نفرت کی نگاہوں سے دیکھنے لگ جاتے ہیں اور اسے گالی دیتے ہیں۔ اتنا ہی نہیں اُسے معاشرے کا ناسور بھی سمجھ لیا جاتا ہے۔ لیکن جب مرد بھی اسی دھندے سے وابستہ ہو تو اسے کون گالی دے۔ فردوس حیدر جوگندر پال کے مذکورہ افسانے کا تجزیہ کرتے ہوئے اپنے ایک مضمون میں لکھتے ہیں:

> ''وہ تو حاکم ہے، مالک ہے، جو کچھ بھی کہے، جو بھی کرے حق بجانب ہے۔ مرد بادشاہ کو کون کچھ کہہ سکتا ہے؟ ایک مرد ہی کہہ سکتا ہے، جو سچا فنکار بھی ہو۔ اس موضوع پر اگر کوئی عورت کہانی لکھتی تو ممکن ہے اسے گردن زدنی کہا جاتا یا کم از کم پارٹی بازی کا الزام تو لگتا۔'' ۱۲؎

یہاں پر جوگندر پال نے یہ سوال اُٹھایا ہے کہ کیا مرد کو کوئی کچھ نہیں کہہ سکتا؟ کیا وہ جو کرتا ہے، وہ سب حق بجانب ہے؟ حالاں کہ عورت کو جسم فروشی پر مجبور بھی مرد ہی کرتا ہے۔ پھر عورت کو غلط اور مرد کو صحیح کیوں سمجھا جاتا ہے۔ ایک طرف ہم مرد اور عورت کے حقوق کی حامی بھرتے ہیں اور دوسری جانب ان کے حقوق چھین بھی لیتے ہیں۔

بہر کیف جوگندر پال نے اپنی کئی تحریروں میں عورت کو بہ طور خاص موضوع بنایا ہے۔ جس میں اُنھوں نے عورتوں کے خارجی مسائل مثلاً: جہیز، صنفی نابرابری اور جنسی استحصال کے ساتھ ساتھ عورتوں کی نفسیات میں جھانک کر اُن کے لاشعور میں دبی اُن نفسیاتی خواہشات اور نفسیاتی کوائف تک بھی رسائی حاصل کرنے کی کامیاب کوشش کی ہے، جن سے ایک عورت کا سماج سے رشتہ جڑا ہوتا ہے۔ اُن نفسیاتی کیفیات میں نامکمل آرزوئیں اور تمنائیں، احساس کمتری، اکیلے پن کا خوف اور رشتوں کے کھو جانے کا درد وغیرہ موجود ہے۔ پال نے مجموعی طور پر اپنی تحریروں میں موضوعات کی کوئی حد مقرر نہیں کی ہے بلکہ اُنھوں نے جہاں سماج سے جڑے دیگر مسائل کی طرف قاری کی توجہ دلائی ہے، ٹھیک اُسی طرح سماج کی ایک مظلوم ترین مخلوق عورت سے جڑے مسائل کی طرف بھی انگشت نمائی کر کے ایک مکمل اور حساس ترین تخلیق کار یا سماج کا نباض ہونے کا ثبوت فراہم کیا ہے۔

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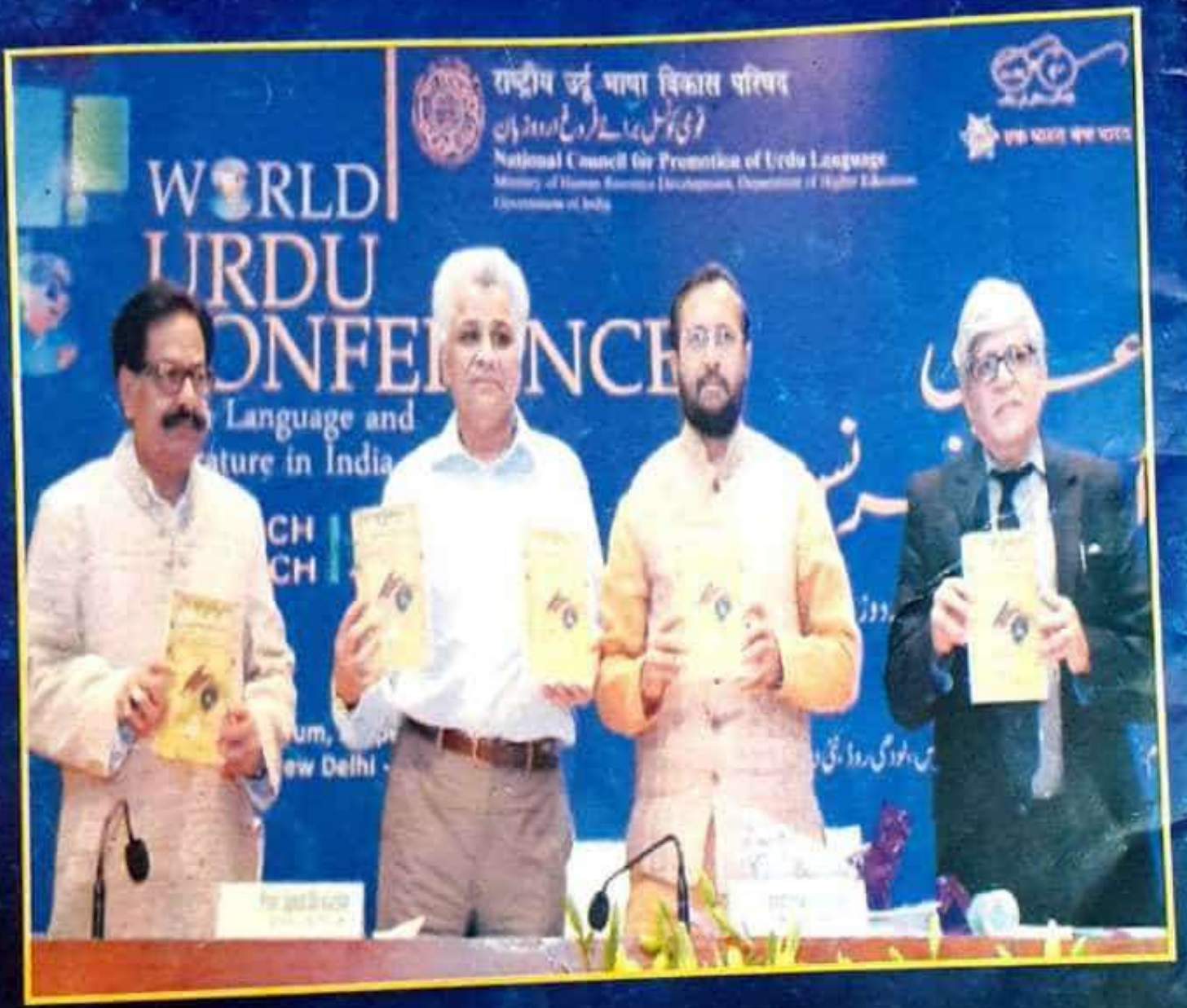

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دَروبست

ناول ''خواب رو'' کا تنقیدی جائزہ

شری سین کمار بھارتی

جوگندر پال فکشن کی دنیا میں ایک ایسا نام ہے جنہوں نے افسانے کے کینواس کو وسیع کرنے کے ساتھ ساتھ ناولٹ اور ناول کے میدان میں بھی طبع آزمائی کی ہے۔ ان کے تخلیقی اظہار کی ایک نمایاں خصوصیت یہ ہے کہ فطرت اور کائنات سے ان کی گہری وابستگی ہے جو ان کے فن کو عظمت عطا کرتی ہے لیکن اس کے باوجود عصری زندگی کے سماجی، سیاسی، سماجی، معاشرتی اور دیگر مسائل بھی ان کے تخلیقی عمل کا حصہ ہیں۔

جوگندر پال کی کہانی میں حقیقت بیانی نظر آتی ہے اور ملک کے سیاسی صورت حال کی براہ راست تصویر بھی ملتی ہے۔ ان کے فکشن میں علامت، تجریدی، تمثیل اور اینٹی اسٹوری (Anti-Story) ہر طرح کے تخلیقی پیرائے ملتے ہیں۔ جن سے ان کے یہاں اظہار و بیاں میں تنوع اور تہہ داری پیدا ہوئی ہے۔ ڈاکٹر سید یحییٰ صبا لکھتے ہیں:

''جوگندر پال کو عوام کی طاقت اور دانائی پر بہت بھروسہ ہے وہ عام انسانوں کی دیگر گوں حالت دیکھ کر پریشان رہتے ہیں۔ ناول کی فنی اور جمالیاتی وقار کا سبب زبان و بیان کا خوش نما استعمال ہے۔ اس ذریعے جوگندر پال اپنے کرداروں کے روحانی تجربات میں قاری اور خود کو شامل کرتے ہیں۔ وہ اپنے ناولوں میں انسانی صورت حال میں معنی کی کئی سمتوں کی جستجو کرتے ہیں۔''[1]

جوگندر پال کے ناولوں میں جہاں زندگی کے بہت سارے موضوع ملتے ہیں وہیں انھوں نے ہجرت کو بھی اپنے ناول ''خواب رو'' میں موضوع کے طور پر اپنایا ہے، جس پر تقسیم ہند کے بعد بہت سے ادیبوں نے قلم اٹھایا ہے۔

جوگندر پال نے ہجرت کو فلسفیانہ نقطہ نگاہ سے پیش کیا ہے۔ ''خواب رو'' کا موضوع چوں کہ جوگندر کا پسندیدہ موضوع رہا ہے۔ یہی وجہ ہے کہ جوگندر پال نے اپنے ناول ''خواب رو'' میں ہجرت کے مسائل کو ایک تلخ ترین حقیقت کی طور پر پیش کیا ہے۔ اس حقیقت کا ایک سراغ انتظار حسین کا ناول ''بستی'' ہے جس کا موضوع بھی ہجرت ہے۔ دونوں معاصر فکشن نگار ہیں۔ دونوں کو ہجرت کا موضوع پسند ہے لیکن جو گندر پال کا عالم یہ ہے کہ انتظار حسین جہاں فاصلے برتتے ہیں وہیں جوگندر پال فاصلے کے لیے ایک حد قائم کر لیتے ہیں۔

جوگندر پال نے ناول ''خواب رو'' میں ہجرت کے مسائل کو ایسے پیش کیا ہے کہ خواب اور حقیقت ایک دوسرے میں اتنے ملے ہوئے ہیں کہ ایک دوسرے کو الگ نہیں کیا جا سکتا اور ناول میں یہ بھی اندازہ لگانا مشکل ہے کہ کہاں تک خواب ہے اور کہاں تک حقیقت۔ ایک لحظہ محض خواب ہے اور دوسرا حقیقت اور جو حقیقت ہے وہ محض ایک خواب ہے۔ اس ناول میں جوگندر پال نے ہجرت کو المیہ کے طور پر یوں پیش کیا ہے۔ اقتباس دیکھئے:

''نہیں، مائی ڈیئر ہاشم چندانی کے برعکس ہم وہاں سے یہاں بھاگ تو آئے ہیں مگر اسی کے مانند ہمیں ابھی تک اپنے ذہن سے باہر آنے میں تامل ہے۔ اللہ تعالیٰ نے ہمیں اس لیے ذہن عطا کیا ہے کہ اس کے ذریعے ہمیں کل کائنات کے ذہن

تک رسائی نصیب ہو۔ مقام بدل جائے تو کیا؟ ہر نئے مقام پر ہم صرف وہیں سانس لے سکتے ہیں، یا بصورت دیگر ہندو سادھوؤں کی طرح ہمیں سانس روک کر جینے پر قدرت ہو۔ اگر ہمیں کھلے کھلے سانس لینا ہے تو اس کے سوا کوئی تدبیر نہیں کہ اپنے ہر نئے مقام پر ہم فوری طور پر مقامی ہو جائیں، اتنے، کہ ہم سے نفرت کرتے ہوئے مقامیوں کو محسوس ہو کہ وہ اپنے آپ سے ہی نفرت کر رہے ہیں۔ بتاؤ کیا میری بیوی اپنے بچوں کے باپ کو گھر سے نکال کر خوش رہ سکتی ہے؟۔۔۔ نہیں بھائی میرے نہیں اصل مسئلہ دراصل یہی ہے۔ ہمارے اور ان کے علاقوں میں اسی لئے آئے دن بم پھٹتے رہتے ہیں کہ چار پانچ دہوں یکسی کے باوجود ذہنی طور پر ہم الگ الگ کروں میں رہائش اختیار کئے ہوئے ہیں۔" ۲

ملک کی تقسیم پر جب لکھنؤ کے مہاجرین پاکستان کے شہر کراچی چلے جاتے ہیں تو وہاں بھی ہم وطنوں اور عزیزوں کے ساتھ مل کر اپنے علاقائی شہروں، قصبوں اور کالونیوں کو بسا لیتے ہیں مثلاً لکھنؤ، الہ آباد، رام پور، حیدرآباد اعظم گڑھ وغیرہ۔ ان مہاجرین میں ایک مہاجر دیوانے مولوی صاحب ہیں جن کا اصل نام مرزا کمال الدین ہے جو اپنے خاندان کے ساتھ کراچی جاتے ہیں اور وہاں اپنی متروکہ لکھنوی تہذیب اور اس کے عناصر کو بسا کر مطمئن زندگی بسر کر رہے ہیں کہ اچانک وہاں کے اصل مقامی سندھیوں کے ذریعے مولوی صاحب کے نواب محل میں ہم دھماکہ ہوتا ہے اور ان کے بیشتر عزیز و اقارب اس حادثے کی نذر ہو جاتے ہیں۔ ایسے بحرانی حالات میں ان کا باورچی سائی بابا ہی ان کی ڈھارس بندھاتا ہے۔ مولوی صاحب سائیں بابا سے گلے مل کر اظہار کرتے ہیں کہ ان کے ہوش و حواس قائم نہیں رہتے۔ کچھ لمحہ کے بعد ان کو ہوش آتا ہے تو پاگل پن شروع ہو جاتا ہے یعنی انھیں احساس ہوتا ہے کہ یہ ہمارا اصل لکھنؤ نہیں ہے اب ہمیں اپنے وطن لوٹ جانا چاہیے۔

اس طرح جوگندر پال نے اپنے ناول میں ہجرت کے المیہ کو بہت ہی پر اثر انداز میں پیش کیا ہے۔ تقسیم کے بعد جہاں بہت بڑی آبادی ایک خطے سے دوسرے خطے میں منتقل ہو جاتی ہے انھوں نے اپنی ثقافت اور معاشرت کو بھی نئے خطے میں بسالیا کہ اکثر مقامی ثقافت و زبان بھی معدوم و مغلوب ہو گئیں۔ یہاں لکھنؤ اور کراچی کے دو ثقافتی مراکز ثقافتی تبدیلی کے نمونے کے طور پر پیش کیا گیا ہے۔ ۱۹۴۷ء میں جب یوپی کے مہاجرین پاکستان چلے جاتے ہیں تو ان کی زیادہ تعداد کراچی میں بستی ہے وہاں اپنے اپنے ہم وطنوں اور عزیزوں کے ساتھ اپنی علاقائی جگہ بنا لیتے ہیں۔ لکھنؤ، الہ آباد، اعظم گڑھ، رام پور، حیدرآباد وغیرہ صرف یہی نہیں بلکہ جو مہاجرین کراچی میں جا بسے تھے ان لوگوں نے زبان، تہذیب، لباس اور غذا کے نقطہ نظر سے ایک ثقافتی برتری قائم کر لی تھی۔ جب کہ یہ ہونا چاہیے تھا کہ ایک نیا رواداری معاشرے کی تشکیل کے لیے مقامی سندھی کلچر اور مہاجر اردو کلچر کے بہترین عناصر کے امتزاج سے ایک جدید اور توانا کلچر وجود میں آتا اس طرح ایک نیا صالح معاشرہ قائم ہو سکتا تھا۔ اقتباس ملاحظہ ہو:

" مگر وگر کچھ نہیں، اسحٰق میاں اللہ تم پہ اپنا کرم رکھے۔ تمہاری کراچی ہم نے بہت دیکھ لی۔ اب ہم گھر کے لیے اداس ہیں۔ خدا کے لیے ہمیں ہمارے لکھنؤ بھیج دو۔ ہو سکے تو آج ہی بلکہ ابھی اسی وقت۔۔۔۔۔ تیار ہو جاؤ بیٹے آج ہم جا رہے ہیں۔" کہاں بڑے ابو "لکھنؤ بیٹے" ہمارا لکھنؤ!" سلیم کے سمجھ میں نہیں آیا ہے کہ بڑے ابو کس لکھنؤ کا ذکر کر رہے ہیں۔ وہ کھڑے کھڑے گیند سے کھیلنے لگا ہے جو اچانک کمرے سے باہر اچھل گئی ہے وہ یہ جواب دے کر گیند کے پیچھے بھاگ گیا ہے۔ "لکھنؤ یہیں تو ہے بڑے ابو۔" ۳

جوگندر پال نے مہاجرانہ زندگی کو اس ناول کا موضوع بنایا ہے کہ جو لوگ ہجرت کر کے پاکستان چلے گئے ان کے جان مال کا خطرہ

بھگتنا پڑتا ہے یعنی "خواب رو" کا مرکزی موضوع ہے۔

اس کے علاوہ جوگندر پال نے اس ناول میں کچھ دوسرے مسائل کو بھی موضوع بنایا ہے جیسے پاک اور ہند کے رہنے والوں کا بود و باش کا طریقہ اور پاکستانی تہذیب کو بھی ناول میں پیش کیا ہے۔

اس ناول میں جوگندر پال نے ایک بہت بڑے المیہ کو اس طرح پیش کیا ہے کہ قاری بے حد متاثر ہوتے ہیں۔ خواب رو اپنا بڑھاپا، معنوی شدت اور اپنے وطن و مکان کے تعلق سے ایک عجیب و غریب الجھن میں ہے۔ ہند و پاک کے تعلقات کی کہانی بہت پرانی اور جاری ہے لیکن جوگندر پال نے اس کہانی کو جس دل سوزی اور جس گداز سے اور جس تعلق کے ساتھ لکھا ہے وہ اہمیت کا حامل ہے۔ انھوں نے ہجرت کے مسائل کو ایک نئے طریقے سے دیکھا اور دکھایا ہے۔ جوگندر پال دیوانے مولوی صاحب کو زندہ ہوتے ضرور دکھایا لیکن ناول کا بہترین پہلو یہ ہے کہ ہجرت کرنے والے نئی سرزمین میں اپنی جڑوں کا پودا لگانا چاہتے ہیں اور وہ اس کی خاطر ہر مشکلات اٹھانے کے لیے تیار رہتے ہیں۔ اس مسئلہ کو جوگندر پال نے اس ناول میں بہت سنجیدگی سے برتا ہے۔ اور اپنے موضوع کو استدلالی اسلوب میں پیش کیا ہے۔ جو قاری کو صرف متاثر ہی نہیں کرتا ہے بلکہ قائل کرنے کا ہنر بھی رکھتا ہے۔

جوگندر پال نے اس ناول میں یہ بھی دکھایا ہے کہ ثقافتی فاصلوں میں اضافہ کرنے میں ریاستوں کا کردار نہایت اہم رہا ہے جس کی وجہ سے آج بھی سرحد کے دونوں جانب رہنے والوں کے بیچ غلط فہمیاں پیچھا نہیں چھوڑتی ہیں:

"ہندوستان کے تعلق سے ہمارے بڑے تو اس قدر الجھن کا شکار ہیں کہ یہیں کے آموں کو ملیح آبادی کے آم سمجھ لیں تو انھیں دو کوڑی کا بھی نہیں گردانتے اور چھوٹوں کا خیال ہے کہ ہندو جانوروں کا گوشت نہیں کھاتے بس یا تو گھاس پھوس کھاتے ہیں یا آدمی کا گوشت۔ ملاحظہ ہو یکساں تاریخ کے دو

[illegible]

جائیں۔"

[illegible] حل کرنے کے لیے کوشاں ہیں۔

ناول "خواب رو" کا پلاٹ مربوط ہے۔ جوگندر پال نے اپنے پلاٹ میں تمام صورت حال کا ذکر [illegible] کے ناول کا پلاٹ ہے۔ ناول میں انھوں نے دیوانے مولوی صاحب کی کیفیات، خواہش کے ساتھ ہی مولوی صاحب کے ہم وطنوں اور مہاجروں کی کیفیت و احوال کو ایک ساتھ پیش کیا ہے۔ اور ان حالات و کیفیات کو اس طرح سے ایک کہانی بنا کر پیش کیا ہے کہ کہانی میں شروع سے آخر تک تسلسل برقرار ہے۔ جب ہم ناول کو پڑھتے ہیں تو یہ محسوس ہوتا ہے کہ اب کیا ہوگا اور آگے کیا ہوگا۔ اس ناول میں کچھ باتیں ایسی بھی ہیں جو غیر ضروری معلوم ہوتی ہیں لیکن جوگندر پال نے اس طرح سے لکھا ہے کہ قاری کو اس کا احساس نہیں ہوتا۔

جوگندر پال نے اس ناول میں سادہ، عام فہم اور رواں

مناسبت سے زبان و بیان استعمال کیا ہے جس میں شائستگی اور نرمی ہے۔

پال نے اس ناول میں جابجا ہندی، انگریزی، سندھی، پنجابی، عربی و فارسی زبانوں کے الفاظ استعمال کیا ہے مثلاً

ہندی کے الفاظ: بھانت بھانت، سنگت بل، نرمم، اچمبھا، روپ، سنگت، پرلوک، مدھار، ڈنتال، بسیت، سپنا، کھلواڑ، چھٹی، جگمگ، بات چیت، ساون، بھادوں، انجان، بروان، آو بھگت، کھونٹا وغیرہ۔

انگریزی کے الفاظ: بلڈپریشر، پلاننگ، مائی ڈیئر، فرینڈ، ویری، چیکنگ، ٹورسٹ، نوٹس، اسپیشل، ریٹائر، سٹیلائیٹ، انٹروڈکشن، رینک ناسٹلجیا وغیرہ۔

سندھی کے الفاظ: ساڈکھوآہے سکھر وینداء کیہ تھیو یاتان، سائیں پاں تراں، اوہو تھیواں، اوتھے وغیرہ۔

پنجابی کے الفاظ: اسیاں توسی لنڈھائے نڈھال سنگرو ہنگرے کھایاپیا وغیرہ۔

عربی کے الفاظ: مخبوط الحواس، متوحش، عین، حب وقت، عجلت، قناعت، معجزہ، جسم نحیف، معقب وغیرہ۔

فارسی کے الفاظ: بذات خود، باز یافت، تجوا، باغ وغیرہ۔

جوگندر پال کے ناول "خواب رو" میں جذبات نگاری کے بھی اچھے نمونے دیکھنے کو ملتے ہیں۔ مصنف نے اس ناول میں کئی طرح کے جذبات کو پیش کرنے کی کوشش کی ہے جس میں ہنسنا، رونا، گانا، غصہ کرنا، رحم کرنا، خوف وغیرہ۔

ہر ایک فنکار کا ایک نقطۂ نظر ہوتا ہے، جو اس کی ہر تخلیق میں کارفرما رہتا ہے۔ جوگندر پال نے اپنی زندگی میں جو مشاہدے اور تجربے کئے ہیں۔ اسی کو اپنے ناول میں پیش کیا ہے۔ پال کی زندگی خود ہجرت سے دو چار ہے۔ اس ناول میں نقطۂ نظر یہ ہے کہ اپنا وطن تو وطن ہی ہوتا ہے انسان ہجرت کر کے کہیں سے کہیں چلا جائے اس کے دل سے وطن کی محبت نہیں نکلتی۔ لیکن ناول میں ان کا یہ نقطۂ نظر ظاہری طور پر واضح نہیں ہے جو ایک کامیاب فن اور فنکار کی دلیل ہے۔ مجموعی طور پر اس ناول میں ہجرت کے واقعہ کو جوگندر پال نے نئے تجربات کے ساتھ منطقی اور استدلالی اسلوب میں پیش کیا ہے جو قاری کو صرف متاثر ہی نہیں کرتا ہے بلکہ اپنا گرویدہ بنالیتا ہے۔ ●●

حوالے

۱۔ اردو ناول کا ارتقا، از ڈاکٹر سید محمد یحییٰ صبا
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अनुक्रमणिका

गंगा–जमुनी मुश्तरका तहज़ीब के रसिया नज़ीर अकबराबादी

*श्रीसेन कुमार भारती**

हिंदुस्तान में अठारहवीं सदी के दौर को अगर सियासी अफ़रा–तफ़री या सियासी इन्तशार व बिखराव का दौर कहा जाये तो ग़लत न होगा। ये वो दौर था जब मुग़लिया सल्तनत अपनी पतन की ओर बढ़ रही थी और मुग़लिया सल्तनत का निज़ाम बिखरने लगा था। लेकिन हिंदुस्तान की सांस्कृतिक व सामजिक जीवन और सांस्कृतिक परिदृश्य अपनी जगह पर क़ायम था। अवामी सतह पर इत्तिहाद–व–यगानगत (एकता) मुल्क के अंदर रहने वाले मुख़्तलिफ़ रंग–व–नस्ल और मुख़्तलिफ़ धर्मों के मानने वाले लोगों में सदियों से चली आ रही थी वो अपनी जगह पर ज्यों का त्यों बरक़रार थी। उसी माहौल में उर्दू शायरी की उफ़क पर एक ऐसा सितारा नमूदार हुआ जिसने उस दौर की अपनी शायरी में भरपूर तर्जुमानी की और हमें उस दौर की सांस्कृतिक, सामाजिक और नैतिक परम्पराओं की मुकम्मल झलक उसके कलाम में नज़र आई।

नज़ीर का नाम शेख़ वली मुहम्मद था और उनके पिता का नाम शेख़ मुहम्मद फ़ारूक़ था। नज़ीर 1740 ई के क़रीब दिल्ली में पैदा हुए लेकिन अहमद शाह अब्दाली के हमले के वक्त दिल्ली से आगरा चले आये। नज़ीर ने अपनी ज़िंदगी का बेशतर हिस्सा आगरा में ही गुज़ारा। हालांकि हर जगह उन्होंने दिल्ली के बजाय आगरे का ही ज़िक्र किया है –

आशिक़ कहो, असीर कहो आगरे का है
मुल्ला कहो, दबीर कहो आगरे का है
मुफ़लिस कहो, फ़क़ीर कहो आगरे का है
शायर कहो, नज़ीर कहो आगरे का है'

यह हक़ीकत है कि नज़ीर आगरे के थे और आख़िर दम तक आगरे के रहे। लेकिन उन्होंने जो बातें कहीं वो सिर्फ आगरे के अवाम के लिए न थी बल्कि उसमें पूरे हिंदुस्तान जीता जागता नज़र आता है, हिन्दुस्तानी तहज़ीब बोलती नज़र आती है और हिन्दुस्तानी अवाम रचते बसते हैं जिसमें हिन्दू मुस्लिम दोनों क़ौमों के लोग शामिल हैं। नज़ीर अकबराबादी शायराना ऐतबार से अवामी थे और सबके थे। ग़ौर करने की बात ये है कि नज़ीर मुसलमान होते हुए भी ईद पर दो नज्में और शब–ए–बरात पर सिर्फ़ एक नज्म कही जबकि हिन्दू त्योहारों पर बेशुमार नज्में कही हैं। सिर्फ़ होली पर ग्यारह नज्में कही हैं। दीवाली पर दो नज्में, राखी पर एक नज्म इसी तरह अगर एक तरफ़ हज़रत शेख़ सलीम चिश्ती का उर्स और ताज गंज के रौज़ा पर एक–एक नज्म है तो दूसरी तरफ़ कन्हैय्या जी पर पांच नज्में हैं। इसके अलावा उन्होंने हरि की तारीफ़, भैरो की तारीफ़, महादेव का बयान जोगी जोगन वग़ैरा इसी तरह मेले–ठेले में बलदेव जी का मेला, तैराकी का मेला वग़ैरा पर भी नज़्मे हैं जिनमें हिन्दू धर्म और रीति–रिवाज को निहायत बारीक़ी से पेश किया गया है। फिराक़ गोरखपुरी अपनी किताब "नज़ीर की बाणी" में नज़ीर के ताल्लुक़ से लिखते हैं –

"वो स्थानीय संस्कृति के रंग में रंग गये थे। हिन्दू त्योहारों, मेलों–ठेलों में बहुत दिलचस्पी लेते थे। ये वो वक्त था कि हिन्दू व मुसलमानों में परायापन नहीं था।"[1]

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* एमफिल, पीएचडी शोध–छात्र, उर्दू विभाग, हैदराबाद केन्द्रीय विश्वविद्यालय, हैदराबाद

मजमूई तौर पर ये कहना ग़लत न होगा कि नज़ीर ने एक तरफ़ अपनी शायरी में अपने मज़हब, अपने खुदा, पैग़म्बर और औलिया का ज़िक्र किया है तो वहीं दूसरी तरफ़ हिन्दू देवी देवताओं, त्योहारों, खेल–कूद, खान–पान पर भी नज़में कही हैं। एक तरफ़ अगर वो ईदुलफ़ितर पर कहते हैं –

पिछले पहर से उठ के नहाने की धूम है
शीर–ओ–शक्कर, सेवईयां पकाने की धूम है
पीर–ओ–जवाँ को नेअमातें खाने की धूम है
लड़कों को ईदगाह जाने की धूम है
ऐसी न शब–ए–बरात, न बक़रीद की ख़ुशी
जैसी हर एक दिल में है इस ईद की ख़ुशी'

ईद मुसलमानों का एक मुक़द्दस त्यौहार है। ईद की ख़ुशी हर दिल में होती है। जब नज़ीर इस माहौल का ज़िक्र करते हैं तो ख़ास तौर पर अवाम में से एक फर्द मालूम होते हैं। ऊपर के बंद को ही देखिये जिसमें उन्होंने अवाम की ख़ुशी और उनके जज़्बात का इज़हार किया और दिखाया है कि ईद की ख़ुशी बच्चे से लेकर बूढ़े सबमें किस क़दर पाई जाती है और कितने ख़ुश नज़र आते हैं।

तो दूसरी तरफ़ नज़ीर होली के रंग में शराबोर और मस्ती में मदहोश लोगों के साथ होली खेलते नज़र आते हैं। नज़्म "होली" से चंद पंक्तियाँ पेश हैं –

हर आन ख़ुशी से आपस में सब हँस–हँस रंग छिड़कते हैं
रुख़सार गुलालों से गुलगूं, कपड़ों से रंग टपकते हैं
कुछ राग और रंग झमकते हैं कुछ मय के जाम छलकते हैं
कुछ कूदे हैं कुछ उछले हैं कुछ हँसते हैं कुछ बकते हैं
ये तौर, नक्शा इशरत का हर आन बनाया होली ने'

वाकई नज़ीर होली के आशिक़ थे और होली की रंग में वो ख़ुद को पूरी तरह डुबो देते थे। होली की एक अहम् ख़ूबी जो नज़ीर को भाती है। वो ये है कि होली के जश्न में समाज के हर तबक़े के लोग बग़ैर किसी लिहाज के शरीक होते हैं, ऊँच–नीच का फ़र्क मिट जाता है। सब भारतीय संस्कृति के रंग में रंग जाते हैं और इन रंगों में दिलों के सारे गुबार धुल जाते हैं। नज्म "होली" से कुछ पंक्तियाँ पेश हैं –

यहाँ तू हमसे न रख कुछ गुबार होली में
कि रूठे मिलते हैं आपस में यार होली में
मची है रंग की कैसी बहार होली में
हुआ है ज़ोर–ए–चमन आशकार होली में
अजब ये हिन्द की देखी बहार होली में'

उपर्युक्त पंक्तियों से स्पष्ट हो जता है की नज़ीर अकबराबादी ने जहाँ एक तरफ़ ईद को एक मुक़द्दस त्यौहार की सूरत में पेश किया है वहीं दूसरी तरफ़ होली को नक्श–ए–इशरत समझ कर होली के त्यौहार के धूम–धाम और उसकी अहमियत को वाज़ह कर दिया है। इससे मालूम होता है कि नज़ीर किस कदर गंगा–जमुनी साझी संस्कृति की ज़ेहनियत के रचनाकार थे। हालाँकि वो चाहते तो सिर्फ मुसलमानों के त्यौहार या सिर्फ हिन्दुओं के त्यौहार को अपनी शायरी में मौज़ू बनाकर पेश कर सकते थे। लेकिन हिंदुस्तान चूँकि मिली–जुली संस्कृति का गहवारा है जहाँ मुख़्तलिफ़ धर्मों और वर्गों

के लोग आबाद हैं जिनको हिन्दुस्तान की मुश्तरका तहज़ीब अपने दामन में समेटे हुई है। लिहाज़ा नज़ीर ने भी इसी मुश्तरका तहज़ीबी रवायत की पासदारी करते हुए बिना भेदभाव किये मज़हब–व–मिल्लत और रंग–व–नस्ल के हिंदुस्तान की मिली–जुली संस्कृति को ही अपनी शायरी का ख़ास मल्का बनाया। नज़ीर एक तरफ़ शब–ए–बरात पर अपने ख़्यालात का इज़हार करते हैं। नज्म "शब–ए–बरात " से एक बंद देखिये –

आलम के बीच जिस घडी आती है शब–ए–बरात
क्या–क्या ज़हूर–ए–नूर दिखाती है शब–ए–बरात
देखें हैं बंदगी में जिसे जागता तो फिर
फूली नहीं बदन में समाती है शब–ए–बरात
रौशन हैं दिल जिन्हों के इबादत की नूर से
उनको तमाम रात जगाती है शब–ए–बरात'

तो दूसरी तरफ़ दीवाली पर भी अपनी ख़ुशी का कुछ इसी तरह इज़हार करते हैं। नज़्म "दीवाली" के एक बंद देखिये –

हर इक मकाँ में जला फिर दिया दीवाली का
हर इक तरफ़ को उजाला हुआ दीवाली का
सभी के दिलों में समां भा गया दीवाली का
किसी के दिल को मज़ा खुश लगा दीवाली का
अजब बहार का है दिन बना दीवाली का'

नज़ीर एक तरफ़ ख़ुदा की तारीफ़ करते हैं। नज्म "इलाही नामा" से दो पंक्तियाँ पेश हैं –

काफ़िर न कोई साहब–ए–इस्लाम रहेगा
आख़िर वही अल्लाह का एक नाम रहेगा'

तो दूसरी तरफ़ कृष्ण जी की जय बोलते नज़र आते हैं। नज्म "जन्म कान्हा जी" से दो पंक्तियाँ पेश हैं –

कर याद नज़ीर अब हर साईत उस पालने और झूले की
आनंद से बैठो, चैन करो जय बोलो कान्हा झंडूले की'

हिन्दुस्तान में जश्न ,उत्सव साथ–साथ मिल कर मनाने की रवायत रही है, जो किसी और मुल्क में नहीं पायी जाती है जैसे हज़रत–ए–शेख़ सलीम चिश्ती के उर्स को मुख़्तलिफ़ धर्मों और वर्गों के लोग एकजा होकर बड़ी धूम धाम से मानते हैं। हज़रत–ए–शेख़ सलीम चिश्ती के उर्स का मंज़र अपनी शायरी में कुछ यूँ पेश करते हैं। नज्म "हज़रत–ए–शेख़ सलीम चिश्ती का उर्स" से कुछ पंक्तियां देखिये–

कितने दरगाह में फैज़ उठाते हैं
कितने झरने में जा नहाते है
कितने नज़र–ओ–नयाज़ लाते हैं
कितने खुश हो यही सुनते हैं
रश्क है गुलशन–ए–बहिश्ती का
उर्स हज़रत सलीम चिश्ती का'

कुछ ऐसा ही बलदेव जी का मेला का ज़िक्र करते हैं जिसमें हर मज़हब के लोग शरीक होते हैं। नज्म "बलदेव जी का मेला" से कुछ पंक्तियाँ पेश हैं –

लोग चारो तरफ़ के आते हैं
आके ऐश–ओ–तरब मानते हैं
दिल से सब दर्शनों को जाते हैं
अपने दिल की मुराद पते हैं
झांझ, मिरदंग, दफ़ बजाते हैं
रास मण्डल भजन सुनते हैं
दिल में फुले नहीं समाते हैं
सब ये हँस–हँस के कहते जाते हैं
रंग है, रूप है, झमेला है
ज़ोर बलदेव जी का मेला है'

बहरहाल नज़ीर की ज़ेहनियत पर एक ऐसा हिन्दुस्तान की छाप है जहाँ मज़हब–ओ–मिल्ल्त, रंग–ओ–नस्ल, ज़ात–पात और ऊँच–नीच की बुनियाद पर खते इमत्याज़ नहीं खिंचा जा सकता है। वो इस बात पर यक़ीन करते हैं कि अपनी जन्म–भूमि की सांस्कृतिक परम्पराओं और धार्मिक रीति–रिवाजों व त्योहारों में इन्सानों के बीच भेदभाव करना सच्चे देशभक्त की विशेषता नहीं है। उन्होंने अपनी शायरी मैं इसी नुक्त–ए–नज़र को पेश किया है कि हिन्दुस्तान सिर्फ एक मुल्क ही नहीं बल्कि एक ऐसी मुश्तरका तहज़ीब की आमाजगाह है जहाँ हर तरह और हर अक़ीदे के लोग रहते हैं। उनकी शायरी में जिस तरह धर्मों में कोई फर्क महसूस नहीं होता वहीं उर्दू और हिंदी ज़बान को बरतने में कोई फर्क महसूस नहीं होता है। क्योंकि उन्होंने जहाँ उर्दू ज़बान के रस भरे अल्फाज़ का इस्तमाल किये है वहीं उन्होंने अपनी शायरी में हिंदी के अल्फाज़ इस्तेमाल करके अपनी शायरी की मिठास और चाशनी को बढाया है। नज़ीर की शायरी दरअसल समाजी नाबराबरी, फिरका वारीयत और धर्मों और भाषाओं में भेदभाव करने के ख़िलाफ़ रद्देअमल है। उनकी शायरी में अपने देश के प्रति प्रेम और एकता का दर्स मिलता हैं। जिसकी ज़रुरत दौर–ए–हाज़िर के हिंदुस्तान के लिए उतनी ही है जितनी नज़ीर के दौर के हिन्दुस्तान के लिए।

सन्दर्भ–

उपर्युक्त दी गई सभी कविताओं की पंक्तियाँ नज़ीर के ग्रन्थ से हैं।

1. फिराक़ गोरखपुरी– नज़ीर की बाणी, बाणी प्रकाशन, नई दिल्ली,1999, भूमिका से।

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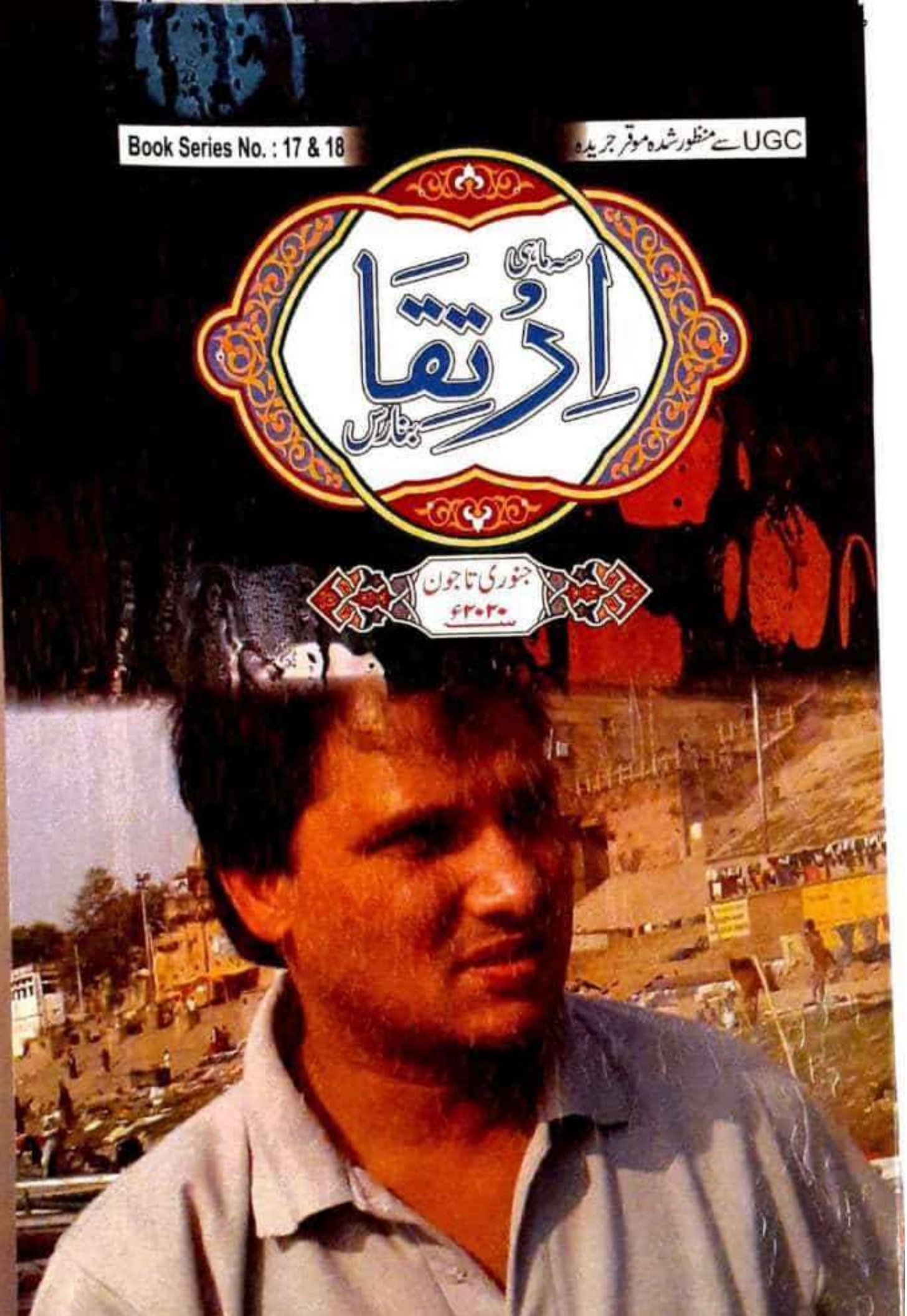
سہ ماہی اُدیقا بنارس

جنوری تا جون
سنہ ۲۰۲۰ء



جنوری تا جون ۲۰۲۰ء

اداریہ ہائے گوشۂ ڈاکٹر سلمان راغب

بہ یادگار: ڈاکٹر سلمان راغب

UGC سے منظور شدہ موقر جریدہ

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فہرست

حصہ منظومات

اپنی بات

ارتقا کے گزشتہ دو شماروں جنوری تا جون ۲۰۱۸ء 'شمیم طارق' نمبر اور 'صبح بنارس اور بنارس کے پانچ شعرا' ۲۰۱۹ء کے خصوصی نمبر کی طرح یہ شمارہ بھی جنوری تا جون ۲۰۲۰ء کا خصوصی نمبر جس میں سلمان راغب (مرحوم) کے نام سے ایک گوشہ آخر میں رکھا گیا ہے آپ کے ہاتھوں میں ہے۔

چھ مہینوں کی ان تاریخوں کے درمیان ہندوؤں کا ہولی کا تہوار خوشیوں کے رنگ بکھیرتا گزر چکا ہے اور مسلمانوں کا عالمی تہوار عید بھی اپنی خوشیاں لٹانے کے لئے دل کے دروازوں پر دستک دے رہی ہوگی، ان کے علاوہ اور بھی نہ جانے کتنے مواقع خوشیوں کے پھول بکھراتے ہوئے آئندہ سال کا آسرا دے کر گزر چکے ہوں گے لیکن اسی درمیان غم کا کوئی ایسا حادثہ رونما ہو جاتا ہے تو وہ غم کا دور ظاہر طور سے خوشیوں کے ہجوم میں مجسم غم بن کر سامنے آجاتا ہے

جینت پرمار کی غزل گوئی (ایک مطالعہ)

سری سین کمار بھارتی

غزل ہر دور میں شعراء کی پسندیدہ صنف رہی ہے۔ غزل نے زمانے کے ساتھ ساتھ اپنے آپ کو ڈھالا ہے۔ صدیاں گزرنے کے باوجود بھی اس صنف کی مقبولیت میں کمی نہیں آئی۔ آزادی کے بعد غزل کے موضوعات میں تبدیلی آتی گئی۔ شعراء نے غزل میں نئے نئے موضوع کو شامل کیا۔ جدید شعراء نے غزل میں نئی لفظیات کو پیش کیا۔ صرف مسلم شعراء ہی نہیں بلکہ کئی غیر مسلم شعراء نے بھی میدان غزل میں طبع آزمائی کی۔ 1990ء کے بعد ایک شاعر اردو شاعری میں منظر عام پر آیا۔ جسے دنیائے شعروادب جینت پرمار کے نام سے جانتا ہے۔ یوں تو جینت پرمار بنیادی طور پر نظم کے شاعر ہیں اور دلت شاعر کی حیثیت سے اردو میں اپنی شناخت رکھتے ہیں۔ لیکن انہوں نے غزلیں بھی کہی ہیں۔ یہ اور بات ہے کہ ناقدین نے ان کی غزلوں سے متعلق بہت کم لکھا ہے۔ نظم کے مقابلے میں جینت پرمار نے غزلیں بہت کم کہی ہیں۔ جینت پرمار کے اب تک سات مجموعۂ کلام شائع ہو چکے ہیں جن میں ''اور'' 1999ء، ''پنسل اور دوسری نظمیں'' 2006ء، ''مانند'' 2007ء، ''انترال'' 2010ء، ''نظم یعنی'' 2013ء، ''جیا کو میتی کے سپنے'' 2016ء اور ''نقطہ اور دوسری نظمیں'' 2019ء شامل ہیں۔ ان کے شعری مجموعہ ''پنسل اور دوسر نظمیں'' کو ساہتیہ اکادمی، دہلی سے 2008ء میں ایوارڈ سے نوازا گیا۔ علاوہ ازیں بھاشا بھارتیہ سمان 2006ء، گجرات اردو ساہتیہ اکادمی ایوارڈ 2001ء، 2006ء، 2008ء، کمار پاشی ایوارڈ 2001ء، بھارتی دلت ساہتیہ اکادمی ایوارڈ 2002ء، اور حال ہی میں ڈاکٹر بی۔ آر امبیڈکر جیون گنورو ایوارڈ سے بھی نوازا گیا ہے۔

جینت پرمار 11 / اکتوبر 1954ء کو گجرات کے شہر احمد آباد کے قصبہ شاہ پور کے ایک دلت مل مزدور کے گھر پیدا ہوئے۔ چونکہ ان کے ماں باپ پڑھے لکھے نہیں تھے اس لیے گھریلو ماحول بھی تعلیم و تعلم سے عاری تھا۔ انہوں نے محض اپنی محنت لگن اور جستجو سے تعلیم حاصل کی پھر شاعری کے شوق نے انہیں اردو زبان و ادب کی طرف راغب کیا تو اردو زبان بھی انہوں نے دلچسپی سے سیکھی اور اس زبان میں شاعری کرنے لگے۔ ابتداء میں انہوں نے غزلیں کہیں۔ پھر نظم نگاری کی طرف راغب ہوئے۔ انہوں نے ''کالی غزل'' کے نام سے ایک غزل احمد آباد کے نام لکھی ہے جس میں انہوں نے سنہ ۲۰۰۲ میں ہونے والے فسادات کا ذکر کیا ہے کہ کس طرح شہروں میں فسادات کے موقع پر سڑکوں پر لاشیں دکھائی دیتی ہیں۔ غزل کے تین اشعار ملاحظہ ہوں

بری طرح سے سڑی ہوئی ہے
یہ لاش تو کس شہر کی ہے

نہ اس طرف سے کبھی گزرنا !
گلی میں افواہ جاگتی ہے

ذرا ٹھہر اس کو کاندھا دے دوں
یہ لاش تو میرے شہر کی ہے

ماہنامہ ''آج کل'' اپریل 2009ء کے شمارہ میں جینت پرمار کا انٹرویو اور ان کا منتخب کلام شائع ہوا۔ جس میں مندرجہ بالا غزل بھی شامل ہے۔ اسی انتخاب میں شامل ایک اور غزل ہے جس کے مطلع میں جینت پرمار بے حس اور خود غرض سماج کا نقشہ مناظر فطرت کے حوالے سے کھینچتے ہیں۔

پو پھٹی دھوپ کا دریا نکلا
راستہ آنکھ جھپکتا نکلا

مذکورہ غزل کے ایک اور شعر میں شاعر نے ''اسم محمد'' کو لے کر شعر کہا ہے۔ اسم محمد سے پیغمبر محمد ﷺ کا نام مراد ہے۔ شاعر نے محمد ﷺ کی عظمت کو اس شعر میں بیان کیا ہے۔ یہ بہت عمدہ شعر ہے۔ شعر ملاحظہ کیجئے۔

ہونٹ پر اسم محمدؐ بن کر
خانۂ دل سے اجالا نکلا

یوں تو جینت پرمار اپنی غزلوں کے مقابلے نظموں کو زیادہ ترجیح دی ہے لیکن ان کی غزلیں کم ہونے کے باوجود بھی اپنا ایک اثر رکھتی ہیں انہوں نے غزلوں میں معیاری زبان کا استعمال کیا ہے۔ کہیں کہیں فارسی آمیز لفظیات بھی ان کی غزلوں میں پائی جاتی ہیں۔ ان کا انداز تکلم بڑا شائستہ ہے۔ نغمہ صدیقی اورنگ آبادی لکھتی ہیں:

''ان کے قلم سے لکھا ہوا ہر وہ حرف شیریں و نغمگی لہجہ کی نمائندگی کرتا نظر آتا ہے۔ ان کی شاعری کچھ اور نہیں بلکہ ان کی ذاتی محبت کا یقین و ایمان ہے جو چہار سو آج اپنے زندہ و تابندہ ہونے کے امکان سے قریب قریب ہیں۔'' [1]

جینت پرمار نہ صرف ایک شاعر ہیں بلکہ وہ ایک عمدہ مصور بھی ہیں ان کی غزلوں میں ان کی مصوری کی جھلک صاف طور پر نظر آتی ہے۔ یہی وجہ ہے کہ ان کی غزلیں خوبصورت پیکروں اور رنگ و نور کا مرقع ہیں۔ شاید اسی لیے گوپی چند نارنگ نے لکھا ہے:

''جینت پرمار کی تخصیص یہ ہے کہ وہ اردو کے ایسے اکلوتے شاعر ہیں جن کے شعری عمل میں آرٹ کا تخلیقی عمل رواں دواں ہے۔'' [2]

مثال کے طور پر ان اشعار کو دیکھئے۔

ابھی تک آنکھ کی کھڑکی کھلی ہے
کوئی کمرے کے اندر جاگتا ہے

چمکتی دھوپ کا بے رنگ ٹکڑا
اکیلا پربتوں پر گھومتا ہے
گھنے جنگل سے لے کر گھاٹیوں تک
ہوا کا ٹیڑھا میڑھا راستہ ہے

گلی کے موڑ پر تاریک کمرا
ہماری آہٹیں پہچانتا ہے

ان اشعار میں شاعر نے ایک خوبصورت امیج بنائی ہے۔ ان میں رنگ بھی نظر آتا ہے، پینٹنگ بھی نظر آتی ہے، رومانس بھی نظر آتا ہے، شعر بھی سنائی دیتا ہے اور لے بھی سنائی دیتی ہے۔ جینت پرمار پیکر بنانا خوب جانتے ہیں۔ ایک شعر دیکھیے۔

دھوپ چڑیا چہچہا اٹھے گی پھر
پیکرِ شب پارہ پارہ دیکھنا

اس شعر میں جینت پرمار دھوپ کی چڑیا لکھنے کے بجائے صرف دھوپ چڑیا لکھے ہیں۔ اسی طرح ایک اور شعر میں دیکھیں لفظوں کا کتنے شاندار طریقے سے استعمال کیے ہیں۔

ریت ہوئے چلتے چلتے
سوچا تھا گھر آئے گا

جینت پرمار اس شعر میں ریت کی جگہ خاک بھی لکھ سکتے تھے لیکن خاک ہونے میں جو استعارہ بنتا ہے۔ اس میں جسم میں بھی بنتا ہے اور موت کا بھی اشارہ ہوتا ہے اور اشارے جو خاک سے نکل سکتے ہیں۔ لیکن جینت پرمار وہاں خاک لکھے نہیں ریت لکھے ہیں۔ اور ریت سب سے نکارہ چیز ہے۔ اسی غزل کا ایک اور شعر دیکھیے۔

مٹی کا تن ہے اپنا
آگے سمندر آئے گا

یہاں جینت پرمار خوب جانتے ہیں کہ ریت کہاں لکھنی ہے کہاں مٹی لکھنی ہے خاک کہاں لکھنی ہے اور خاک کے کیا کیا Dimension ہوتے ہیں مٹی کے کیا ہوں گے اور ریت کے کیا کیا ہیں۔

یہ حقیقت ہے کہ جینت کو مصوری کا شوق بچپن سے ہی تھا۔ پھر بعد میں شاعری کا شوق چرایا تو ان کی نظر مظلوم سماج پر پڑی اور انہوں نے سماج میں پھیلی غیر برابری کو اپنی شاعری میں جگہ دی۔ ایک حساس انسان جب اپنی سطح سے اتر کر ایک عام انسان کی طرح سرل ہو جاتا ہے تو اس کے اندر شاعری جنم لیتی ہے۔ جینت پرمار کی شاعری عہد حاضر کا منظر نامہ ہے۔ امتیاز احمد ان کی شاعری کے متعلق رقمطراز ہیں۔

> ''اردو شاعری کے موجودہ منظر نامے پر جینت پرمار کی شاعری اپنی ایک الگ شناخت رکھتی ہے اور یہ شناخت رائج شعری تصورات سے مختلف ہے۔ اس میں دکھ درد کی جو لہر ہے وہ میر کی شاعری کی طرح ہڈی میں چھید کرنے والی بھلے ہی نہ ہو لیکن دکھ درد کا ذاتی تجربہ ضرور ملتا ہے۔'' ۳

جینت پرمار نے غزل کو اپنے اظہار کا وسیلہ نہیں بنایا کیونکہ ان کے دل میں جو درد پنپا ہے اس کے بیان کے لئے انہیں غزل کا دامن تنگ معلوم ہوا اسی سبب انہوں نے نظموں کا سہارا لیا۔ لیکن غزلوں میں ان کی لفظیات بڑی اچھی رہی ہیں۔ انہوں نے غزل کے معیار کو ملحوظ رکھا ہے چند اشعار پیش کئے جاتے ہیں۔

نہ جانے کون سی بستی میں چاند ٹھہرا ہے
سیاہ رات کا دریا ہے میرے حصے میں

مرا جسم خوشبو کا جنگل لگے
مجھے کوئی شاخِ صبا چھو گئی

دل سوچتا ہے یہ بھی نیا حادثہ نہ ہو
بچھڑے تھے ہم جہاں سے اسی موڑ پر ملے

جینت پرمار کی شاعری علاقائی سطح تک محدود نہیں بلکہ ان کی شاعری کے شغل نے ہندوستانی تہذیب وثقافت کی قدروں کے نت نئے موضوع کو اپنی گرفت میں لے رکھا ہے جینت پرمار کی پہچان آج ملک بھر میں بن گئی ہے یہ اور بات ہے کہ بحیثیت غزل گو ان کا مرتبہ اتنا بلند نہیں جتنا کہ بحیثیت نظم نگار رہا ہے۔ان کی زیادہ تر غزلیں جدید طرز اظہار کی نمائندگی کرتی ہیں۔بعض غزلوں میں رومانی عنصر بھی مل جاتا ہے۔

لمس میں جانے کیسا جادو تھا
جسم کی شاخ کر گیا وہ ہری

جینت پرمار کی غزلوں نے اردو شاعری میں منفرد لب ولہجہ اور وہ روایتی انداز چنا جو نمونہ فن کار بن کر سنہری لفظوں میں اپنا منفرد مقام بناتا ہے۔شعری مجموعہ ''مانند'' کے ایک غزل کا ایک شعر ملاحظہ ہو۔

نہ دے سکوں گا تجھے لمحہ سکون کبھی
گلِ عذاب کا سایہ ہے میرے حصے میں

یہ پوری غزل پانچ شعر کی غزل ہے اس میں ہر بار دوسرا مصرعہ یہ آتا ہے ''گلِ عذاب کا سایہ ہے میرے حصے میں'' یہ شعر کہیں ترقی پسندی کی یاد دلاتا ہے۔جینت پرمار سے پہلے اسی بات کو فیض کچھ اس طرح کہے ہیں۔

مجھ سے پہلی سی محبت میری محبوب نہ مانگ
میں نے سمجھا تھا کہ تو ہے تو درخشاں ہے حیات

اور بھی دکھ ہیں زمانے میں محبت کے سوا
راحتیں اور بھی ہیں وصل کی راحت کے سوا
مجھ سے پہلی سی محبت میری محبوب نہ مانگ

مذکورہ بالا جینت پرمار کا یہ شعر اردو شاعری کے روایتی رنگ میں ڈوبا ہوا نظر آتا ہے۔ کچھ اسی طرح کا تجربہ ان کے شعری مجموعہ ''انترال'' میں شامل ایک غزل کے مطلعے میں بھی نظر آتا ہے۔ غزل ملاحظہ ہوں۔

موج مچھلی سیپ سورج ناریل
حیرتوں سے دیکھتے ہیں سبز پل

موج مچھلی سیپ سورج ناریل
آمری جاں ریشمی سانسوں میں ڈھل

موج مچھلی سیپ سورج ناریل
آج کے دن اور یہ سب دیکھ چل

موج مچھلی سیپ سورج ناریل
جسم کی دیوار سے باہر نکل

موج مچھلی سیپ سورج ناریل
آج ہوگی ایک، اچھی سی غزل

مذکورہ بالا غزل پانچ اشعار پر مشتمل ہے۔ جس میں مطلع کے شعر کے مصرع اول کو بار بار دہرا کر جینت پرمار نے اپنی شاعرانہ انفرادیت کو ظاہر کرنے کی کوشش کی ہے۔

جینت پرمار کے ہر شعری مجموعوں میں زیادہ تر نظمیں ہی شامل ہیں چند غزلیں اور کچھ دوہے نظر آتے ہیں جسے ہم مجموعی طور پر ان کی دس فیصدی شاعری کا حصہ کہہ سکتے ہیں۔ ان کی غزلوں میں بعض جگہ دقیق الفاظ بھی ملتے ہیں۔ ان کے شعری مجموعہ ''ماند'' کے صفحہ نمبر 102 پر

تحریر کردہ غزل دل کو چھو لینے والی ہے۔ جس میں ردیف وقوافی کا استعمال بھی شاعر نے خوب کیا ہے۔ مطلع میں شاعر کہہ رہا ہے کہ یہاں ایک نیم کا درخت تھا جواب نہیں ہے اور محلے میں پریوں کا گھر بھی تھا دوسرے شعر میں شاعر یہ بتانا چاہتا ہے کہ شاعری کتنی مشکل سے تخلیق کی جاتی ہے وہ کاغذ پہ صرف لفظ ہی نہیں ہوتے بلکہ شاعر کا خونِ جگر بھی اس میں شامل ہوتا ہے۔ اس غزل کے دو شعر ملاحظہ ہو

یہاں نیم کا اک شجر بھی تو تھا
محلے میں پریوں کا گھر بھی تو تھا

جسے شعر کہتے رہے ہم سدا
وہ کاغذ پہ خونِ جگر بھی تو تھا

جینت پرمار اگر اپنی غزلوں پر ترجیح دیتے تو ضرور وہ ایک بہترین غزل گو شاعر بن سکتے تھے لیکن انہوں نے اپنے دلت نظریات کو پیش کرنے کیلئے نظم کا سہارا لیا۔ ان کی غزلوں کے متعلق اتنا ضرور کہا جا سکتا ہے کہ ان کی غزلوں میں مروجہ لفظیات کے علاوہ نئی لفظیات بھی ملتی ہیں کہیں کہیں صنعت تکرار کا استعمال بھی شاعر نے کیا ہے اس ضمن میں چند اشعار پیش ہیں۔

وہ نیک نام جسے آج تک میں پڑھ نہ سکا
وہ حرف حرف مہکتا ہے میرے حصے میں

اسی راستے میں کڑی دھوپ ہے
اسی راستے میں صنوبر بھی ہے
لفظ لفظ معنی دے
پھر نئی کہانی دے

ان کی غزلوں کا اسلوب شائستہ ہے۔ ان کی سنجیدہ اور سادگی پسند شخصیت ان کی غزلوں

میں بھی نمایاں ہے۔ ایک غیر اردو داں ہونے کے باوجود بھی جینت پرمار نے جتنی بھی غزلیں کہی ہیں وہ یقیناً قابل ستائش ہیں۔ ان کے یہاں چھوٹی بحر میں بھی غزلیں ملتی ہیں اور بڑی بحر میں بھی، ان کی غزلیں جدید غزل کے انتخاب میں شمار کی جاسکتی ہے۔ چند اشعار ملاحظہ فرمائیں۔

آگ اک جسم کے شجر میں تھی
خواہشوں کی ہوا سفر میں تھی

ہر طرف اک عجیب منظر تھا
اک گھٹن آسمان بھر میں تھی

سروں میں سر پھری وحشی ہوا ہے
نہ جانے شہر کو کیا ہو گیا ہے

نکل بھاگے تو ہیں اک دائرے سے
مگر آگے نیا پھر دائرہ ہے

دیکھا جائے تو ان کی شاعری کے موضوع دلت مسائل، حسن فطرت، سماجی سیاسی و معاشی مسائل کے ساتھ ساتھ وہ تمام مصلحین، فلسفی، صوفیاء، نقاد، شعراو ادباء، موسیقار کار اور مصور بھی ہیں، جن کی دانشوری کی آفاقیت جاوداں ہے۔ مثلاً امیر خسرو، ولی، غالب، اوکتاویو پاز، وان گاگ، امبیڈکر، ٹیگور، گوگیں، کمار پاشی، ندا فاضلی، محمد علوی، وارث علوی، ریاض لطیف، شمس الرحمن فاروقی، گوپی چند نارنگ وغیرہ۔ مجموعہ ''پشمل اور دوسری نظمیں'' میں رقم کردہ غزل انہوں نے مرزا اسد اللہ خاں غالبؔ کی نذر کی ہے۔

تند شعلے مری لحد میں تھے

دل نے چاہا چھپا لوں آنکھوں میں
وہ ستارے جو دل کے حد میں تھے

اک جنوں سر پسند تھا گویا
کچھ شفق حوصلے شبد میں تھے

جب میں پڑھتا ہوں تازہ لگتے ہیں
رنگ کیا کیا میاں اسدؔ میں تھے

☆☆☆

حوالے :

۱۔ نقہ صدیقی ''اردو کا عاشق زاد: جینت پرمار'' مضمون مطبوعہ رسالہ ''زرین شعاعیں'' بنگلور، شمارہ ۱۱، نومبر ۲۰۱۲، ص ۴۲

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عکسِ ادب (اُردو)

اورنگ آباد

اکتوبر تا دسمبر ۲۰۲۰ء

قارئین کی نیک تمناؤں کے ساتھ

تینتسواں شمارہ جلد (۹)

غم ٹپکنے لگا ہے لفظوں سے
دردِ کیسے بیاں کرے کوئی

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بات تو جب ہے کہ انسان وہاں تک پہنچے

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جینت پرمار کی نظموں میں دلت تصورات

● سری سین کمار بھارتی
ریسرچ اسکالر، شعبہ اردو،
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جینت پرمار

☆ خلاصہ (Abstract):
لفظ ''دلت'' سنسکرت زبان کا لفظ ہے جو لفظ ''دل'' سے مشتق ہے جس کے معنی روندا ہوا، کٹا ہوا، چیرا ہوا، ٹوٹا ہوا، لپٹا ہوا، پھیلا ہوا، مسلا ہوا، دبایا ہوا، کچلا ہوا، برباد کیا ہوا، پھاڑا ہوا اور پھوڑا ہوا ہیں۔ ہندی لغت میں لفظ دلت کے معنی کچھ اس طرح دیئے ہوئے ہیں جس کا دلن یا استحصال ہوا ہو، روندا یا کچلا ہوا، بہت غریب، بھکاری، جو سماجی، مالی، تعلیمی اعتبار سے پیچھے رہ گیا ہو۔
دلت ادب سے مراد وہ ادب ہے جو دلتوں کے مسائل کو پیش کرتا ہے۔ دلت ادب کو مراٹھی زبان کے زیر اثر ہندوستان کی مختلف زبانوں کے ساتھ ساتھ اردو میں فروغ ہوا۔ اردو میں اس کا عمدہ نمونہ جینت پرمار کی شاعری ہے۔ اردو میں دلت ادب کی شروعات ابھی مکمل طور سے نہیں ہوئی ہے۔ لیکن دلت طبقوں سے ہمدردی کا اظہار اردو ادب کے شعراء و ادیبوں کی تحریروں میں بھی ملتا ہے۔ جن میں علامہ اقبال، فیض احمد فیض، منشی جوالا پرشاد، پریم چند، علی عباس حسینی، فراق گورکھپوری، یعقوب راہی، چندر بھان خیال اور صادقہ نواب سحر بھی شامل ہیں۔ اس مقالے میں جینت پرمار کی نظموں میں دلت تصورات پیش کئے گئے ہیں۔

۱۹۸۰ء کے بعد اردو نظم میں بھی تبدیلیاں آتی گئیں۔ ۱۹۸۰ء کے بعد نئی نئی نظمیں کہی جانے لگیں جیسے آزاد نظم، نثری نظم، ترائیلے، سانیٹ وغیرہ۔ حمالیات و رومان کے نئے تلازمے نکالے گئے۔ اظہار کی سطح پر بھی دیکھیں تو غیر ضروری تجریدیت اور ابہام کی جگہ ابلاغ و ترسیل پر زیادہ زور دیا جانے لگا۔ روایت سے انحراف و انکار کے بجائے کلاسیک سے ازسرنو استفادہ کرنے پر آمادگی ظاہر کی جانے لگی۔ ۸۰ء کے بعد نظم گو شعرا کی تعداد ۶۰ کے دہے کے مقابلے کم رہی۔ ۸۰ء کے بعد ابھرنے والے نظم گو شعراء میں، حمید الماس، محمد علوی، زبیر رضوی، ندا فاضلی، ساجد حمید، خالد سعید، حامد اکمل، جبار جمیل، عنبر بہرائچی، شیدا رومانی، بلراج کومل اور جینت پرمار کے نام اہمیت کے حامل ہیں۔

جینت پرمار کا تعلق گجرات کے شہر احمد آباد سے ہے انہوں نے شاعری کا آغاز غزل سے کیا لیکن بہت جلد اپنا رجحان نظم نگاری کی طرف موڑ دیا۔ جینت پرمار کے متعلق قابل غور بات یہ ہے کہ ان کی مادری زبان گجراتی ہے۔ اردو انہوں نے بہت بعد میں سیکھی، اس کے باوجود انہوں نے اردو زبان میں غزلیں اور نظمیں کہنے میں کامیابی حاصل کی۔ بہت جلد جینت پرمار نے اردو نظم کی مختلف ہیئتوں اور اردو شاعری میں استعمال کی جانے والی علامتوں اور استعاروں سے واقفیت حاصل کرلی اور خالص نظمیہ شاعری کے ذریعہ ادبی حلقوں میں اپنی شناخت بنائی۔ ان کی نظموں کے متعلق کوثر مظہری لکھتے ہیں:

''ان کی تخلیقی حسیت کا اظہار بہ یک وقت برش اور رنگوں کے ذریعہ بھی ہوتا ہے اور صفحہ قرطاس پر قلم کے ذریعہ بھی۔ ان کی نظموں میں باپ، ماں، نانی اور ایسے ہی دوسرے رشتوں کا تقدس بھی ملتا ہے اور مذموم سیاست سے پیدا شدہ ہندستان کا کریہہ چہرہ بھی۔ دکھوں اور غموں کی جھیل میں وہ سنگ ریزے مار کر لہریں پیدا کرتے ہیں اور یہ لہریں انسانی دلوں کے ساحلوں کو چھوتی اور بھیدتی رہتی ہیں۔''[۱]

جینت پرمار کی شاعری کا محور و مرکز دلت ادب رہا ہے۔ انہوں نے سماج اور زندگی سے جڑے مختلف موضوعات کو اپنی شاعری میں جگہ دی ہے۔ علاوہ ازیں سیر و سیاحت کے مقامات پر بھی ان کے یہاں نظمیں ملتی ہیں جیسے 'اوٹی میں اک شام' 'کوسانی' 'کوسانی ۲' 'کوسانی ۳' 'مرینا بیچ' 'مرینا بیچ پر ایک لڑکی' وغیرہ۔ جینت پرمار چوں کہ خود بھی دلت ہیں اور وہ بہتر طور پر جانتے ہیں کہ دلتوں کے مسائل کیا ہوتے ہیں اسی سبب انہوں نے اپنی نظموں میں دلتوں پر کیے جانے والے ظلم و ستم کو بڑے موثر انداز میں پیش کیا ہے۔ ایک حساس انسان جب اپنی سطح سے اتر کر ایک عام انسان کی طرح ہو جاتا ہے تو اس کے اندر شاعری جنم لیتی ہے۔ جینت پرمار کا پہلا شعری مجموعہ ''اور'' 1999ء میں منظر پر آیا۔ اس مجموعہ میں انکی وہ مخصوص نظمیں شامل ہیں جو انہوں نے دلت ادب کے لیے لکھی ہیں۔ ان کی اہم نظموں میں ''منو'' میری کویتا تیز نکیلا خنجر ہے''، نظم نے میرا ہاتھ نہیں چھوڑا''، اپرا''، پیشتھر اور پوسٹر''، کالا سورج''، گدڑی''، میری بستی میں اک شام'' وغیرہ خصوصی اہمیت کی حامل ہیں۔ ان کی شاعری سے متعلق بال گنگا دھر لکھتے ہیں:

'' دلت مسائل پر لکھی نظمیں محض کورے کاغذ کا پیٹ بھرنے کے سوا کچھ نہیں ہوتیں اگر عملی زندگی میں ڈوب کر نہ لکھی گئی ہوتیں۔ جینت پرمار بحیثیت دلت ان سماجیاتی مسائل سے دوچار تھے اس لئے ان کا مشاہدہ کوری بحث ہے۔ چھوا چھوت کا درد جو ایک دلت سہتا ہے وہ کوئی اور نہیں محسوس کرسکتا۔ اس لئے ان کا درد اس بات کی مزید دلیل پیش کرتا ہے کہ دلتوں کا درد اس کا باغی لب ولہجہ جعلی نہیں ہے بلکہ ظلم و جبر کے پس منظر میں ایجاد و انتشار ہے جو دلتوں کے وقار کو ریزہ ریزہ کرتا ہے''[۲]

صدیوں سے کیے جارہے دلتوں کے ظلم و ستم کو جینت پرمار نے اپنی نظموں میں پیش کرنے کی کوشش کی ہے۔ ''منوا سمرتی'' اس نظریہ کے تحت برہمن یہ سمجھتے ہیں کہ وہ منہ سے پیدا ہوئے ہیں اور وہ سب ذاتوں سے پاک ہیں۔ اس طرح وہ دلتوں کو حقیر سمجھتے آئے ہیں۔ جینت پرمار کی نظم ''منو'' برہنوادی نظام کی سخت مخالفت کرتی ہے۔ نظم کے چند سطر ملاحظہ ہو

ایک نہ اک دن
گھر کے آگے
نیم کے شاخ پہ
ٹنگا کر کے
لٹکا دوں گا تجھ کو منو!
تیری رگوں کو چیر پھاڑ کے دیکھوں گا
تو نے پیا ہے کتنا لہو
میرے بزرگوں کا!

جینت پرمار کی نظمیں دلتوں کو صرف تسلی ہی نہیں دیتی بلکہ دوش بدوش ہو کر لڑنے کے لیے بھی آمادہ کرتی ہیں۔ عدم مساوات کا خاتمہ کرنا چاہتی ہیں۔ سماج میں دلتوں کو ان کا مقام دلانے کے لیے جینت پرمار

نے بھرپور کوشش کی ہے ۔ چھوا چھوت کا معاملہ ہندوستان میں برسوں سے چلا آرہا ہے اس کے خاتمہ کے لیے کئی تنظیموں نے اپنے اپنے طور پر کوشش کی، یہی کوشش شاعری کے ذریعہ جینت پرمار کر رہے ہیں۔ جینت پرمار نے ایک نظم میں چھوا چھوت کا تذکرہ بڑے پُراثر انداز میں کیا ہے نظم کا عنوان "اچھوت" ہے شاعر اعلیٰ ذات کی لڑکی سے مخاطب ہو کر کہہ رہا ہے۔

"تم مجھ کو چھوتی ہو جانم
تن پہ گنگا جل چھڑک کر
خود پوتر ہوتی ہو
لیکن دنیا میں کوئی ایسی چیز نہیں
جو پوتر کر سکے مجھ کو!
میں تو پیدا ہی ہوا ہوں اپوتر
عمر بھر اپوتر رہوں گا
اور مر جاؤں گا آخر اپوتر

جینت پرمار کی نظم "میری بستی میں شام" حقیقت کا رنگ اجاگر کرتی ہے۔

جینت پرمار نے اس نظم میں دلتوں کی بستیوں میں شام کی تصویر کشی کی ہے۔ شام کی خوبی سیاہی یا تاریکی ہے۔ دلت بستیاں اکثر جھگی جھونپڑیوں کی ہوتی ہیں، جہاں گندے نالے، یا کوڑے کرکٹ کا ڈھیر ہوتا ہے۔ دلتوں کی آبادی کا یہ علاقہ ان کی سماجی و اقتصادی زندگی کی عکاسی کرتا ہے۔ شاعر کہتا ہے کہ دلت اکثر محنت مزدوری سے بیوی بچوں کا پیٹ پالتے ہیں۔ امیروں کی شام رنگینیوں سے آراستہ ہوتی ہے۔ برخلاف اس کے کہ میری بستی کی شام روزمرہ کی طرح بدبو میں لپٹی، روکھی سوکھی کھانے تڑپتی آہوں سے شروع ہوتی ہے جو شام غم کی سیاہی میں غرق ہو جاتی ہے۔ نالے ہوں یا نکڑ دلت بستیوں میں بھوکے، ننگے بچے یا لوگ دیکھے جاسکتے ہیں۔ جینت پرمار کی شاعری سے متعلق ملراج کوہلی رقم طراز ہیں:

"اردو زبان کے تعلق سے کوئی ایسی تحریک بھی وجود میں نہیں آئی جسے دلت ادب کی تحریک کہا جاسکے۔ اردو زبان میں لکھنے والے کوئی ادیب بھی سامنے نہیں آئے جنہیں ہم دلت سروکاروں سے وابستہ قرار دے سکیں۔ اس پس منظر میں جینت پرمار غالباً اردو کے واحد شاعر ہیں (وہ گجراتی زبان میں بھی دلت ادب کے سروکاروں کا اظہار کرتے ہیں) جنہوں نے دلت سروکاروں کو اپنی تخلیقات کا حصہ بنایا ہے۔ ان کی دلت سروکاروں سے جڑی ہوئی نظمیں اپنی مخصوص شناخت رکھتی ہیں۔ ان کی شاعری کا یہ پہلو انہیں عملی طور پر دیگر زبانوں کے دلت ادب سے جوڑتا ہے"۔ [۳]

جینت پرمار کی نظموں کا موضوع صرف دلت ہی نہیں ہے۔ ان کے ہاں حسن فطرت، سماجی، سیاسی و معاشی مسائل کے ساتھ ساتھ وہ تمام مصلحین و فلسفی، صوفیاء، نقاد، شعراء، ادباء اور مصور بھی ہیں۔ جن کی دانشوری کی آفاقیت جاوداں ہے۔ جیسے امیر خسروؔ، غالبؔ، ولیؔ، وان گاگ، گوگیں، پاز، شمیم حنفی، محمد علوی، نمار پاشی، ندا فاضلی، شمس الرحمٰن فاروقی، گوپی چند نارنگ، ڈاکٹر بی۔ آر امبیڈکر، ٹیگور، لکشمی مانے، اوکتاویو پاز۔ ایک نظم دیکھیں جس میں جینت پرمار میکسیکن شاعر اوکتاویو پاز کو کس طرح خراج عقیدت پیش کرتے ہیں۔

"میں نے پاز کو دیکھا تھا
امیر خسروؔ کے مقبرے پر
شام کے پیلے سائے میں
سُر اور شبد کے گنبد نیچے
نظام الدین اولیا فقیر
امیر خسرو کے درمیاں
نظم کی محرابوں کے نیچے سویا ہوا"

جینت پرمار کی نظموں کی خصوصیت یہ ہے کہ ان کی زبان عام فہم اور لہجہ سیدھا سادا ہے۔ انہوں نے قاری کو افہام و تفہیم کی الجھنوں میں نہیں ڈالا اور نہ ہی فارسی آمیز الفاظ کو برتا ہے اسی سبب ان کا کلام قاری کے دل میں راست اترتا ہے۔ انہوں نے علامتوں اور استعاروں سے بھی کام لیا ہے۔ کہیں کہیں دشنام طرازی بھی کی ہے جس کے سبب ان کی نظمیں رسائل کے مدیران نے ردی کی ٹوکری میں ڈال دیں۔ جینت پرمار زبان کی صفائی سے زیادہ اپنے مقصد پر توجہ دیتے ہیں وہ چاہتے ہیں کہ ہمارا پیغام پورے سماج تک بہ آسانی پہنچے خصوصاً دلت سماج کو وہ راہ راست پر لانا چاہتے ہیں۔ وہ دلت سماج کو ان کا جائز مقام دلانا چاہتے ہیں۔ آج نہیں تو کل ان کی یہ کوشش ضرور کامیاب ہوگی اور دلتوں کی امیدوں کا سورج طلوع ہوگا۔

جدید نظم نگاری میں جینت پرمار نے اپنی منفرد شناخت بنائی ہے۔ ان کے جملہ سات شعری مجموعے شائع ہو چکے ہیں پہلا "اور" 1999ء دوسرا "پٹمل اور دوسری نظمیں" 2006ء، تیسرا "مانند" 2007 چوتھا "انترال" 2010 پانچواں "نظم یعنی" 2013 چھٹا "جیا کومتی کے سپنے" 2016ء اور ساتواں "نقطہ اور دوسری نظمیں" 2019ء میں منظر عام پر آچکے ہیں۔ جینت پرمار نے اپنی شناخت نظم گو شاعر کے طور قائم کرلی ہے۔ انہوں نے غزلیں بھی کہی ہیں لیکن ان کی نظمیں غزلوں پر غالب آتی ہیں ان کی ادبی خدمات کے صلے میں انہیں "ساہتیہ اکاڈمی ایوارڈ" بھاشا بھارتی سمان"، "گجرات اردو ساہتیہ اکاڈمی ایوارڈ"، "بھارتی دلت ساہتیہ اکادمی ایوارڈ" کے علاوہ "کمار پاشی ایوارڈ" اور حال ہی میں انہیں "ڈاکٹر بی۔ آر۔ امبیڈکر جیون گھورو ایوارڈ سے بھی نوازا گیا ہے۔ جینت پرمار کا شعری سفر جاری ہے۔ ان کی پہچان ہندوستان تک محدود نہیں بلکہ پورے برصغیر کے ادبی حلقوں میں ہے۔

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حوالے

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Research Paper - Sanskrit

अथर्ववेदीय वनस्पति–सूक्तों में वर्णित औषधियाँ एवं वनस्पतियाँ

सुमित कुमार पाण्डेय

सारांशिका

औषधि–वनस्पति क्या है? किन–किन रोगों पर कौन–कौन सी औषधि–वनस्पति प्रभावकारी है? आदि अनेक प्रश्न दीर्घकाल से मानव–चिन्तन के विषय रहे हैं, चूँकि औषधि– वनस्पतियों का प्रयोग प्रायः प्रत्येक व्यक्ति किसी न किसी रूप में अवश्य करता है चाहे वह आहार के रूप में हो या किसी रोग के निवारण केलिए प्रयुक्त औषध के रूप में।इनकी इसी उपयोगिता को दृष्टिगत रखते हुए वैदिक ऋषियों ने सम्पूर्ण अथर्ववेद में औषधि–वनस्पति विषयक पर्याप्त मन्त्र–दर्शन प्रस्तुत किया है।

इसी औषधि–वनस्पति विषयक ज्ञान का कुछ अंशअथर्ववेदीय वनस्पति–सूक्तों के द्वारा प्राप्त होता है। प्रस्तुत शोध–पत्र"अथर्ववेदीय वनस्पति–सूक्तों में वर्णित औषधियाँ एवं वनस्पतियाँ" में औषधि–वनस्पति विषयक ज्ञान को विभिन्न भाष्यकारों की अन्वेषणात्मक दृष्टि के माध्यम से शोधार्थी के द्वारा प्रस्तुत किया जायेगा।

मुख्य भाग

मनुष्य अपने जीवन काल में कई प्रकार कीऔषधि–वनस्पतियोंपरआश्रित रहा है। कुछ वनस्पतियों का प्रयोग वह स्वयं के जीवित रहने के लिए करता है तो कुछ का प्रयोग स्वस्थ रहने तथा अपने पशुओं की समृद्धि के लिए करता है। केवल एक प्रकार की औषधि–वनस्पति के ज्ञान से मनुष्य का जीवनयापन होना सम्भव नहीं है।इसलिए मनुष्य को विभिन्न प्रकार की औषधियों–वनस्पतियों का ज्ञान होना अत्यावश्यक है, जिससे उसका जीवन सुगम हो तथा वह अच्छे स्वास्थ्य के साथ दीर्घायु भी बन सके।

अथर्ववेदीय वनस्पति–सूक्तों में वर्णित औषधि एवं वनस्पतियों का परिचय विभिन्न वैदिक भाष्यकारों के मतानुसार निम्नलिखित प्रकार से दिया जा सकता है –

1. अपामार्ग

अथर्ववेद के सभी भाष्यकारों ने अपने–अपनेभाष्य में इसका "अपामार्ग" इस नाम से ही वर्णन किया है। आचार्य सायण ने अपने भाष्य में इसका एक अन्य नाम "सहदेवी'' का भी उल्लेख किया है।अथर्ववेद में अपामार्ग वनस्पति के मुख्यतः 3 भेद प्राप्त होते हैं– श्वेत, कृष्ण और लाल। इन तीनों के गुण समानही हैं।

उपयोग –

अथर्ववेद में अपामार्ग, माता–पिता से हमें प्राप्त होने वाले संक्रामक रोगों जैसे– क्षय, कुष्ठ, अपस्मार आदि को दूर करने वाली औषधि के रूप वर्णित है।

अपामार्ग वनस्पति तिक्त, उष्ण, कटु, कफनाशक, खुजली और

रक्तसंबंधी रोगों का नाश करने वाली है। सन्निपात ज्वर की चिकित्सा में पृश्निपर्णी और अपामार्ग इनका उचित रूप से प्रयोग किया जाता है। यह वनस्पति शरीर की कांति को बढ़ाने वाली, व्रण, विष, वात, कफ तथा खुजली आदि रोगों को नष्ट करती है।

2. अर्जुन

अथर्ववेद के दूसरे काण्ड के 8वें सूक्त में अर्जुन का वर्णन मिलता है। इस सूक्त में अर्जुन के काष्ठ से, जौ की भूसी से एवं तिल की मंजरी से निर्मित मणि द्वारा रोग को दूर करने का विधान प्राप्त होता है।

उपयोग–

अथर्ववेद में अर्जुन, क्षेत्रिय व्याधियों अतिसार, यक्ष्मा आदि रोगों का विनाश करनेवाली औषधि के रूप में वर्णित है।

3. आसुरी श्यामा वनस्पति

अथर्ववेदके प्रथम काण्ड के 24वें सूक्त में आसुरी श्यामा वनस्पति का वर्णन प्राप्त होता है। शरीर के रंग का सुधार करने वाली दो औषधियों के संयोग से यह श्यामा वनस्पति बनती है।

उपयोग –

अथर्ववेद में आसुरी श्यामा वनस्पति श्वेतकुष्ठ नाशक औषधि केरूप में वर्णित है। इस सूक्त में श्वेतकुष्ठके लिएकिलास और पलित शब्दों का प्रयोग किया गया है। प्रायः किलास और पलित दोनों श्वेतकुष्ठ के भेदहै।शरीर के वास्तविक रंग के समान कुष्ठ रोग के स्थान की पूरी त्वचा के रंग को बना देना आसुरी श्यामा वनस्पति का मुख्य कार्य है। इसीलिए कुष्ठ रोग में इसका उपयोग होता हैं।

4. हरिद्रा (हल्दी)

अथर्ववेद के प्रथम काण्ड के 23वें सूक्त के

नक्तंजातास्योषधे रामे कृष्णे असिक्नि च।
इंदं रजनि रजय किलास पलितं च यत।।

उपर्युक्त मन्त्र में रामा, कृष्णा, असिक्नी, और रजनि नाम औषधि वाचक हैं, ' आचार्य धन्वन्तरि के अनुसार– रजनि शब्द से हरिद्रा, दारुहरिद्रा, उदकीर्य (करंजभेद), रोचना आदि औषधियों का ग्रहण होताहै।

उपयोग–

आचार्य सायण हरिद्रा को रात में उत्पन्न हुई होने के कारण शरीर की सफेदी दूर करने वाली औषधि के रूप में इसका उल्लेख करते हैं।

5. असिक्नी

आचार्य सायण ने अपने भाष्य में इसका 'नील' नामक औषधि के रूप में वर्णन किया है।

उपयोग–

अथर्ववेद में असिक्नी (नील) औषधि से कुष्ठ रोग तथा बालों के पकने के रोग के निवारण का विधान किया गया है।

6. दूर्वा (सहस्रकांड) –

अथर्ववेद के द्वितीय काण्ड के 7वें सूक्त में इस वनस्पति का वर्णन मिलता है। दूर्वा वनस्पति की उत्पत्ति वहाँ अधिक होती है, जिस स्थान पर पानी की अधिकता होती है।

उपयोग–

शाप को सब जानते ही हैं– गाली देना,आक्रोश करते हुए दूसरे का नाश होने की बात कह देना, बुरे शब्दों का उच्चारण करना इत्यादि सब घृणित बातें शाप के अंतर्गत आती हैं। जिस प्रकार साधारण स्त्री–पुरुष गालियाँ देते हैं, उसी प्रकार विद्या से युक्त मनुष्य भी क्रोध के समय बुरा–भला कहते ही हैं। यह सब क्रोध के कारण होता है, यदि क्रोध गया और उसके स्थान पर विचार युक्त शांत–स्वभाव आ गया तो शाप देने की मनोवृत्ति हट जाएगी। इसलिए अथर्ववेद में सहस्रकाण्ड (दूर्वा) नामक औषधि की प्रशंसा करते हुए कहा गया है कि इस औषधि के प्रयोग से शॉप देने की क्रोधी वृत्ति को दूर किया जाए। पित्त रोग, मूर्च्छा रोग, मस्तिष्क की अशांति, मस्तिष्क की गर्मी, उन्माद रोग आदि रोगों की चिकित्सा में सहस्रकाण्ड (दूर्वा) वनस्पति का प्रयोग किया जाता है।

7. भगवती और तारका

अथर्ववेद के द्वितीय काण्ड के 8वें सूक्त में इन वनस्पतियों का वर्णन मिलता है। आचार्य सायण एवं हरिशरण सिद्धान्तालंकार आदि भाष्यकारों के अनुसार भगवती एवं तारका से अभिप्राय प्रकाश एवं ज्योत्सनारूप ऐश्वर्य वाले नक्षत्र विशेष (सूर्य और चन्द्रमा) का अर्थ ग्रहण किया गया है। भाष्यकार श्रीराम शर्मा आचार्य के अनुसार भगवती, तारका (सूर्य चन्द्र नक्षत्रादि) का विशेषण है।

जबकि श्रीपाद दामोदर सातवलेकर इन दोनों शब्दों को औषधि–वाचक मानते हैं। वह भगवती से– वैष्णवी, शतावरी, तुलसी, अपराजिताया विष्णुकान्ता एवं तारका से–देवतावृक्ष, इन्द्रवारुणी, पत्रक्षार, मोठी आदि औषधियों के अर्थ को ग्रहण करते हैं।

उपयोग –जो रोग माता–पिता के शरीर से अथवा इनके भी

पूर्वजों के शरीर से उनकी संतानों में आता है, उस आनुवांशिक रोग को क्षेत्रीय रोग कहते हैं। अथर्ववेद में ऐसे रोगों के निवारण के लिए भगवती और तारका ऐसी दो वनस्पतियों का वर्णन मिलता है । "भगवती और तारके'' यह औषधि वाचक दोनों शब्द यहाँ द्विवचनी हैं।इससे बोध होता है कि इस एक नाम से 2–2 वनस्पतियों का ग्रहण करना है। इस प्रकार इन दो नामों से चार बनस्पतियाँ होती हैं, जो क्षेत्रिय रोग को दूर करने के साथ–साथ शरीर की कांति को भी बढ़ाती हैं।

8. दशवृक्ष

अथर्ववेद के द्वितीय काण्ड के 9वें सूक्त में इसका वर्णन मिलता है। श्रीपाद दामोदर सातवलेकर तथा हरिशरण सिद्धान्तालंकार आदि भाष्यकारों ने दशवृक्षों के मेल से बनाये जाने वाले "दशमूल" नामक औषध का वर्णन किया है।

आचार्य सायण दशवृक्ष से अभिप्राय पलाश, गूलर आदि इसी प्रकार के दशवृक्षों के अर्थ का ग्रहण करते हैं।

उपयोग–

दशवृक्ष नामक वनस्पति गठिया (ग्राही) रोग को दूर करती है। यह गठिया रोग संधियो को जकड़ कर रखता है, जिससे मनुष्य चल फिर नहीं सकता। इसकी चिकित्सा दशवृक्ष से की जाए तो वह रोगी शीघ्र आरोग्य प्राप्तकरके अन्य जीवित मनुष्यों की तरह अपना व्यवहार कर सकता है।

'दशमूल' नाम से वैध–ग्रंथों में 10 औषधियाँ प्रसिद्ध हैं। वातरोग नाशक होने के विषय में इनकी बड़ी प्रसिद्धि है, संभव है कि यह दशमूल नाम से वर्णित दशवृक्ष ही हों। इन दशवृक्षों का तेल, घृत, कषाय, आसव, अरिष्ट आदि भी बनाया जाता है, जो वात रोग को दूर करने में प्रसिद्ध है।

9. पृश्निपर्णी

अथर्ववेद के द्वितीय काण्ड के 25 वें सूक्त में इसका वर्णन मिलता है। प्रायः सभी भाष्यकारों ने अपने भाष्य में इसे पृश्निपर्णी नाम से उद्धृत किया है। सातवलेकर जी के अनुसार इसे चित्रपर्णी, पीठवन, पीतवन तथा पठौनी आदि नामों से भी जाना जाता है।

उपयोग –

ब्रह्मचर्यादि सुनियमों का पालन ना करने तथा दुराचार का व्यवहार करने से रक्तदोष हुआ करता है। जिसके परिणामस्वरूप पाण्डु रोग, क्षय आदि रोग होते हैं। इन रोगबीजों के उत्पत्ति स्थान का भी वर्णन वेदों में स्पष्ट रूप से किया गया है। अथर्ववेद में रोगबीजों का पृश्निपर्णी वनस्पति द्वारा उपचार का विधान किया गया है। अथर्ववेद में रोगी को पर्वत पर ले जाकर पृश्निपर्णी वनस्पति द्वारा रक्तदोषों के उपचार का वर्णन किया गया है। यह वनस्पति रक्त सुखाने वाले रोग का नाश करने वाली अत्यन्त प्रचण्ड औषधि है। पृश्निपर्णी के सेवन से रक्त दोष दूर होगा, शरीर में रक्त बढ़ने लगेगा, शरीर पुष्ट होने लगेगा, शरीर पर तेज आयेगा, गर्भ की कृशता दूर होकर गर्भ बढ़ने लगेगा। इस प्रकार पृश्निपर्णी का सेवन अनेक लाभों को प्राप्त कराने वाला है।

10. वचा

अथर्ववेद के चतुर्थ काण्ड के 7वें सूक्त में इनका वर्णन मिलता है। प्रायः सभी भाष्यकारों ने विषनाशक औषधि के रूप में इसका वर्णन किया है।

उपयोग –

अथर्ववेद स्वस्थ शरीर को समृद्धिशाली जीवन की कुंजी मानता है, किन्तु विषैले तत्व स्वस्थ शरीर में विकारों को उत्पन्न कर देते हैं। विष से मूर्च्छा या बेहोशी आती है। विष की तीव्रता होने पर रोगी की मृत्यु भी हो जाती है। इसलिए यदि वचा औषधि का प्रयोग किया जाए तो मूर्च्छा दूर की जा सकती है। अथर्ववेद में बतायागया है कि यदि वचा नामक औषधि का प्रयोग किया जाए तो विष अपना असर नहीं कर सकता और इससे बेहोशी दूर होती है।

11. रोहिणी

अथर्ववेद के चतुर्थ काण्ड के 12वें सूक्त में इस वनस्पति का वर्णन मिलता है। प्रायः सभी भाष्यकारों ने रोहिणी नाम से ही इसका वर्णन कियाहै। अथर्ववेद में इसका एक अन्य नाम अरुन्धती भी प्राप्त होता है। सातवलेकर जी के सुबोध भाष्य में इसका मांसरोहिणी नाम से भी वर्णन प्राप्त होता है।

उपयोग –

यह औषधि वीर्यवर्धकऔर त्रिदोष का नाश करने वाली है। यह वनस्पति शरीर के टूटे हुए अवयवों को ठीक करती है। इसको अरुंधति भी कहते हैं।

शरीर को चोट लगी हो, अंग जला हो, अवयव दब गया हो, तो इस वनस्पति के सेवन से शरीर का जोड़ पूर्ववत् हो जाता है, इस औषधि से शरीर की मज्जा, मांस, अस्थि सब अवयव पूर्ण होते हैं। यह वनस्पति शरीर के अवयव – मज्जा, चर्म, रुधिर, हड्डी, मांस, त्वचा, तथा टूटे हुए अंगों को ठीक करतीहै।

12. विषाणका

अथर्ववेद केषष्ठ काण्ड के 44वेंसूक्त में इसका वर्णन मिलता है।

उपयोग– शस्त्र आदि के आघात से शरीर में रक्त की धारा प्रवाहित होती है। यह कभी–कभीविशेष वेग से निकलती है, इसे ही रक्तस्त्राव कहते हैं। अथर्ववेद में रक्तस्राव या खून रोकने के लिए विषाणका नामक वनस्पति का विधान किया गया है। इसके अतिरिक्त विषाणका नामक वनस्पति से वातरोगों, कफ, खाँसी आदि एवं आनुवांशिक रोगों के उपचार का विधान अथर्ववेद में प्राप्त होता है।

13. वरुण

अथर्ववेद के पष्ठ काण्ड के 85 वेंसूक्त में वरुण नामक वनस्पति का वर्णन किया गया है। आचार्य सायण के भाष्य में इसे वरण नाम से उद्ध्धृत किया गया है। जबकि सातवलेकर जी के सुबोध भाष्य में यह वरुण नामक वनस्पति के रूप में वर्णित है।हरिशरण सिद्धान्तालंकार कृत अथर्ववेद भाष्य में इसके दोनों नाम प्राप्त होते हैं।

उपयोग–

वरुण की छाल पाचक एवं शक्तिवर्धक है। यह अश्मरी (पथरी रोग) को नष्ट करती है। इसकी छाल का काढ़ा पथरी को गलाकर मूत्र के द्वारा बाहर निकाल देता है। यह मूत्रदोष, मूत्रकृच्छर (कष्ट से मूत्र आना) वातगुल्म (गठिया) और रक्त विकार को ठीक करता है। वेदों में इस वनस्पति का वर्णन राजयक्ष्मा (टी.वी.) के उपचार के लिए किया गया है । यह रक्तशोधक तथा वातरोगों को दूर करने वाली वनस्पति है।

14. कूठ(कुष्ठ)

अथर्ववेद के षष्ठ काण्ड के 95 वें सूक्त गया में कूठ नामक वनस्पति का वर्णन किया है। आचार्य सायण ने इसे अपने भाष्य में "कूठ" नाम से वर्णित किया है। जबकि श्रीराम शर्मा आचार्य तथा हरिशरण सिद्धान्तालंकार आदि भाष्यकारों ने इसे 6 कुष्ठ" नाम से अपने–2 भाष्यों में उद्ध्धृत किया है।

उपयोग–

कुष्ठ (कूठ) औषधि विशेष रूप से ज्वरनाशक तथा कृमिनाशक है। कुष्ठ (कूठ) हिमालय से उत्पन्न होती है तथा सोमलता से इसका घनिष्ठ संबंध है । यह औषधि प्रायः वातविकार,यक्ष्मा काश्वास, नेत्ररोग, शिरोरोग, आम (आंव) आदि रोगों के निवारण में प्रयोग की जाती है।

15. उपजीका

अथर्ववेद के पष्ठ काण्ड के 100वें सूक्त में इसका वर्णन मिलता है। इस वनस्पति की मुख्य विशेषता है कियह निर्जल भूमि पर उत्पन्न होती है।

उपयोग–

उपजीका नामक वनस्पति मरूदेश में उत्पन्न होती है। यह वनस्पति विष सम्बन्धी दोषों के निवारण में प्रयोगकी जाती है।

16. चीपुद्रु

अथर्ववेद के पष्ठ काण्ड के 127वें सूक्त में इसका वर्णन मिलता है। सभी भाष्यकारों ने इसे चीपुद्रु नाम से ही अपने भाष्यों में उद्धृत किया है।

उपयोग–

अथर्ववेद में चीपुद्रु को अत्यंत महत्वपूर्ण वनस्पति केरूप में वर्णित किया गया है। इसको खाँसी, फोड़ा, फुंसी, रक्तस्त्राव, चर्मरोग आदि का नाशक बताया गया है। यह वनस्पति काख की गिल्टियों, जांध की गिल्टियों, कान के रोग, कफक्षय, विसर्प और हृदय के रोगों को भी दूर करती है। चीपुद्रु से निर्यास (गोंद, लीसा) निकलता है। इसे विरोजा या पिरोजा कहते हैं। इसका मलहम बनाया जाता है, यह सभी चर्म रोगों और छतों (घावों) के लिए लाभप्रद है।

17. नितत्नी

अथर्ववेद के पष्ठ काण्ड के 136वें तथा 137वें सूक्त में इसका वर्णन प्राप्त होता है। आचार्य सायण कृत भाष्य में इसे "कालमाची" नामक जड़ी–बूटी के रूप में वर्णित किया है।जिसे हिन्दी भाषा में हम सभी मकोय के नाम से जानते हैं। जबकि सातवलेकर तथा हरिशरण सिद्धान्तालंकार आदि भाष्यकारों ने इसे नितत्नी नाम से ही अपने–अपनेभाष्यों में वर्णित किया है।

उपयोग–

इसके द्वारा केशरोगों की चिकित्सा का विधान अथर्ववेद में प्राप्त होता है। यह औषधि बालों को बढ़ाती है और उनकी जड़ मजबूत करती है। जहां बाल नहीं है, वहाँ नए बाल उगाती है । यह भूमि के नीचे फैलने वाली औषधि है।

18. सहस्रपर्णी (शंखपुष्पी)

अथर्ववेद के षष्ठ काण्ड के 139वें सूक्त में सहस्त्रपर्णी नामक वनस्पति का वर्णन प्राप्त होता है। आचार्य सायण ने अपने भाष्य में इसे शंखपुष्पी इस नाम से वर्णित किया है, जबकि सातवलेकर कृत सुबोध भाष्य में इसका सहस्रपर्णी औषधि के रूप में उल्लेख मिलता है।

उपयोग – अथर्ववेद में वीर्यसंबंधी दोषों के निराकरण एवं वीर्यवर्धक वनस्पति के रूप में सहस्त्रपर्णी (शंखपुष्पी) वनस्पति

का उल्लेख किया गया है। अथर्ववेदानुसार इसमें सौ शाखाएं, तैंतीस जड़ें तथा हजार पत्तियाँ हैं। यह सौभाग्यप्रद तथा वशीकरण वनस्पति के रूप में अथर्ववेद में वर्णित है। सौभाग्यके लिएइसकी जड़ हाथ में बांधने का विधान है। यह मानसिक शांति, कांति और मेधा को बढ़ाती है। इस वनस्पति के सेवन से पति–पत्नी का प्रेम सुदृढ़ होता है।

19. आसुरी वनस्पति

अथर्ववेद के सप्तम काण्ड के 39वें सूक्त में आसुरी वनस्पति का वर्णन प्राप्त होता है। प्रायः सभी भाष्यकारों ने इसे राजिका (राई) के रूप में अपने–अपने भाष्यों में उद्ध्धृत किया है।

उपयोग

अथर्ववेद में वशीकरण औषधि के रूप में इसका वर्णन प्राप्त होता है। अथर्ववेद में स्त्री के सौंदर्य की वृद्धि के लिए आसुरी वनस्पति का वर्णन किया गया है। वैदिक ग्रंथो में ऐसा वर्णन प्राप्त होता है कि सफेद सरसों (राई) देह की कांति बढ़ाती है, सुकुमारता लाती है, और शरीर की अशोभा को दूर करती है। इसके प्रयोग से स्त्री अपने पति को अपने वश में कर लेती है। जिस कारण मनुष्य का पापाचरण दूर होता है, और वह पराई स्त्री की ओर आकर्षित नहीं होता है।

उपसंहार

उपर्युक्त अध्ययन से स्पष्ट है कि वैदिक काल से मनुष्य को अनेक प्रकार की औषधियों एवं वनस्पतियों का ज्ञान रहा है। इनके उपयोग से वह भोजन, स्वास्थ्य आदि के कई साधनों को प्राप्त करता था। वैदिक मानव जीवन देने वाली, रोग का नाश करने वाली, रोग को दबाने वाली, कभी हानि न पहुंचाने वाली इत्यादि कई प्रकार की औषधि–वनस्पतियों का ज्ञान रखते थे। यह औषधि–वनस्पति न केवल रोग होने पर हमारी रक्षा करती थी अपितु इनके सेवन से रोग हो ही न ऐसा विधान भी अथर्ववेद में प्राप्त होता है।

इस प्रकार सम्पूर्ण अथर्ववेद में वनस्पति एवं औषधि संबंधी पर्याप्त ज्ञान प्राप्त होता है जोकि दीर्घकालीन प्रयोग एवं शोध के माध्यम से उत्तरोत्तर विकसित हो रहा है। इस ज्ञान के विकसित स्वरूप के रूप में हीहम आज पतंजलि, डाबर, हिमालय, वैद्यनाथआदि कम्पनियोंके आयुर्वेदिक उत्पादों को देखते हैं। इन उत्पादों में प्रयुक्त वैदिक औषधि–वनस्पतियाँ आज भी रोगों पर उसी प्रकारप्रभावीहैजैसा कि वैदिक काल मेंवर्णन प्राप्त होता है।इस प्रकारयह वैदिक कालीन औषधि–वनस्पतियाँआज भी प्रासंगिक हैं।

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Investigation of Spatio–Temporal Changes in Land Use and Heat Stress Indices over Jaipur City Using Geospatial Techniques

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Abstract: Heat waves are expected to intensify around the globe in the future, with a potential increase in heat stress and heat-induced mortality in the absence of adaptation measures. India has high current exposure to heat waves, and with limited adaptive capacity, impacts of increased heat waves might be quite severe. This paper presents a comparative analysis of urban heat stress/heatwaves by combining temperature and vapour pressure through two heat stress indices, i.e., Wet Bulb Globe Temperature (WBGT) and humidex index. For the years 1970–2000 (historical) and 2041–2060 (future), these two indicators were estimated in Jaipur. Another goal of this research is to better understand Jaipur land use changes and urban growth. For the land use study, Landsat 5 TM and Landsat 8 OLI satellite data from the years 1993, 2010, and 2015 were examined. During the research period, urban settlement increased and the majority of open land is converted to urban settlements. In the coming term, all months except three, namely July to September, have seen an increase in the WBGT index values; however, these months are classified as dangerous. Humidex's historical value has been 21.4, but in RCP4.5 and RCP8.5 scenarios, it will rise to 25.5 and 27.3, respectively, and slip into the danger and extreme danger categories. The NDVI and SAVI indices are also used to assess the city's condition during various periods of heat stress. The findings suggest that people's discomfort levels will rise in the future, making it difficult for them to work outside and engage in their usual activities.

Keywords: heat stress; WBGT index; climate change; land use; humidex index

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1. Introduction

The occurrence of more extreme climate events has been becoming more frequent and severe as global warming, and causes a distressing effect on human lives [1]. These changes can have both positive and negative impacts on urbanization and human health. Climate change will have a significant impact on metropolitan areas, and it may result in chronic health concerns [2]. Different climate change pathways affect human health between different time periods [3]. India has generated only 2% of total carbon emissions from fossil fuel combustion over the last 100 years [4], which is likely owing to the effects of extreme weather events (NIOO-KNAW, 2017). Human health risks related to climate change can, directly and indirectly, affect older people [5]. An urban heat island (UHI) is a metropolitan area which is significantly warmer than its surrounding rural areas due to

human activities. In metropolitan regions, UHIs tend to amplify the impact of heat waves, and rising temperatures in the area contribute to the likelihood of heat-related deaths [6,7]. In 2003, 3500 deaths were estimated across Europe due to extreme heatwave [8]. People's conditions are worse at night due to the high temperature during heatwaves compared to the high daytime temperature, and it also increases the mortality rate at night-time [9]. The high temperature causes an increase in mortality in metropolitan areas, as well as various health conditions such as heat cramps, weariness, non-fatal heat stroke, and overall discomfort [10]. Climate change models anticipate that a gradual increase in summer temperatures and heat waves will exacerbate the situation [8].

India is most vulnerable to the increased temperature associated with climate change. It is estimated that from 1992, about 25,000 Indian people died because of heat waves [11]. In 2003, heatwaves hit parts of India (Uttar Pradesh, Haryana, Punjab, Rajasthan, Gujarat, Bihar, and Orissa), resulting in a higher fatality rate [12]. As a result of the increased number and frequency of heat waves, the death rate will rise in the future [13]. The climatic approaches such as El Niño-Southern Oscillation (ENSO) and fluctuations in the sea surface temperatures in the Bay of Bengal have been related to the heatwaves over India. Heatwaves may occur as a result of changes in wind direction and a lack of moisture in inland areas, resulting in heat waves. Despite the significant societal impact, no systematic attempt has been made to investigate the primary mechanism of heatwaves in India.

In different parts of the world, some authors employed the WBGT and humidex for heat stress assessments [14,15]. WBGT is an experimental index that was developed by Yaglue and Minard in 1957 and published as an ISO 7243 standard in 1989. It is used in both indoor and outdoor environments. It was recommended to eliminate the time-consuming process of calculating the effective temperature index (ET), which was developed from a series of laboratory investigations about 1920 and quickly became the standard approach for assessing heat stress [16]. Temperature, humidity, radiation, and wind were merged into a single figure that could be utilized for assessment (ISO, 1989). The natural wet bulb temperature, globe temperature, and air temperature are the key determinants of WBGT. The WBGT index's most important strength is its sensitivity to radiant heat and air movement, which are two important factors in estimating the ambient air temperature [15,17]. In tropical and subtropical areas of the world, climate change has resulted in temporal and spatial changes in workplace heat exposure, resulting in occupational health issues. In this regard, the results of prior studies show that WBGT values have been rising in recent years. Wet bulb globe temperature (WBGT) is used as a heat stress indicator for assessment of thermal comfort in environments [15,18,19]. Ref. [20] examined WBGT in the Coimbra region of Portugal and found a strong association between globe temperature of 2.8 percent and natural wet bulb temperature of 2.6 percent and WBGT. Ref. [21] assessed the thermal comfort in 15 regions with the help of WBGT by evaluating the past and future threshold exceedance rates concerning moderate (28 °C), high (32 °C) and extreme (35 °C) temperatures. They are using the WBGT for the 2020s and 2050s with A1B scenarios and in the HadCM3 model, and observed that heat events might become aggravated in regions of tropical humidity and mid-latitude even though the temperature there would be less than the global average, but the absolute humidity is on the rise. The authors of [22] projected the future heat waves in India using the WBGT index using the CMIP5 scenarios data. They used the three representative concentration pathways (RCPs) RCP2.6, RCP4.5, and RCP8.5 for the historical and future period and projected the severe heatwave in the future period. The study aims to calculate the heat stress in the study area and its effects on human health in the past and future scenarios. The state-of-the-art of the research in the study is presented in Section 2. Section 3 data and methodology describes the SWBGT, humidex, and NDVI procedures and defines the simulation flow. Section 4: Results and Discussion presents the simulation's results as well as a discussion on them. The study's findings and the most important outcomes are summarized in Section 5 Conclusions.

2. Study Area Description

Jaipur is Rajasthan state's capital, India, also called the Pink city, for its characteristics of the buildings' colour. Jaipur has a population of around 3.15 million people (Census of India, 2011). The city is mostly flat and is flanked on three sides by the Aravalli hill ranges: north, northeast, and east. The rest of the city is made up of a combination of barren ground, low to medium height vegetation, and built-up areas like as highways, buildings, and industries [23]. According to the Köppen climate classification, the Jaipur come under the hot semi-arid climate. It is located at an elevation of 431 m above mean sea level and at 26.92° N latitude and 75.82° E longitude. Jaipur covers approximately 1464 km^2 (JDA) area and this study cover the 472 km^2 area (Figure 1). Jaipur city has mostly as-associated a flat plain and hills encircle it in the northern, northeast, and east directions. The area around Jaipur city experiences three seasons each year: winter from November to February (cold nights with average air temperatures as low as 3 °C), summer from March to June (very hot during the day with maximum air temperatures as high as 48 °C), and monsoon from July to October (with extensive variations in daily average air temperature due to atmospheric conditions) [22]. The rainfall mainly occurs in the July and August months due to the monsoon. According to Chandra et al. 2018, the percentage change of the urban area of the Jaipur city was 13.54 (1993) to 57.32 (2015) and open land has been decreased by 45.84 (1993) to 19.4 (2015) [24]. They also explained the urban city expansion in the north, west, and south direction.

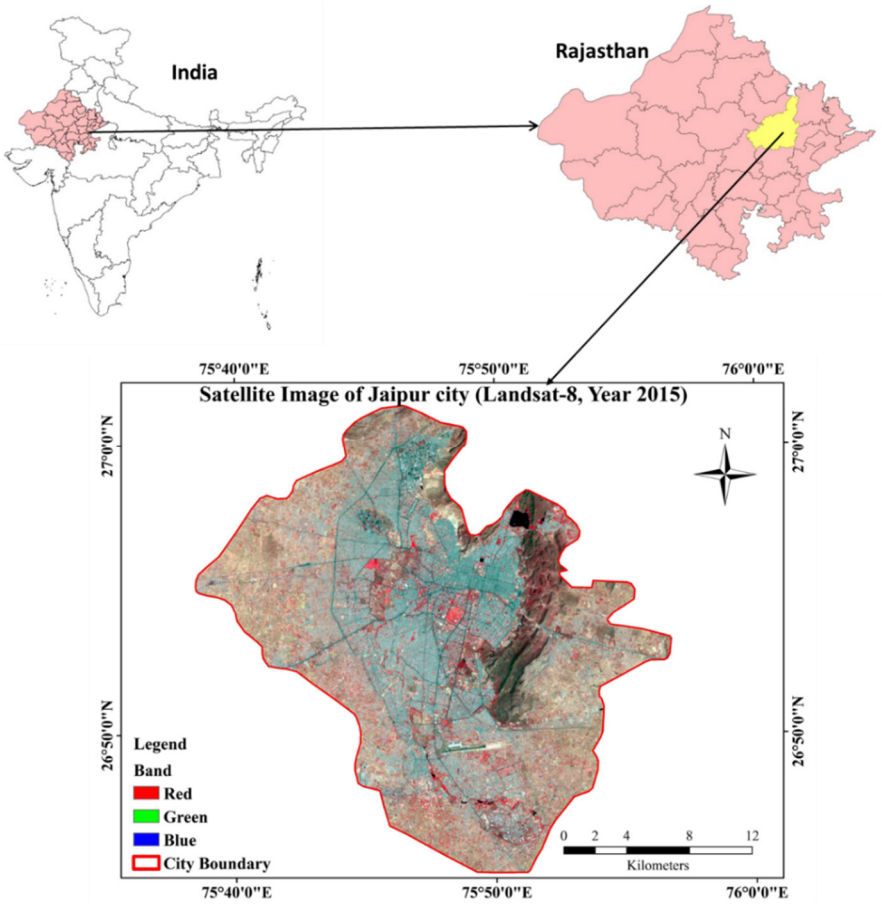


Figure 1. Study area map (Jaipur city).

3. Materials and Methods

The heat stress indicators were calculated using WorldClim's historical and future datasets. The WorldClim portal (http://worldclim.org (accessed on 2 May 2016) provides

free access to WorldClim datasets for many climate indicators. Long-term average monthly climate data of maximum temperature and vapour pressure were acquired from the WorldClim data portal for the historical period (1970–2000) and future period 2050s (2041–2060) RCP4.5 and RCP8.5 scenarios. Table 1 lists all of the GCMs that were employed in the heat stress analysis. For the past and future eras, this study calculates two heat stress indicators for Jaipur. Monthly ensemble 17 GCMs are used to forecast the research area's future heat stress indices for the future timeframe.

Table 1. Detailed information of the GCMs (CMIP5) data of RCP4.5 and RCP8.5.

GCMs Information	Data Information
ACCESS1-0(AC), BCC-CSM1-1(BC), CCSM4(CC), CNRM-CM5(CN), GFDL-CM3(GF), GISS-E2-R(GS), HadGEM2-AO(HD), HadGEM2-CC(HG), HadGEM2-ES(HE), INMCM4(IN), IPSL-CM5A-LR(IP), MIROC-ESM-CHEM(MI), MIROC-ESM(MR), MIROC5(MC), MPI-ESM-LR(MP), MRI-CGCM3(MG), NorESM1-M(NO)	Monthly average maximum temperature (°C*10) GHG Scenarios: RCP4.5; RCP8.5

This analysis was conducted by combining temperature and vapour pressure through two heat stress indices, namely Simplified Wet Bulb Globe Temperature (SWBGT) and humidex. Many researchers used the SWBGT indicators to estimate the general heat stress index at various spatial and temporal scales [25,26].

The Australian Bureau of Meteorology [21] suggested the SWBGT indicator for spatial analysis. Equation (1) is used to calculate the *SWBGT* of Jaipur city.

$$SWBGT = 0.567Ta + 0.393e + 3.94 \quad (1)$$

where, *Ta* and *e* represent the air temperature (°C) and water vapour pressure (hPa) near the surface.

The humidex index was developed in Canada to estimate the humidity and consequence of high temperature on human health. The humidex indicator is assessed by using Equation (2) [27]:

$$Humidex = Ta + \left(\frac{5}{9}\right)(e - 10) \quad (2)$$

where, *Ta* is air temperature (°C) and *e* is the water vapour pressure (hPa) near the surface.

After an assessment of these indices, different categories are allocated based on these values. Each group represents a particular kind of condition and is linked with the heat stress situation for their effect on human health. Table 2 provides the classes of heat stress along with their consequence on human health.

Table 2. Categories of the heat stress, WBGT and humidex index with human effects.

Heat Stress Category	WBGT Index	Humidex Index	Inferences
Extreme danger	Greater and equal to 40	Greater and equal to 46	Dangerous and the risk of heat stroke
Danger	34–39	38–45	Very uncomfortable and avoid physical exertion
Extreme caution	28–33	30–37	Little uncomfortable
Caution	22–27	20–29	Comfortable

Source: http://www.crh.noaa.gov, http://www.ec.gc.ca/meteo-weather/ (accessed on 6 August 2016).

3.1. Image Classification and Accuracy Assessment

The study area is divided into five key groups using a supervised technique with the maximum likelihood classification method: water body, vegetation, urban settlement, open land, and hilly area/rocky area. The Kappa technique was used to examine the categorization accuracy [28,29].

Kappa coefficient (k) for the image classification is as follows:

$$k = \frac{N\sum_{i=1}^{r} xii - \sum_{i=1}^{r} xi + *xi + 1}{N^2 - \sum_{i=1}^{r} xi + *xi + 1} \quad (3)$$

$$\mathrm{k} = \frac{(Total\ sum\ of\ correct) - Sum\ of\ the\ all\ the\ (row\ and\ column\ total)}{Total\ squared - Sum\ of the\ all\ the\ (row\ and\ column\ total)} \quad (4)$$

The Kappa coefficient should never be greater than or equal to one. The high Kappa value indicates accurate land use class information. According to [30] Monserud and Leemans (1992), Kappa coefficients ranging from 0.55 to 0.7 indicate good agreement, 0.7 to 0.85 indicate very good agreement, and values more than 0.85 indicate excellent agreement between image and ground.

3.2. Normalized Difference Vegetation Index (NDVI)

Vegetation cover plays a vital role in diminishing the conservation issues in urban areas. As indicated by Batista et al. 1997, the NDVI esteems went from −1 for the non-vegetated area to +1 for vegetation [31]. For the NDVI estimation red band and visible range band and the NIR band are utilized. The NDVI calculation is as follows:

$$NDVI = \frac{(Band\ 4 - Band\ 3)}{(Band\ 4 + Band\ 3)} \quad (5)$$

3.3. Soil-Adjusted Vegetation Index Calculate (SAVI)

The *SAVI* index also plays a role in the vegetation cover, but it adds the area's background soil conditions. *SAVI* calculation is as follow:

$$SAVI = (1 + L) * (band4 - band3)/(band4 + band3 + L) \quad (6)$$

where the TOA reflectance is used for each band and L is a soil brightness correction factor. From Huete (1988), L = 0.5 is used in most conditions. Figure 2 shows the methodology and the climatic data used in the study.

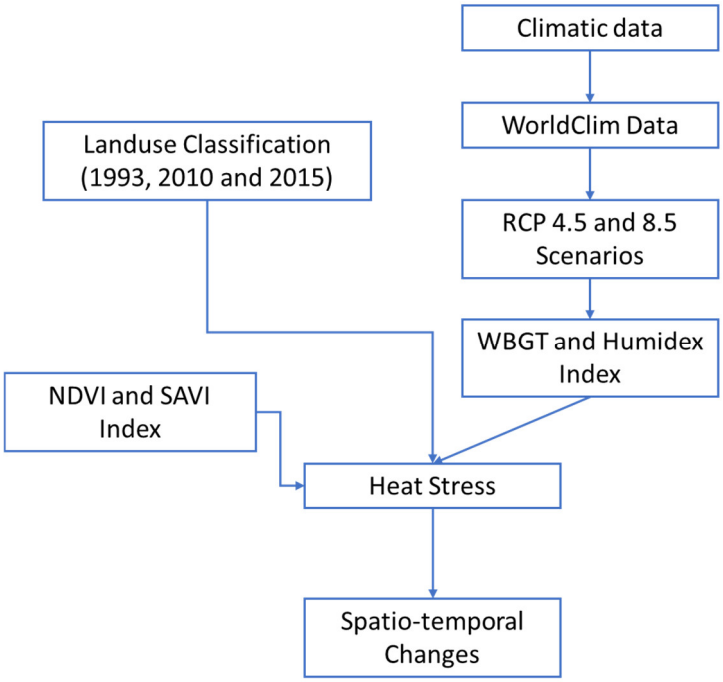


Figure 2. Flowchart of methodology and data used.

4. Results and Discussions

Heat stress is on the rise in various countries of the world, including India, and is to blame for the rising level of human misery. Heat stress is becoming more severe in cities as a result of urbanization and greenhouse gas emissions.

4.1. Land Used Classification

Water body, vegetation, urban settlement, open land, and hilly terrain/rocky area are the five primary land use types evaluated in this study. Land use classifications are carried out for 3 years: 1993, 2010, and 2015. The accuracy of the classified map was determined by a random selection of 330 points for each year. The overall accuracy of the classified maps was found to be 0.92, 0.97, and 0.95 for selected years. According to Table 3, the Kappa coefficients for the indicated years are 0.88, 0.95, and 0.93. In comparison to ground reality, the classified land use accuracy is shown to be good.

Table 3. Accuracy assessment of the land cover types.

Users Accuracy %							
Year	**Water**	**Vegetation**	**Urban Settlement**	**Open Land**	**Hilly/Rocky Area**	**Overall Accuracy**	**Kappa Coefficient**
1993	100.0	95.4	96.7	97.9	69.8	0.92	0.88
2010	100.0	94.7	100.0	96.6	91.2	0.97	0.95
2015	100.0	95.7	97.2	92.7	88.6	0.95	0.93
Producer Accuracy %							
Year	**Water**	**Vegetation**	**Urban Settlement**	**Open Land**	**Hilly/Rocky Area**		
1993	100.0	98.41	87.88	90.73	91.67		
2010	100.0	97.83	98.21	95.45	100.00		
2015	100.0	94.74	99.28	86.44	93.94		

Table 4 shows the total area covered by various categories and their percent coverage. It has been observed that the urban settlement of Jaipur city has grown over time. It was 63.9 km^2 in 1993, but by 2015, it expanded to 270.47 km^2. This indicates that during the course of 22 years, the area has changed nearly four times. In 2015, over 43.78% change of the studied area was under settlement, compared to the entire area. These trends suggest that the city is rapidly expanding, and it accelerated significantly after 2010.

Table 4. Land use area and percent change of different years.

Class Name	Area 1993	Area 2010	Area 2015	% Change (2010–1993)	% Change (2015–2010)	% Change (2015–1993)
Water.	0.4	0.9	0.8	0.10	−0.01	0.09
Vegetation	84.4	88.6	45.7	0.87	−9.09	−8.21
Urban Settlement	63.9	166.5	270.5	21.75	22.03	43.78
Open Land	216.3	159.8	91.5	−11.96	−14.47	−26.44
Hilly/Rocky Area	106.9	56.1	63.4	−10.76	1.55	−9.21

Figure 3 depicts the spatial distribution and patterns of land cover change during the three years. The image clearly shows the evolution of urban settlement in Jaipur city. In comparison to the 1993 map, there is a significant rise in of urban area in the Jaipur and found the maximum land use was converted into the urban settlement.

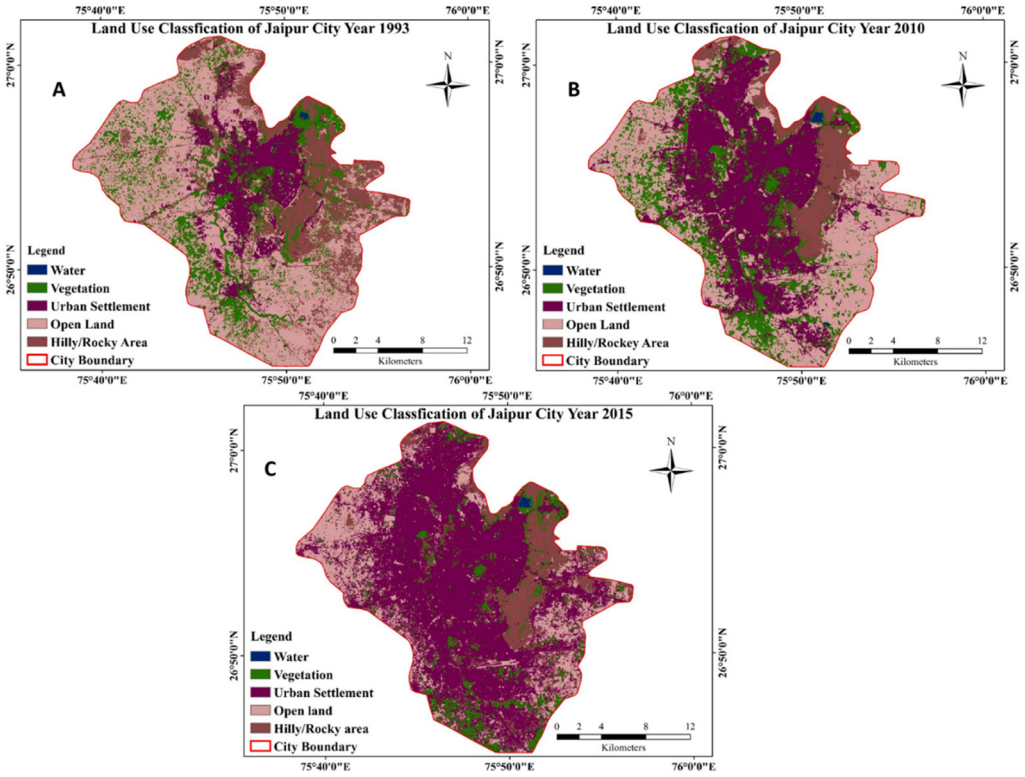


Figure 3. LULC maps for different years (**A**) 1993 (**B**) 2010 (**C**) 2015.

4.2. Humidex Index

For the historical and future RCP4.5 and RCP8.5 scenarios, the humidex index was calculated on a monthly and seasonal basis. All of the monthly and seasonal data were shown in Table 5. The lowest humidex was recorded in the month of January. The historical minimum humidex value has been 21.4, and in the RCP4.5 and RCP8.5 scenarios, it will

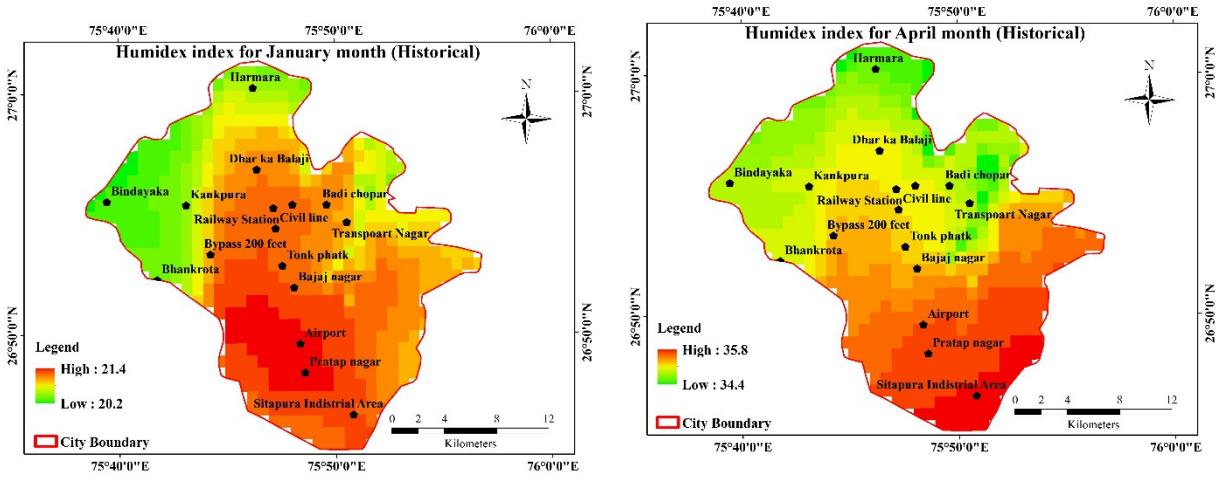
rise to 25.5 and 27.3, respectively. The highest humidex values are observed to be 39.5, 43.2, and 46.4 for the historical and two future RCPs in the May month. In Table 5, the May and June months show the danger conditions in the humidex index for all three cases, but the RCP4.5 and RCP8.5 show the danger and extreme danger conditions in most of the months.

Table 5. Average monthly variation in humidex for historical and future periods.

	Historical	RCP4.5	RCP8.5	Historical	RCP4.5	RCP8.5
January	21.4	25.5	27.3	C	C	C
February	24.2	28.2	30.4	C	C	EC
March	29.9	34.1	36.7	EC	EC	EC
April	35.8	39.9	42.7	EC	**D**	**D**
May	**39.5**	**43.2**	**46.4**	**D**	**D**	**ED**
June	**39.5**	41.5	44.3	**D**	**D**	**D**
July	39.1	36.0	38.2	**D**	EC	**D**
August	37.7	33.4	35.4	**D**	EC	EC
September	37.7	35.0	37.3	**D**	EC	**D**
October	35.3	35.6	38.3	EC	EC	**D**
November	30.2	31.5	33.7	EC	EC	EC
December	25.5	26.9	25.5	C	C	EC
Winter	23.7	26.9	27.7	C	C	EC
Monsoon	**38.5**	36.5	38.8	**D**	EC	**D**
Summer	35.1	**39.1**	**41.9**	EC	**D**	**D**
Autumn	32.8	33.6	36.0	EC	EC	EC

C—caution; EC—extreme caution; D—danger; ED—extreme danger.

Figure 4 depicts the spatial distribution of Humidex for all of the months in the past. The months of May and June are classified as Danger and Extreme Danger. From January to May, the Humidex values rise, then begin to decrease until the month of December. There is a slight rise in value in September and October months compared to the decreasing trend. In majority of the months over the historical period, the humidex is high in the southeast and west.



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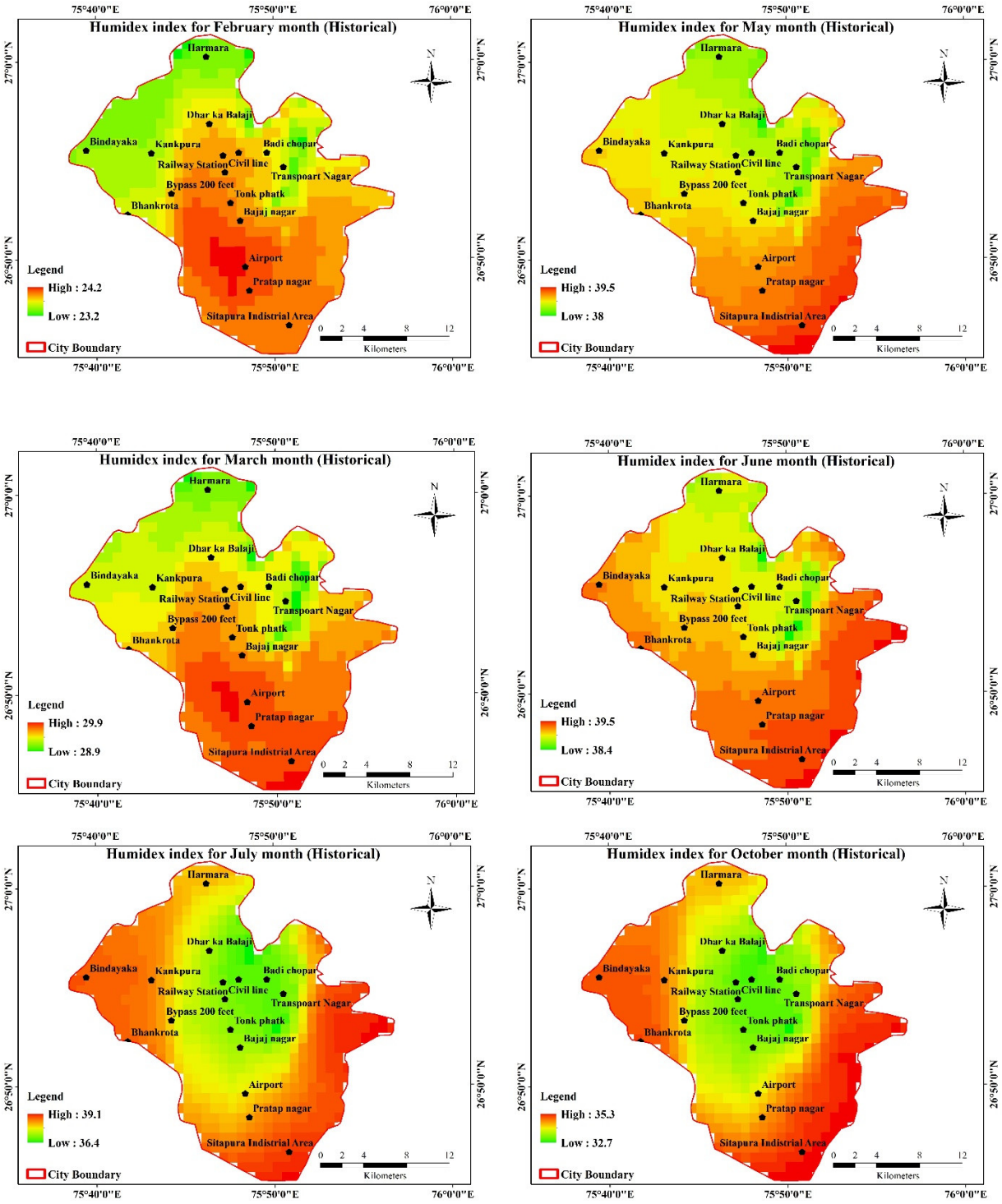

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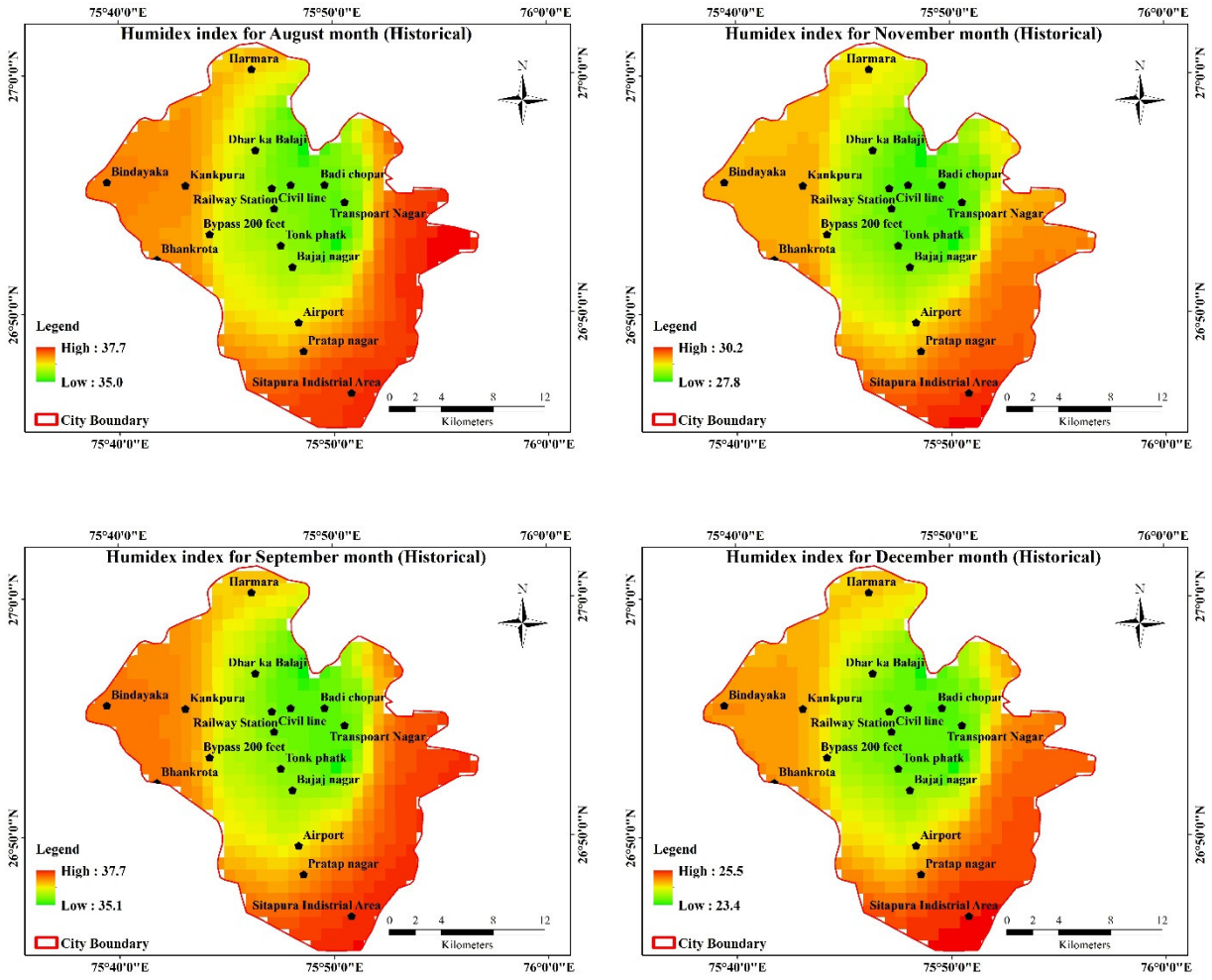
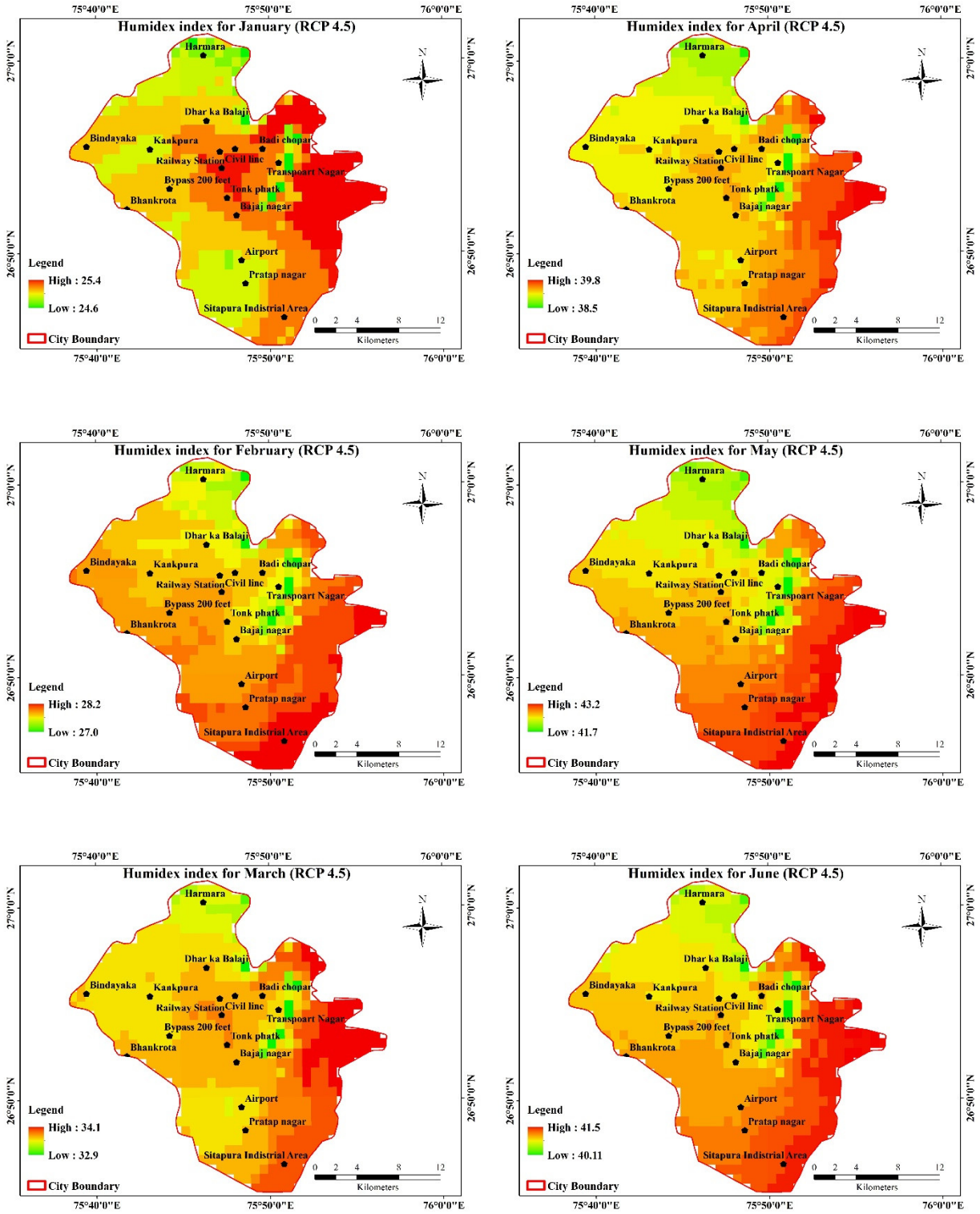


Figure 4. Spatial variation of humidex for historical in January to December months.

The spatial maps of humidex variations for January to December for the future RCP4.5 and RCP8.5 scenarios are shown in Figures 5 and 6. The majority of the month in these statistics depicts danger and extreme danger conditions in hypothetical futures. The months of May and June exhibit a danger situation, and the majority of the months fall into the danger and extreme dangerous categories. In the figure, the area with low values is represented by the colour green, while the area with high values is represented by the colour red. The humidex is elevated in the east and south as well as in a small portion of the west side between RCP4.5 and RCP8.5.



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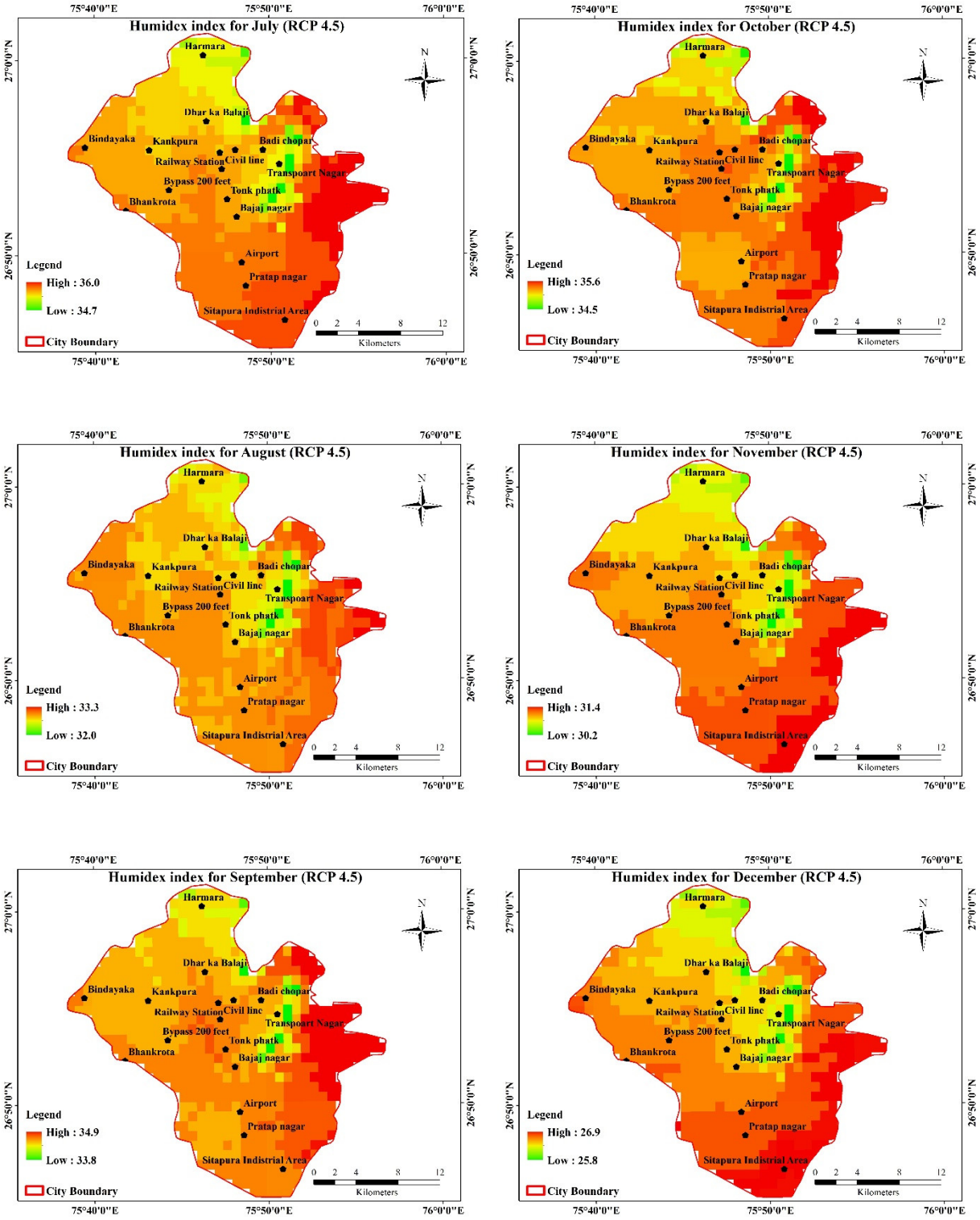
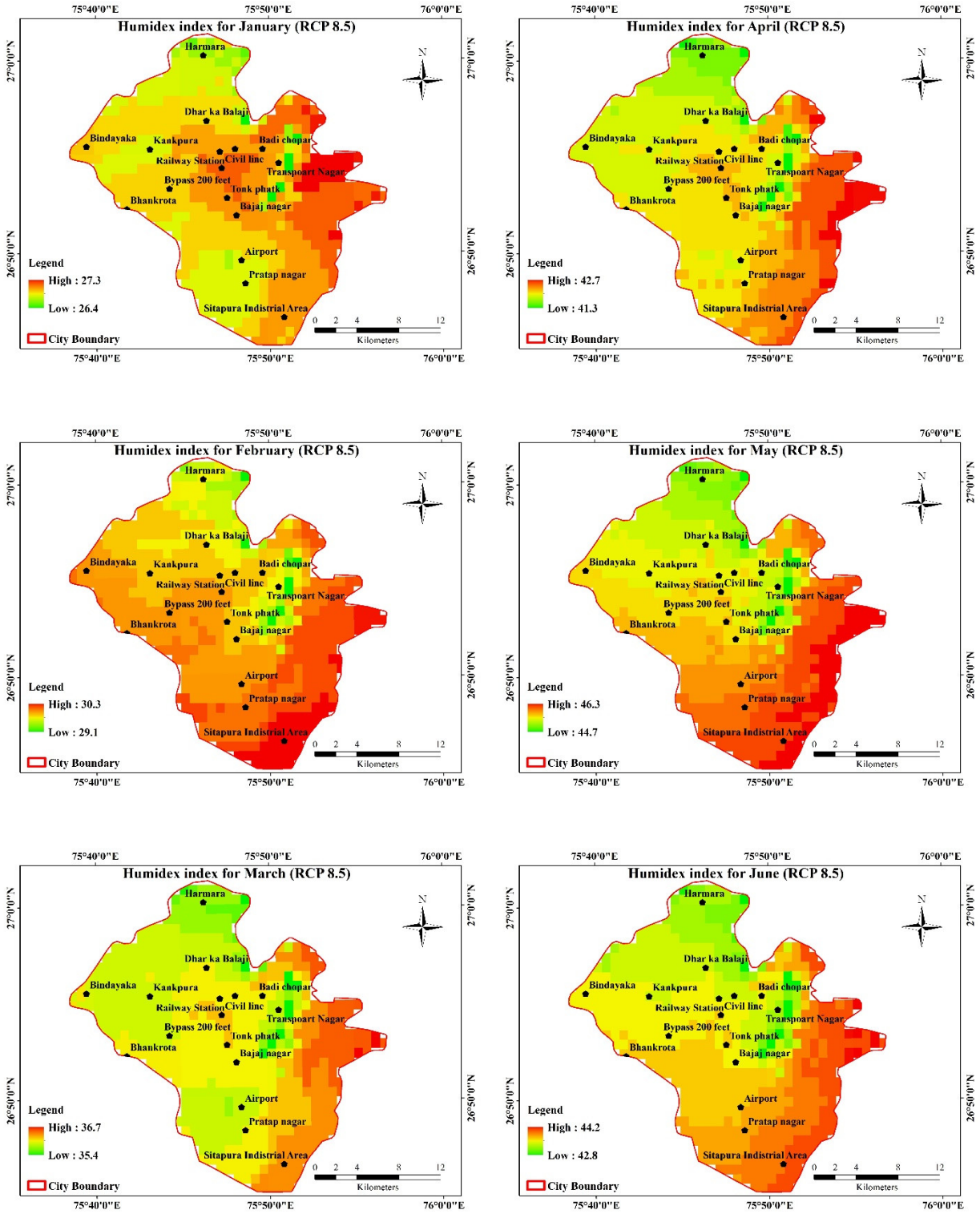


Figure 5. Spatial variation of the humidex for future (RCP4.5) in January to December months.



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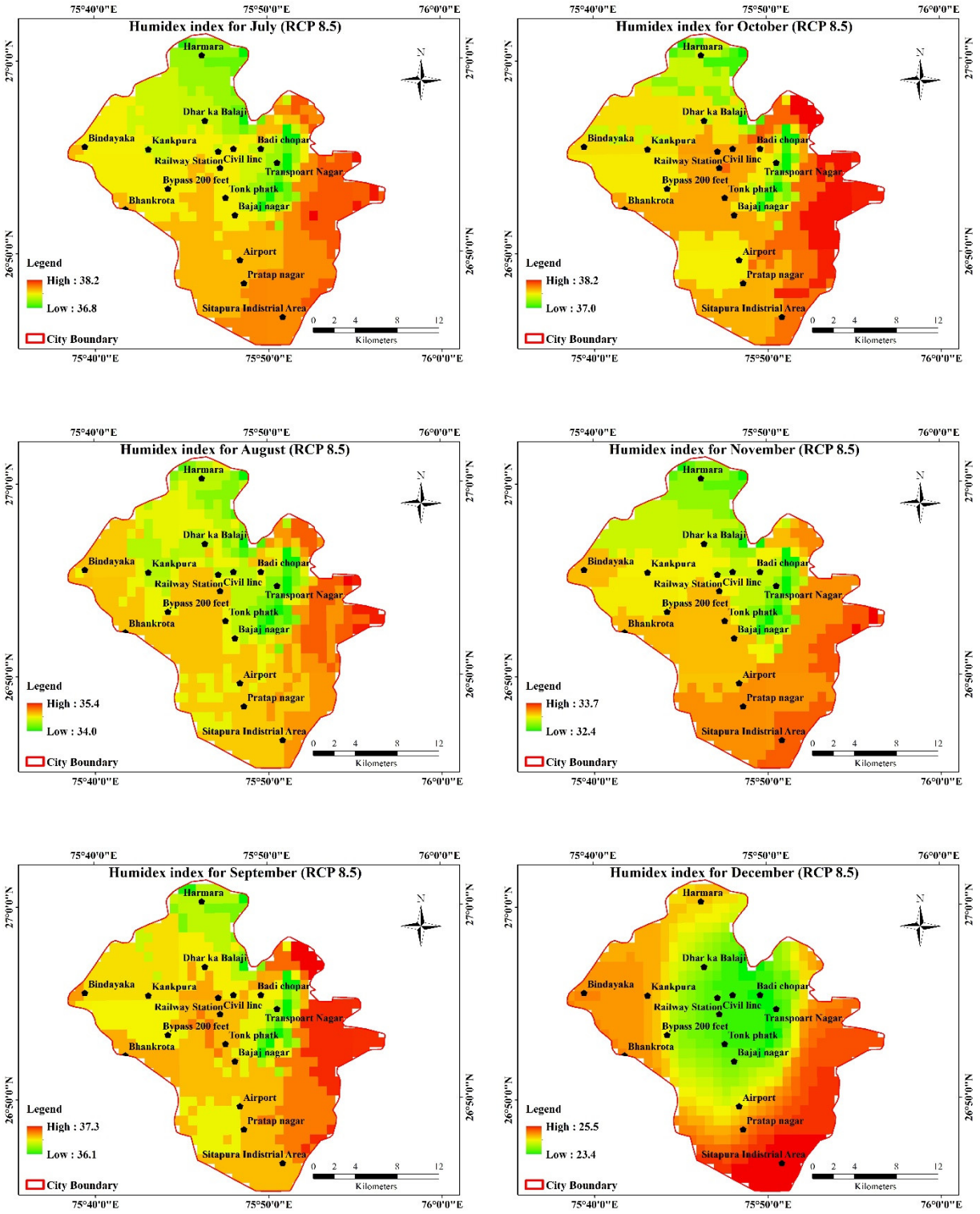


Figure 6. Spatial variation of the humidex for future (RCP8.5) in January to December months.

The monthly difference in humidex for historical and projected RCP4.5 and RCP8.5 is shown in Figure 7. In the three months, July to September, as well as throughout the monsoon season, humidex displays a drop. Because RCP8.5 represented the high emission scenario, there is always a significant disparity between RCP8.5 and RCP4.5. It has been demonstrated that the seasonal analysis helps to explain how the severe category shifts.

By the year 2050, the summer season displays a shift from extreme caution to danger and a rise in temperature in the urban region. Figure 8 displays the seasonal humidex variations for the past and future of the city border. The monsoon and autumn seasons show the maximum humidex value in all scenarios and cover the city's east, west, and north direction.

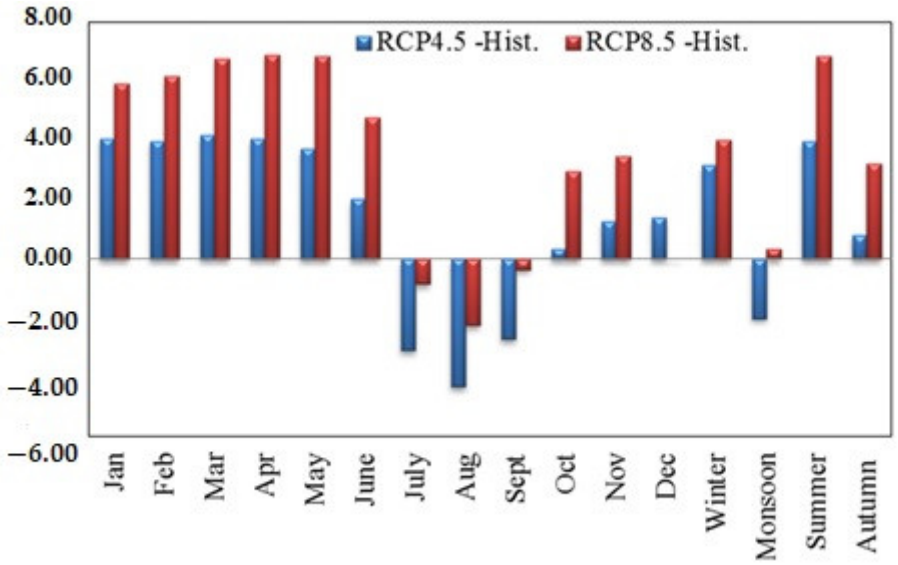
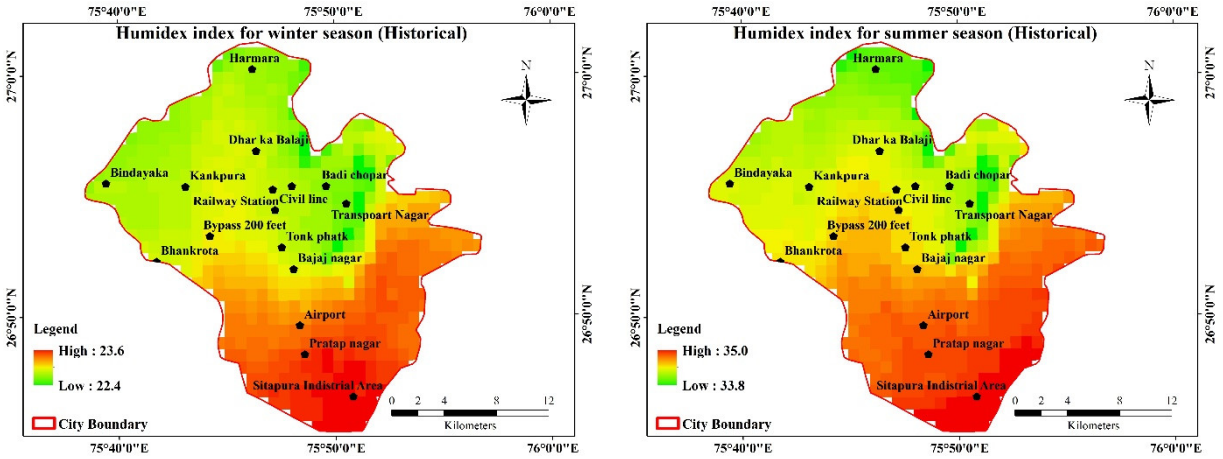


Figure 7. Difference in humidex values for future scenarios (2050s).



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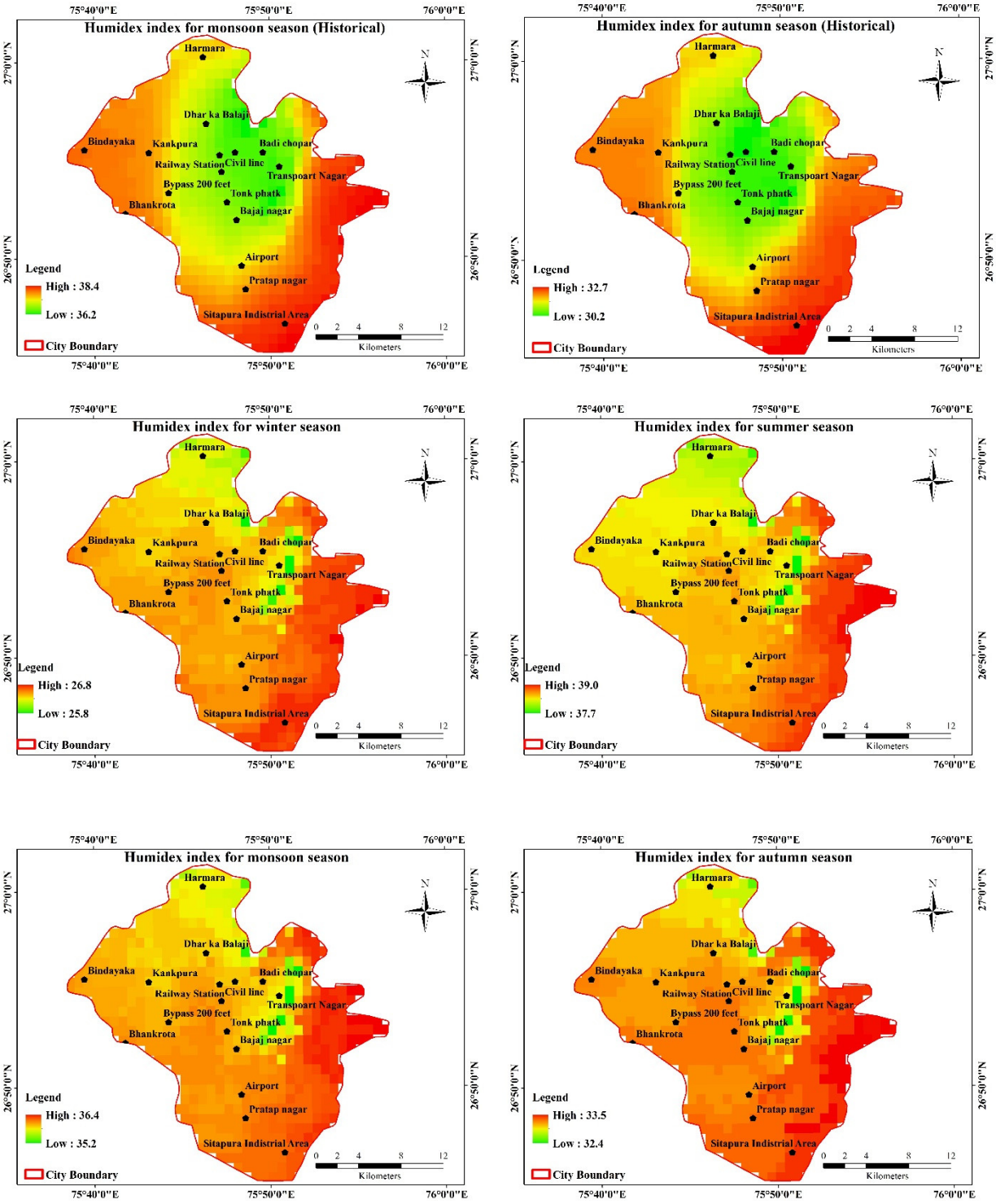

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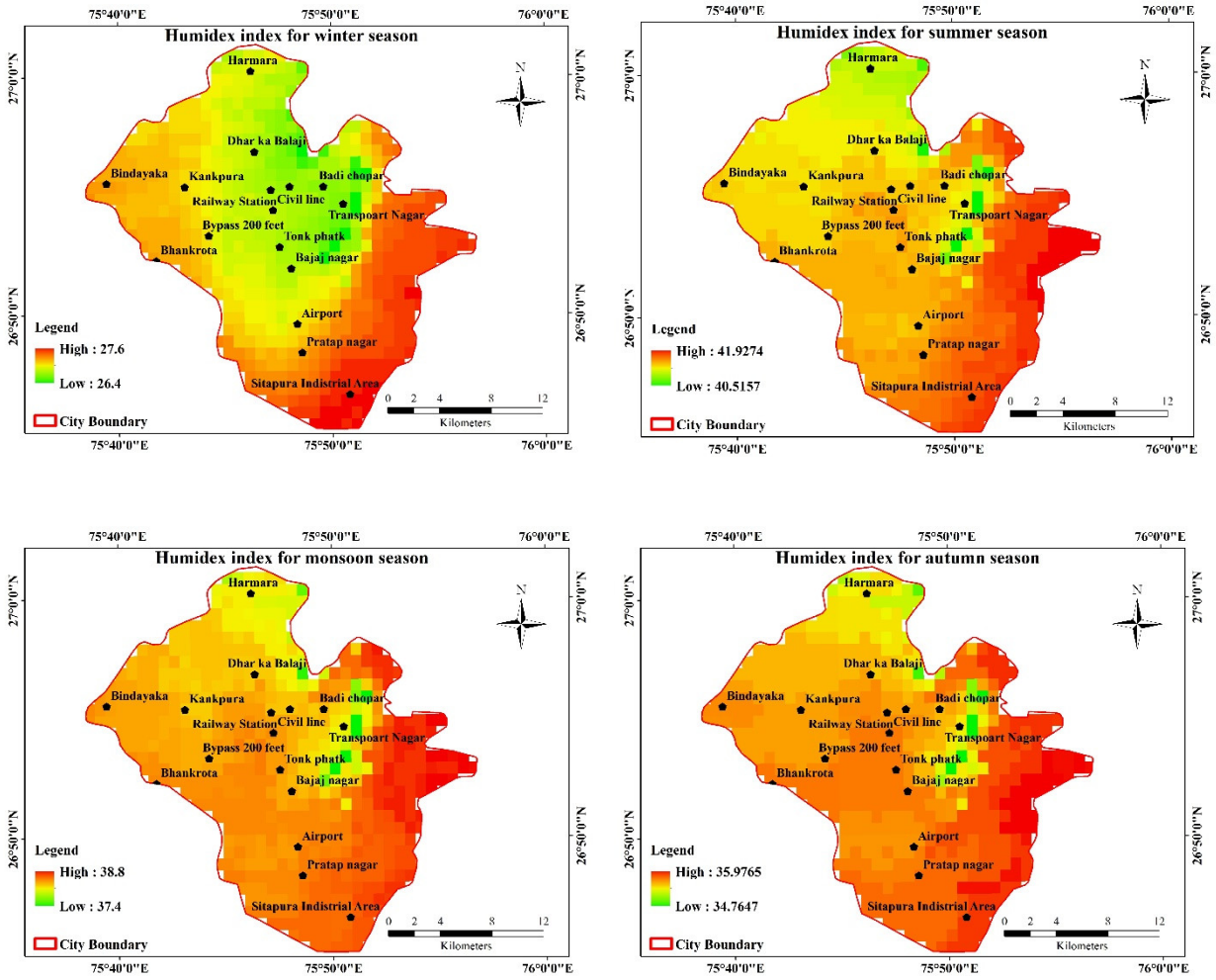


Figure 8. Seasonal map of the humidex index of Jaipur city (Historical, RCP4.5, RCP8.5).

4.3. WBGT Index

The WBGT index is computed in this study on a monthly and seasonal basis for both past and future periods. The average monthly seasonal fluctuations in the WBGT indicator, together with its stress category, are shown in Table 6. In all three scenarios—historical, RCP4.5, and RCP8.5—the danger categories are visible from June through September. In January, the value is at its lowest, and in June and July, it is at its highest. However, the WBGT, high in the monsoon season of RCP scenarios and the danger situation of the heat of the city of Jaipur, are shown in the season-wise calculation. The correlation coefficient of ESI and environmental parameters of wet temperature, dry temperature, solar radiation, and relative humidity was obtained as 0.88, 0.96, 0.4, and −0.7, respectively, in a study by [32] Hajizadeh et al. (2016), which aimed to investigate the correlation between the environmental stress index (ESI) and WBGT index in a hot and dry climate.

As with the humidex, the lowest values of WBGT are observed for January month in the historical and future periods. The historical value of WBGT is 19.7, which will increase to 22.0 for RCP4.5 and 23.1 for RCP8.5 (Table 6). In the historical period, the high value of WBGT is obtained in the month of July, but it shifts to June for the future period. It is also observed that WBGT values are projected to decrease in the monsoon season (July to September) with the heat stress category of danger. The monthly pattern of values is similar for humidex, increasing from January to June/July and then further decreasing until December. Some cases of a shift from the existing caution condition to extreme caution condition in March, November, and December. The spatial variance of

WBGT in Jaipur city for the past and the future is explained in Figures 9–11. In Figure 9, the southern half of the city showed the greatest changes when compared to other places. Figures 10 and 11, which depict possible futures and determine the city's danger condition, show the same pattern. These show the monthly variation of WBGT values for a future period (both scenarios) compared with historical data. The indicator's value decreases throughout a three-month period from July to September, indicating a decline in indicators during the monsoon season. These areas came under the industrial zones and cover half of the city area. The green colour represents the area with low values, whereas the red colour represents high values.

Table 6. Average monthly variation in WBGT for historical and future periods.

	Historical	RCP4.5	RCP8.5	Historical	RCP4.5	RCP8.5
January	19.7	22.0	23.1	C	C	C
February	21.2	23.5	24.8	C	C	C
March	24.7	27.1	28.6	C	EC	EC
April	28.2	30.5	32.1	EC	EC	D
May	30.3	32.5	34.2	EC	EC	D
June	34.6	**35.8**	**37.3**	**D**	**D**	**D**
July	**37.3**	35.5	36.8	**D**	**D**	**D**
August	36.7	33.4	35.4	**D**	**D**	**D**
September	34.9	33.4	34.7	**D**	**D**	**D**
October	30.0	30.2	31.7	EC	EC	EC
November	25.5	26.2	27.5	C	C	EC
December	22.2	23.0	22.1	C	C	EC
Winter	21.0	22.8	23.3	C	C	C
Monsoon	**35.9**	**34.5**	**36.1**	**D**	**D**	**D**
Summer	27.7	30.0	31.6	EC	EC	EC
Autumn	27.8	28.2	29.6	EC	EC	EC

C—caution; EC—extreme caution; D—danger; ED—extreme danger.

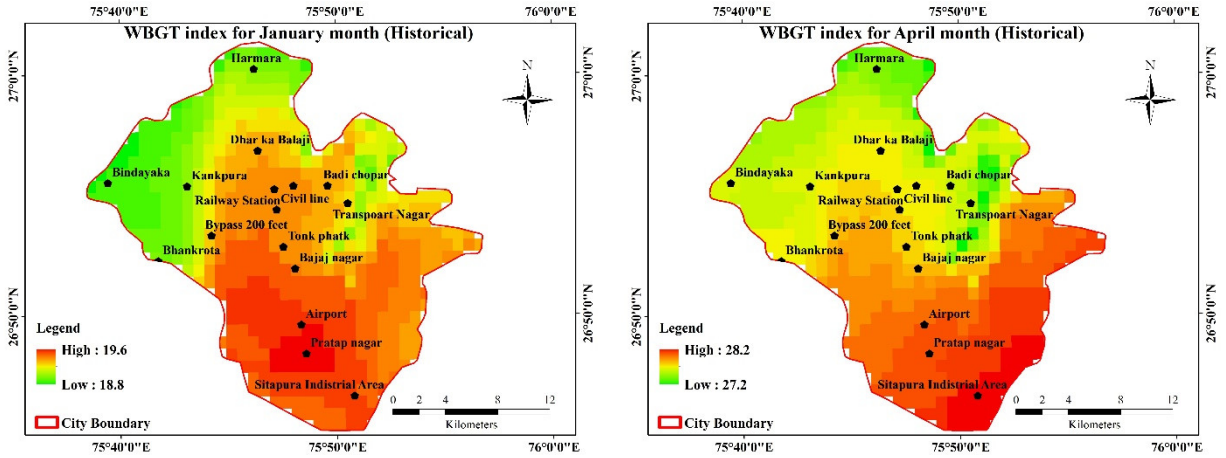
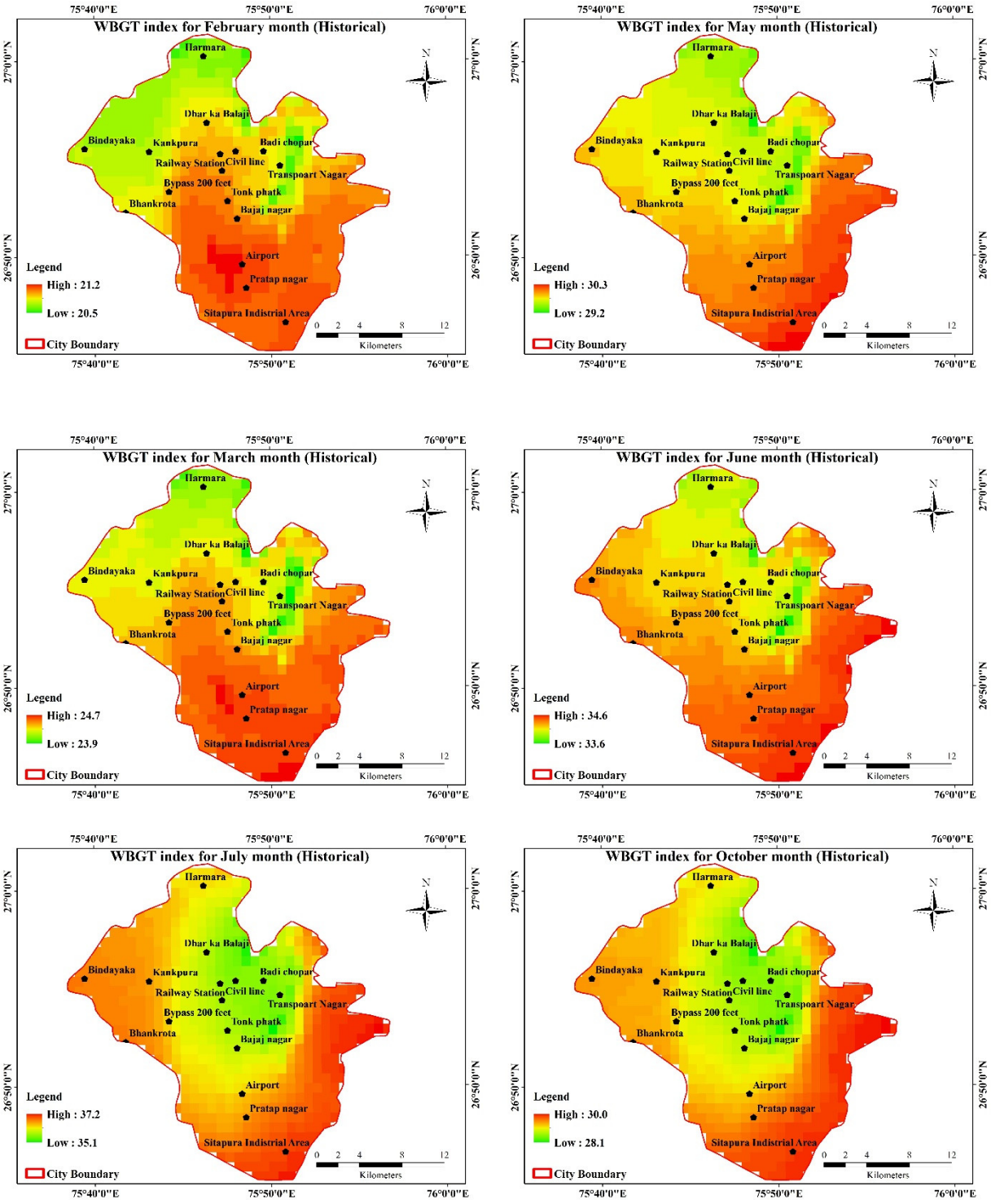


Figure 9. *Cont.*



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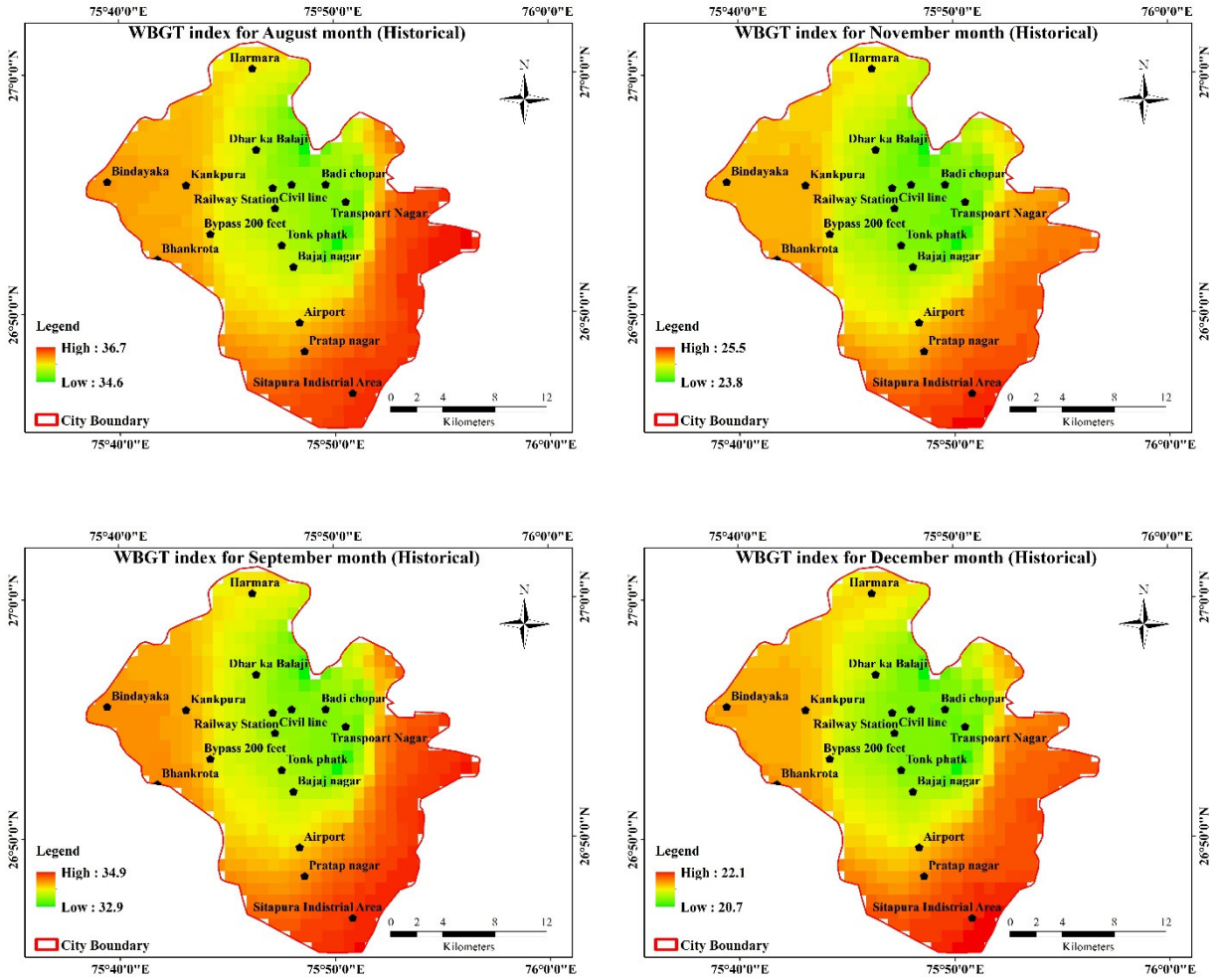
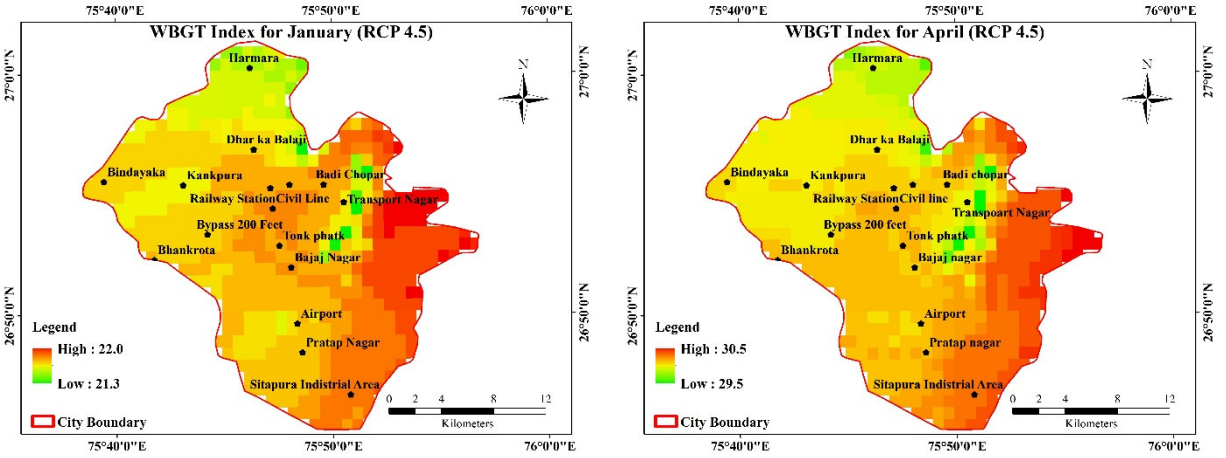


Figure 9. Spatial variation of WBGT for the historical period.



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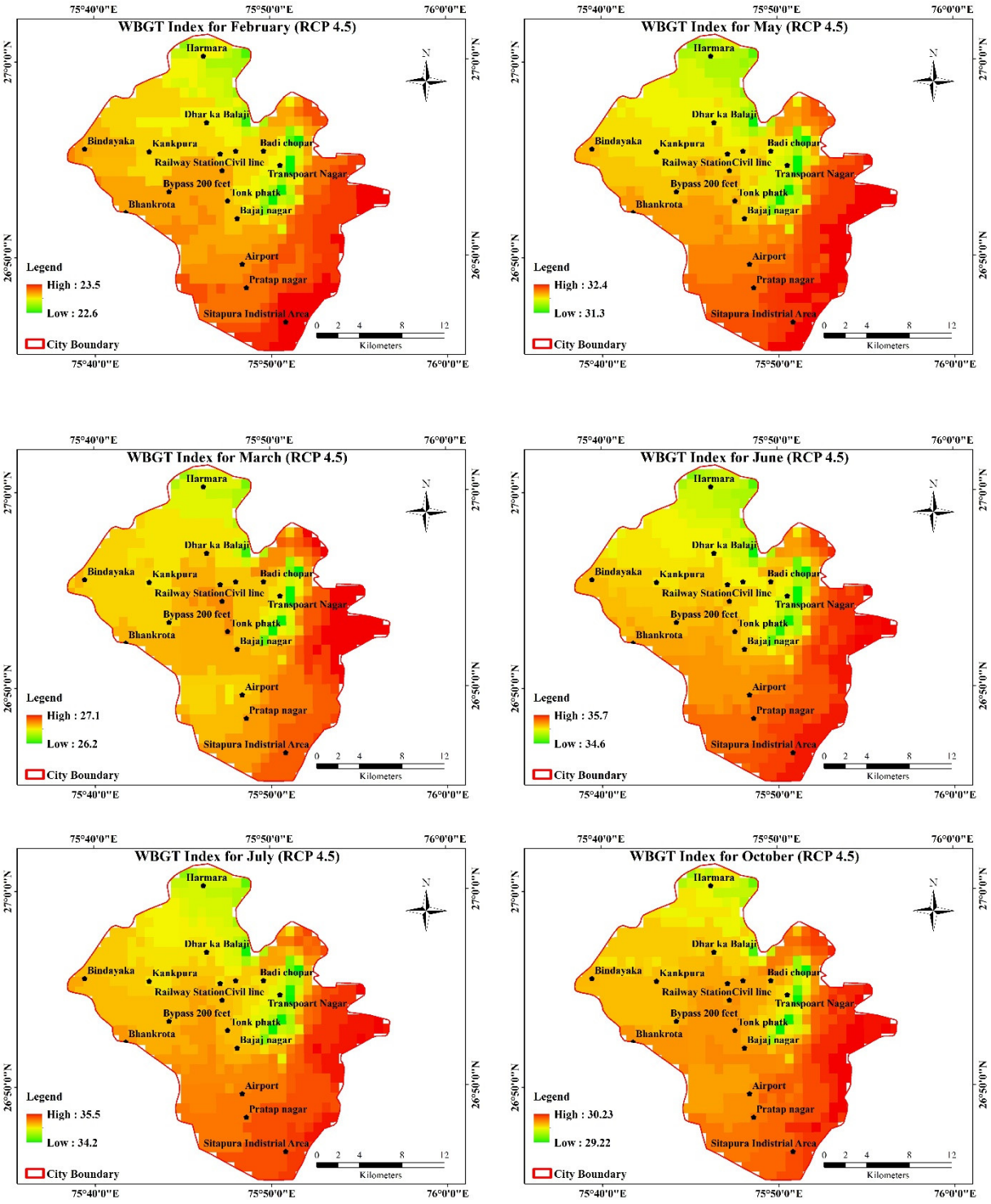

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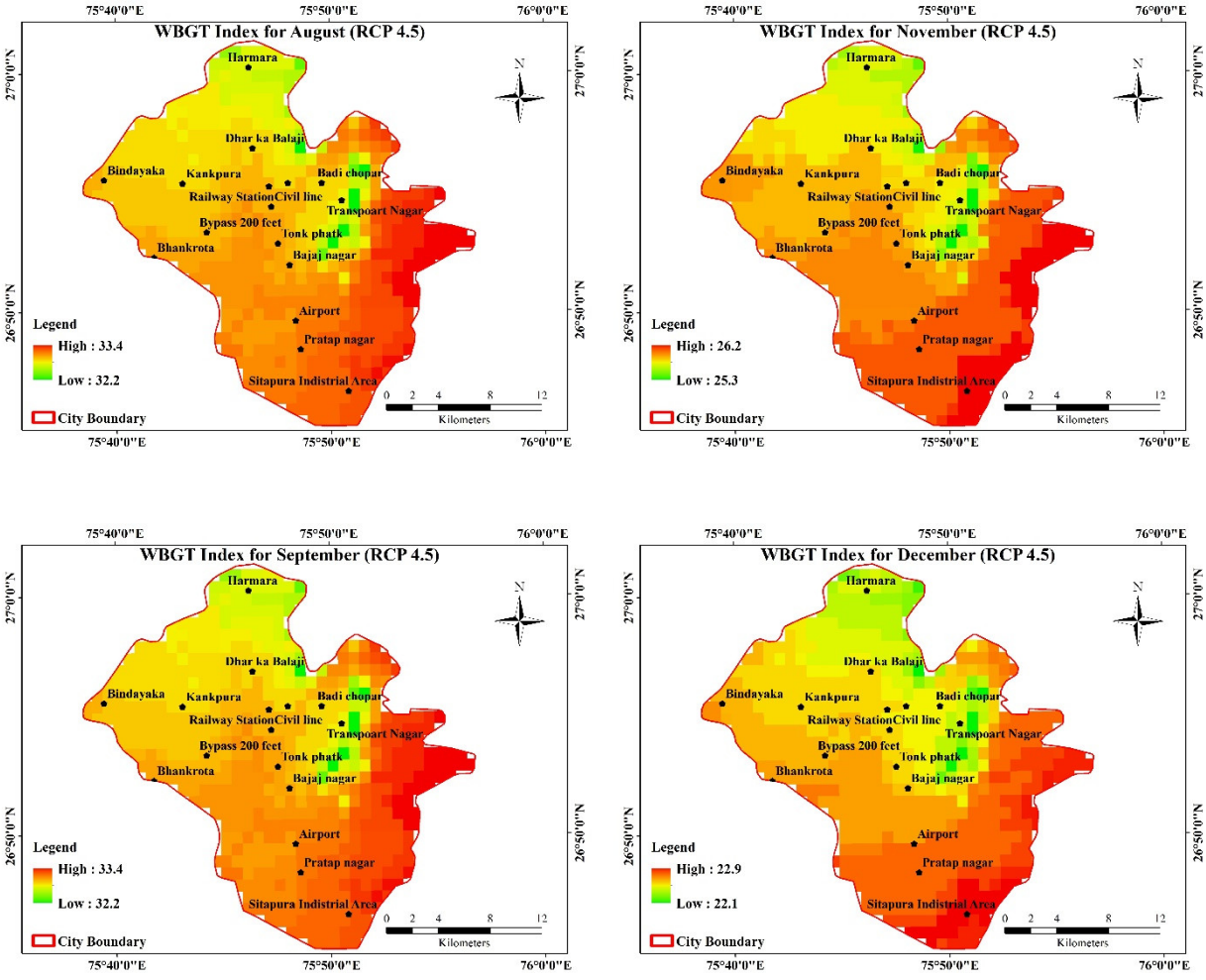
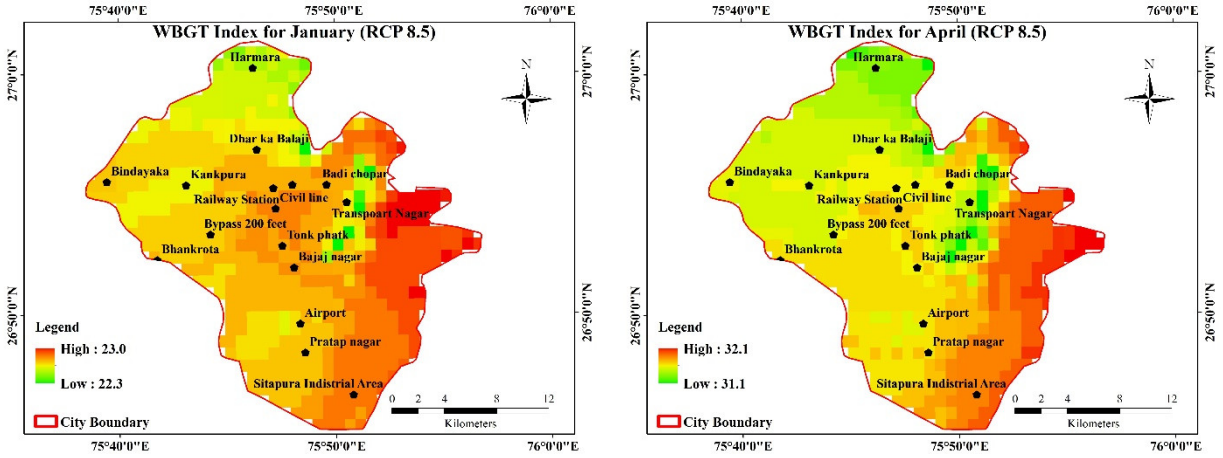


Figure 10. Spatial variation of WBGT for the future (RCP4.5) period.



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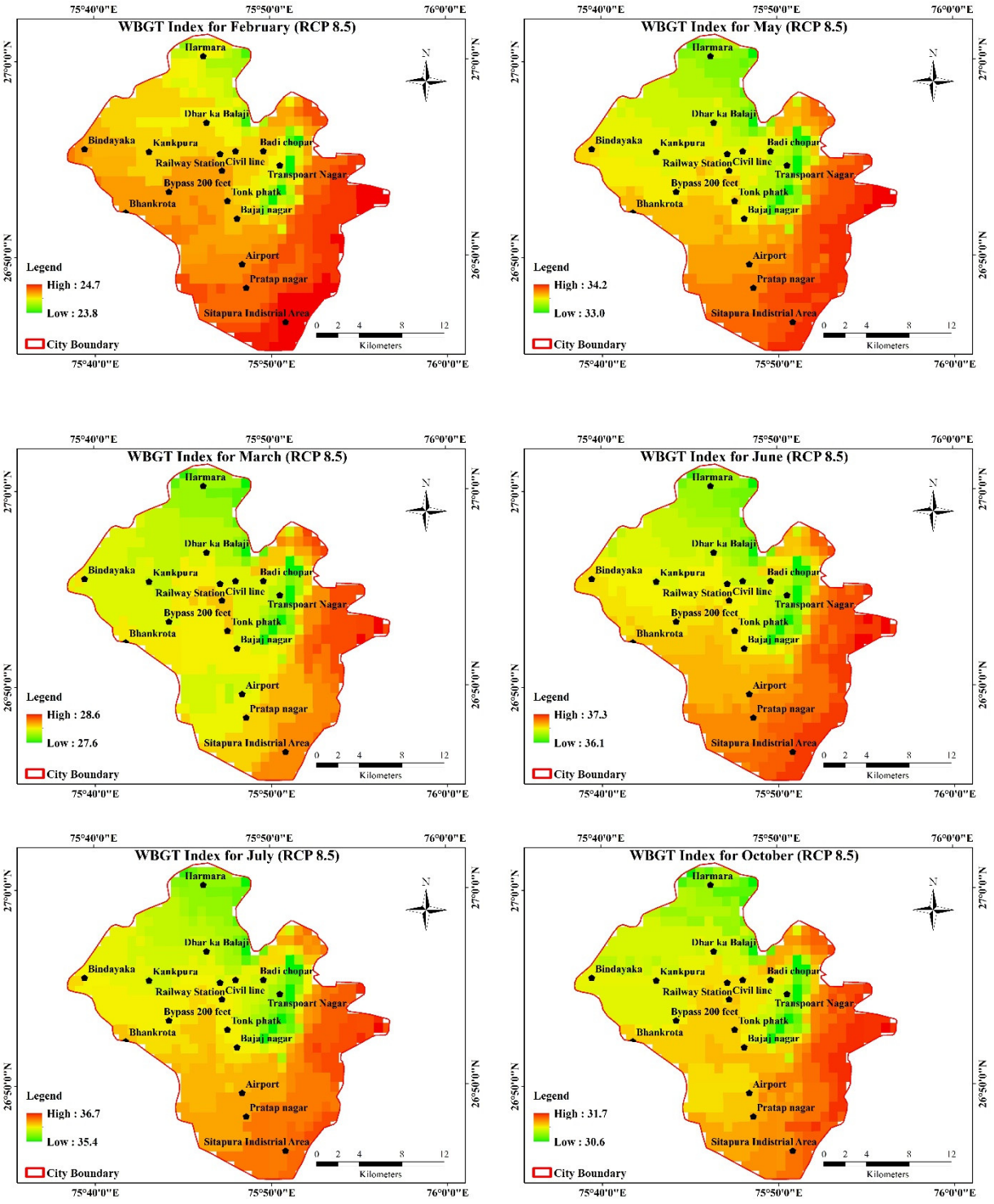

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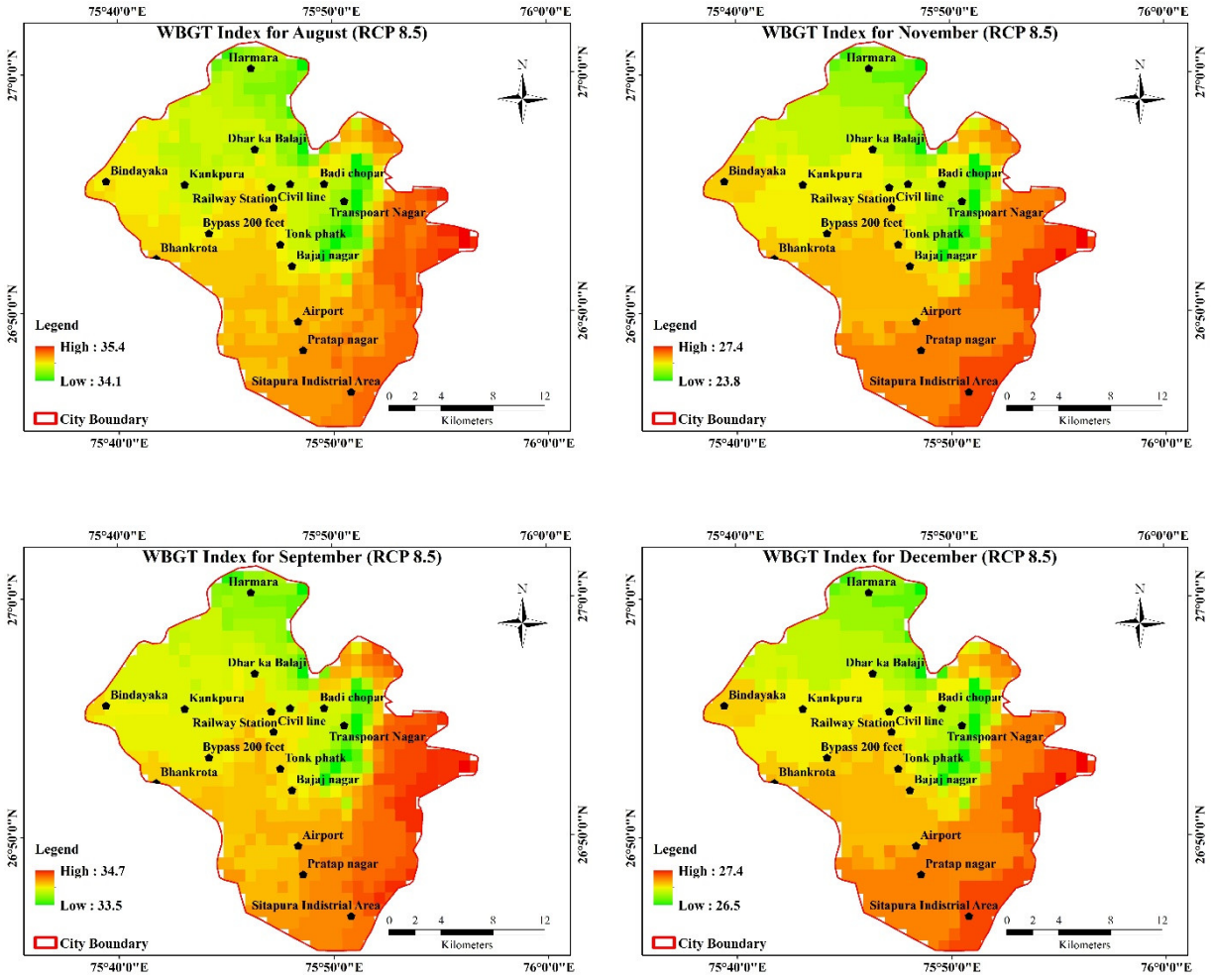

Figure 11. Spatial variation of WBGT for future (RCP8.5) period.

RCP8.5, which simulates a high emission scenario, consistently provides a large difference from RCP4.5. Figure 12 illustrates the disparity pattern, which is seen to be similar to the humidex indication. The study is being carried out to better understand how heat stress conditions vary seasonally. All four seasons' heat stress categories show little variation; however, the monsoon season shows a rise in the danger category. In the monsoon season, WBGT is at its highest; in the winter season, WBGT is at its lowest. An increasing value is found in the future period when compared to the historical period. Figure 13 shows the variation in monsoon WBGT for historical and future periods and the difference in indicator value within the city boundary. The WBGT is high in the summer and autumn season in the southeast direction and these changes are created due to the changes in land use pattern and expansion of urban areas.

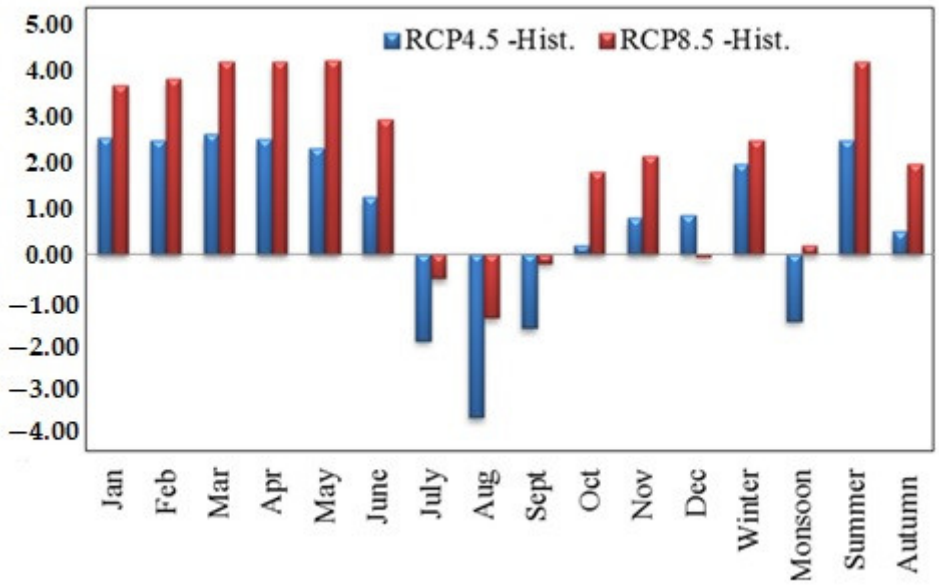

Figure 12. Difference in WBGT values for future scenarios (2050s).

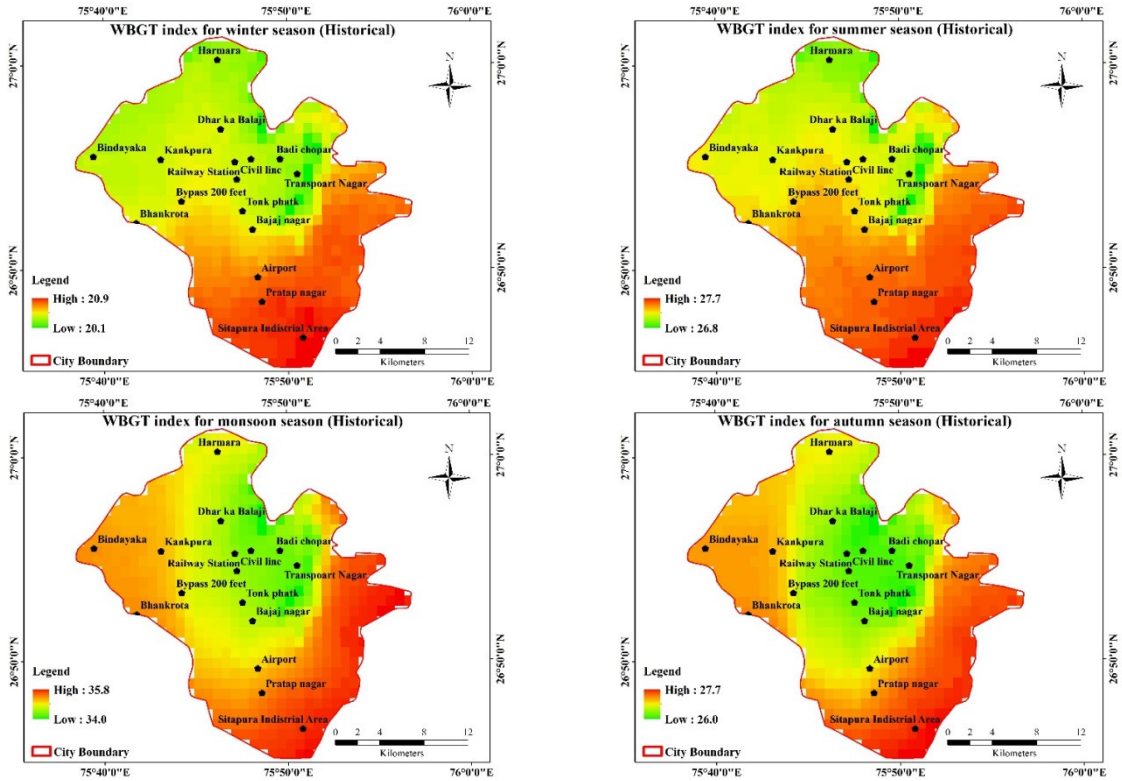

Figure 13. *Cont*.

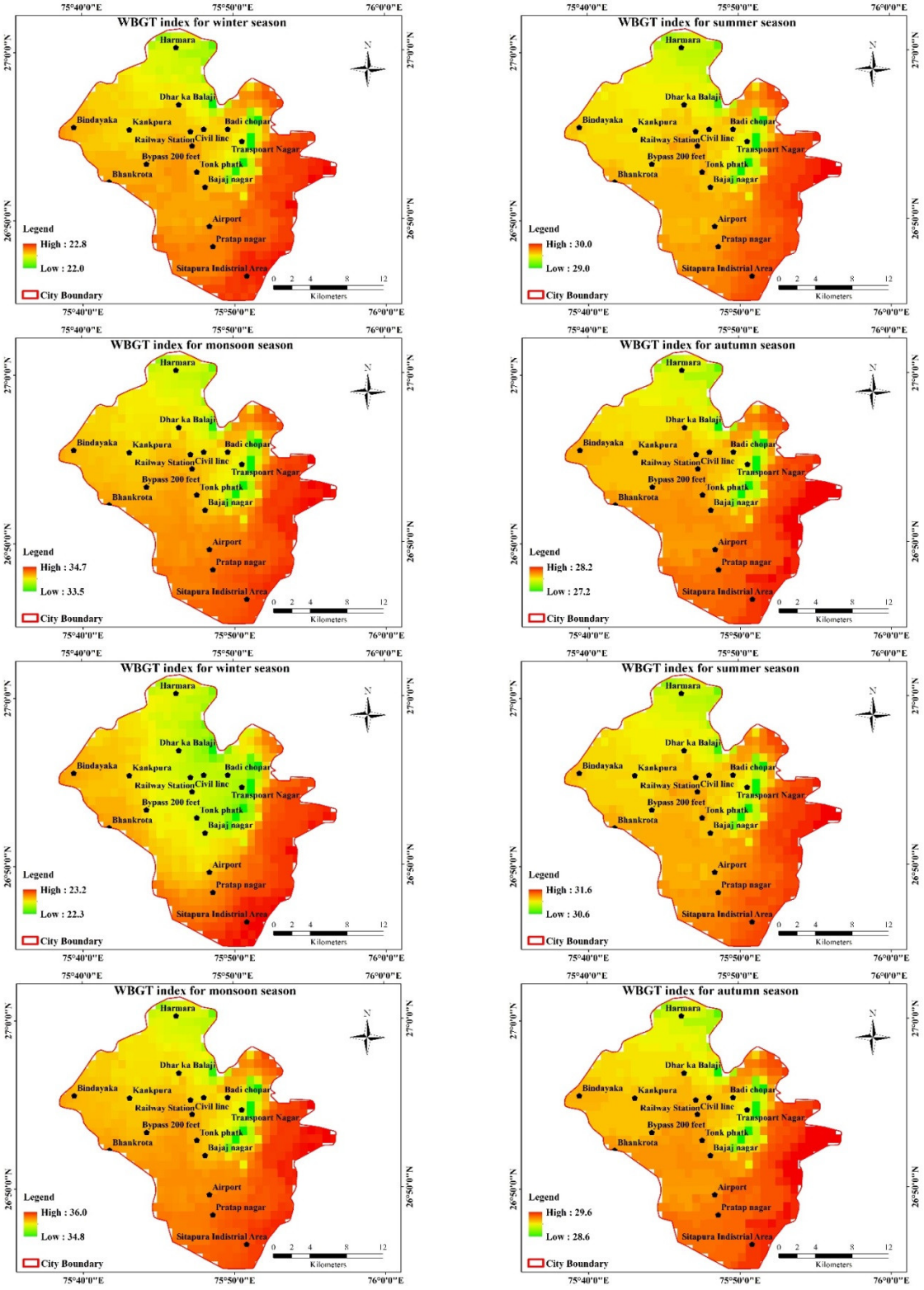

Figure 13. Seasonal map of the humidex index of the Jaipur city (Historical, RCP4.5, RCP8.5).

4.4. Normalized Difference Vegetation Index (NDVI)

In this study, NDVI was calculated for different periods: April 1993, April 2000, June 2010, and April 2015; NDVI values range from −1 to +1, different geographical features show the different NDVI values. These layers give different information through the bands and band 3 and 4 provides the vegetation with cover information of Jaipur city.

The extracted vegetation layer covers of NDVI were spatially compared with the colour composite image of Landsat-5 and Landsat-8 (TM and OLI) imagery. The range of NDVI in 1993 was −0.01 to 0.71, in 2000 was −0.019 to 0.63, and in 2010 was 0.04 to 0.56 of Landsat 5 TM imagery, and year 2015 shows the range of NDVI was −0.24 to 0.70 for the Landsat 8 OLI image of Jaipur city (Figure 14). The vegetation cover area utilizes solar radiation in the photosynthesis process and reduces the city's surrounding temperature.

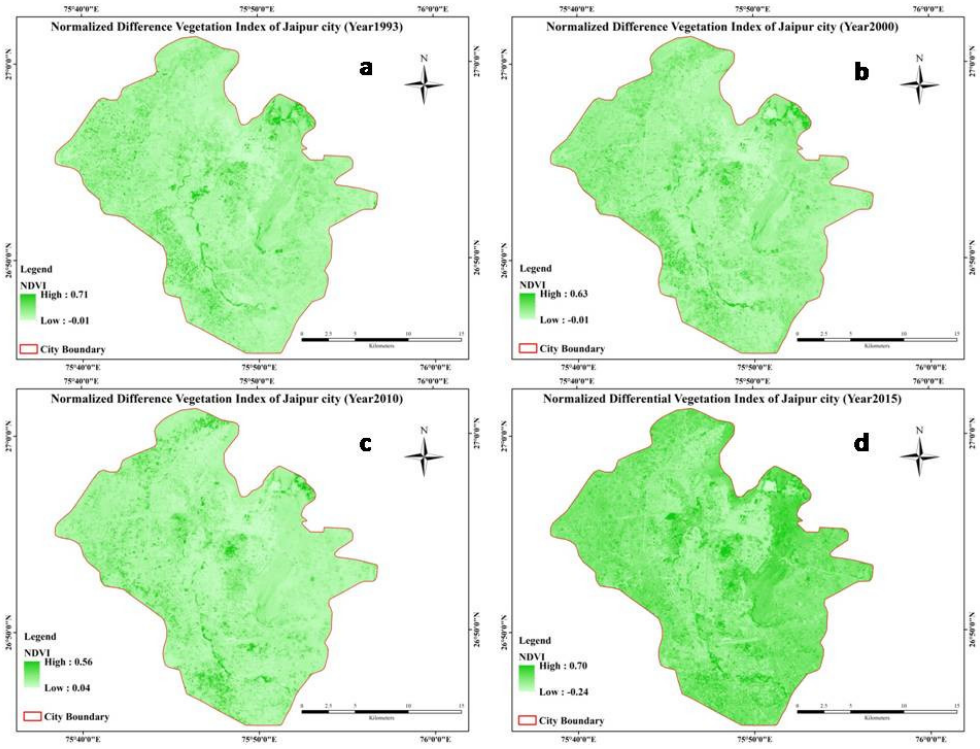

Figure 14. NDVI map of Jaipur city: (**a**) April 1993, (**b**) April 2000, (**c**) June 2010, and (**d**) April 2015.

4.5. Soil-Adjusted Vegetation Index (SAVI)

The study area is mainly classified into different types of land use. All these random samples are selected and the values of these cites are observed between NDVI and SAVI indices. The range of SAVI in 1993 was −0.005 to 0.50, in 2000 was −0.005 to 0.44, and in 2010 was −0.024 to 0.43 of Landsat 5 TM imagery, and 2015 shows the range of SAVI was 0.118 to 0.52 for the Landsat 8 OLI image of Jaipur city (Figure 15). This influence can be restricted using SAVI instead of NDVI. High NDVI and SAVI values were found in the buildup area.

On the other hand, there is a correlation between land use and NDVI data and data measured in meteorological stations in most research, including the current study, which is a significant reason for the efficiency of using this data for environmental issues. As a result, which can be derived indirectly using daily recorded metrological parameters in weather stations, it can be used to assess thermal conditions in Jaipur. Because evaluating environmental parameters for the calculation of heat stress indices is normally costly and time consuming, it is possible to alleviate this problem in environmental evaluations in open spaces by using daily recorded weather station data. Meteorological data has the advantage of being continuously recorded and providing a low-cost and comprehensive database for computing a variety of essential thermal indicators.

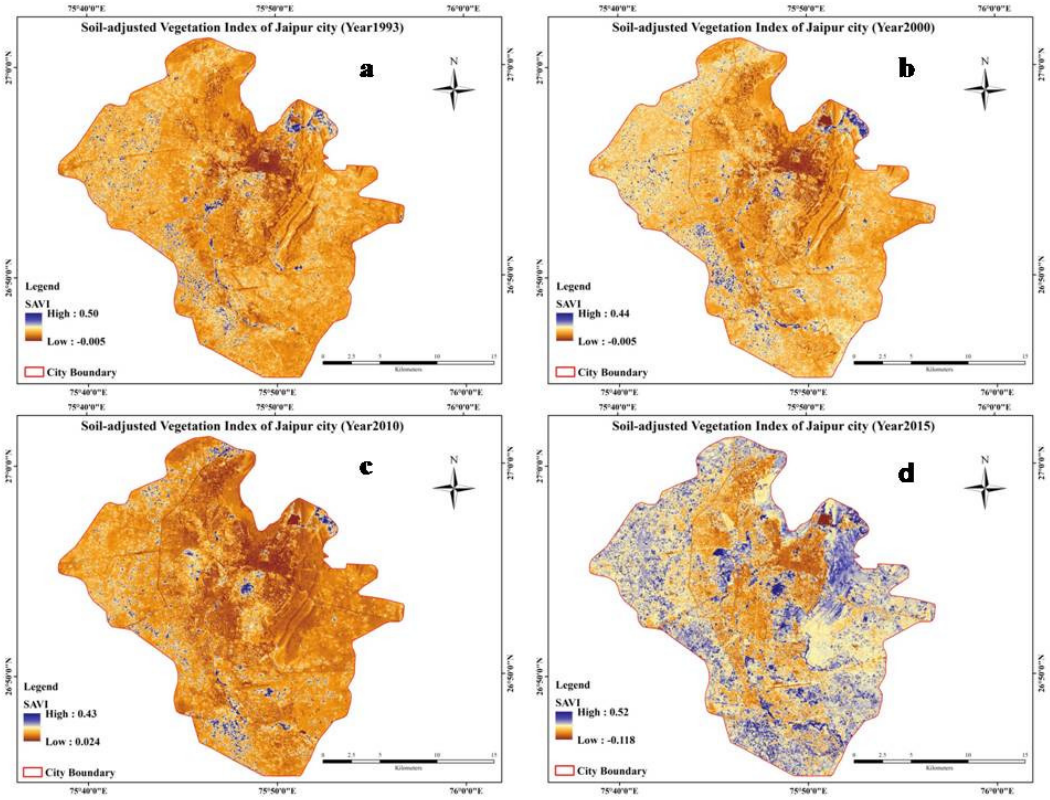

Figure 15. SAVI map of Jaipur city: (**a**) April 1993, (**b**) April 2000, (**c**) June 2010, and (**d**) April 2015.

5. Conclusions

The study's major goal was to predict the WBGT and humidex indexes for the past and future. This study demonstrates the expansion of urban land usage in Jaipur city from 1993 to 2015 using intermediate satellite images. The number of people living in cities has increased substantially in the last 23 years. The most prevalent type of land converted to urban areas is open terrain, followed by vegetation and hilly/rocky areas. The NDVI and SAVI indices are also used to determine the changes in land use patterns in the city and the amount of green space in the urban and peri-urban areas. The WBGT is highest during the monsoon season and lowest during the winter. When compared to the historical period, the future time shows an increase in value. Humidex's historical value has been 21.4, but it is projected to rise to 25.5 and 27.3 under the RCP4.5 and RCP8.5 scenarios. In May, the greatest humidex values were 39.5, 43.2, and 46.4 for the historical and two future RCP scenarios. The months of May and June are shown in the danger and extreme danger categories in the analysis. From January to May, the humidex values rise, then begin to fall until the month of December. It predicts that, with the exception of the monsoon season in the metropolis, discomfort levels will rise in the future. The findings indicate that the index's average value is increasing. Global warming or the absence of suitable conditions in these environments may be responsible for this trend. This will help in the identification of a better heat stress index for diverse situations and temperatures. There are some restrictions on the study; the distribution of indices studied throughout the different continents varies because the majority of studies undertaken in this field are focused on regions with hot climates. Application of WBGT and humidex indices has limited application in warmer climates as it shows a low level when the air temperature is in high range. The environmental heat index is preferred in occupational situations, but is not suitable at all work locations [33]. The possible reason for using these indices is comprehensiveness of the index for assessing the thermal stress conditions with limited data availability. However, it is a useful indices to understand the pattern of long-term

change and warning purposes. The additional limitations of this analysis were the dearth of pertinent papers and the evidence provided in the articles. Appropriate protective strategies are required to prepare for the working population, which includes vulnerable persons whose occupational health and performance are harmed by heat stress.

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ORIGINAL PAPER

Linkage of urban expansion and land surface temperature using geospatial techniques for Jaipur City, India

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Abstract
The aim of this study is to understand the land use change and urban expansion of Jaipur City of Rajasthan (India). Landsat 5 TM and Landsat 8 OLI satellite data of 4 years, i.e., 1993, 2000, 2010, and 2015 are used for land use and land surface temperature (LST) analysis. ERDAS Imagine and ArcGIS software are used to conduct the analysis. Urban settlement increased from 13.5 to 57.3% in the study period. Open land is mainly changed to urban areas. Urban settlement is also expanded to peri-urban area of Jaipur City. Jaipur City expanded along three directions i.e., north, west, and south and less development is found in the east direction. Based on radial analysis, it is observed there is not much development within the periphery of 2 km (close to city center) but maximum growth is observed within the distance from 4 to 6 km radius of city center. Expansion intensity was observed highest in the period 2015–2010 from 6 km onwards and reached to a maximum value close to 17 km^2/year. In LST analysis, there is less change in extreme temperature, but more areal increase in average temperature range (30–35 °C). Urbanization is the main driving process of land cover changes and consequently changes in LST.

Keywords Land use land cover (LULC)e · Urban expansion · Land surface temperature (LST) · Landsat · Geospatial techniques

Introduction

In present scenario, both urbanization and land use change are serious concern for scientists and urban planners. Fast and unplanned development of city is an important environmental issue for society and policy makers as it may lead to further deterioration of city situation. It is important to monitor the change in overall growth of the city for its resource management and future sustainable growth. Due to the rapid growth of population and rapid change in land use pattern, there is change in land surface temperature. It is an important concern to understand the conversion of green and open area to impervious surfaces (Mallick et al. 2008). Continuous change in geographical features (vegetation, forest, open land, and water body) mostly affects the absorption and reflection properties of earth for solar radiation. In result, it changes the surface temperature, evaporation rates, albedo, heat storage, and wind circulation close to surface over the surrounding of cities (Mallick et al. 2008) and overall alters the energy and water budget (Oke 1987). These changes directly and indirectly play important role in changing various environmental processes and societal health (Weng and Yang 2004).

It is important to understand the land use and land cover (LULC) changes in emerging cities, particularly country like India, due to the rapid growth of economy development. In order to understand the growth and expansion pattern of city, it is worth to use recent geospatial tools and spatial data. In cities, there is need to have data sets with fine resolution to capture the spatial variability of change and its consequences. Remote sensing and geographical information system (GIS) is considered as more approachable and effective tools for land surface temperature (LST) and other environmental studies to develop a decision support system (Abdel Rahman et al. 2016; Deep and Saklani 2014). In India, many studies are conducted in different cities like Mumbai (Grover and Singh 2015), Chennai (Lilly Rose and Devadas 2009), Jaipur (Jalan and Sharma 2014), and Delhi (Mallick et al. 2008; Grover and

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Singh 2015). Kawashima et al. (2000) explained the relation between mean air temperatures and mean surface temperature and also mentioned the relationship to show temperature variation for different latitudinal ranges. Markham and Barker (1986) estimated the LST from satellite thermal data and explained the digital number (DN) of image pixels needs to be converted into spectral radiance, and using the sensor calibration data. Owen et al. (1998) described the satellite imagery-based analysis and explained the high-resolution, consistent, and repetitive coverage and measure the conditions of geographical feature of the earth's surface through satellite image. Cao et al. (2008) used temperature vegetation index (TVI) for investigating the effect of land use change over the LST. Table 1 presents the list of studies conducted by various researchers by using different satellite data for the LST calculation. Mallick et al. (2013) identified the urban heat island of the fastest growing urbanizing city of Delhi, India. ASTER and Landsat 7 ETM+ images of the years 2001 and 2005 were used to develop the association between UHI and land use. Liu et al. (2016) explained the relationship between land surface temperature and different land use types of the Nanjing Metropolitan Region, China, by using the Landsat 5 TM data. The results of study revealed that major portion of area in high-temperature zone is urban, whereas green and water are found in low-temperature zone. Some researchers also analyzed the LST of the different years for Indian cities and developed the relationship of LST with vegetation index (NDVI), normalized difference built-up index (NDBI), emissivity, and albedo (Srivastava et al. 2009; Kikon et al. 2016; Sharma et al. 2015).

The objective of the present paper is to understand the LULC changes for different periods and develop linkage on spatial variation and LST of Jaipur City, Rajasthan, India. Landsat satellite images of four different periods 1993, 2000, 2010, and 2015 are used to assess the spatio-temporal dynamics of LULC and LST over the study area.

Study area

Jaipur City is district headquarter and the capital city of Rajasthan state. Jaipur City is situated in the northeast part of the state. It is located at an elevation of 431 m above mean sea level and at 26.92° N latitude and 75.82° E

Table 1 List of various studies with their objective conducted in various cities by using different geospatial data

Study objective	Data used	City	Author
Effects of urbanization and seasonal cycle on the surface urban heat island patterns in the coastal growing cities	Landsat 5 Landsat 7 Landsat 8	Casablanca, Morocco	Bahi et al. (2016)
Detection of land use and land cover change and land surface temperature	Landsat 5 and Landsat 8	Municipality of Malda District, India	Pal and Ziaul (2017)
Analyzing land surface temperature distribution in response to land use/land cover change using split window algorithm and spectral radiance model	Landsat 5 TM & 8 OLI	Sundarban Biosphere Reserve, India	Sahana et al. (2016)
Urban heat island	Landsat 7 ETM+ TM	Jaipur, India	Jalan and Sharma (2014)
Remote sensing-based analysis of the role of land use/land cover on surface temperature and temporal changes in temperature	Landsat 7 ETM	Ajmer, India	Hussain et al. (2014)
Retrieval of land surface temperature from the using a single-channel algorithm and its validation	Kalpana-1 VHRR	Western India	Pandya et al. (2014)
Identifying seasonal heat islands in urban settings, an anomaly-based approach	Landsat 5	Delhi, India	Sharma and Joshi (2014)
Monitoring urbanization and its implications in a mega city from space: spatiotemporal patterns and its indicators	Landsat 5	Delhi, India	Ramachandra et al. (2015)
Remote sensing-based analysis of urban heat islands with vegetation cover	Landsat 7	Colombo City, Sri Lanka	Senanayake et al. (2013)
Estimation of land surface temperature to study urban heat island effect	Landsat 7	Vijayawada, India	Kumar et al. (2012)
Night time LST and distance from hot spots in urban areas	MODIS	Jaipur, India	Khandelwal et al. (2011)
Urban heat island analysis	Landsat 5 and ASTER	Hong Kong	Liu and Zhang (2011)
Urban expansion and its impact on surface temperature	Landsat5	Zhujiang Delta, China	Weng (2001)
Estimation of land surface temperature	Landsat 7	Delhi, India	Mallick et al. (2008)
Relationship between land surface temperature and NDVI	Landsat 7	Shanghai, China	Yue et al. (2007)

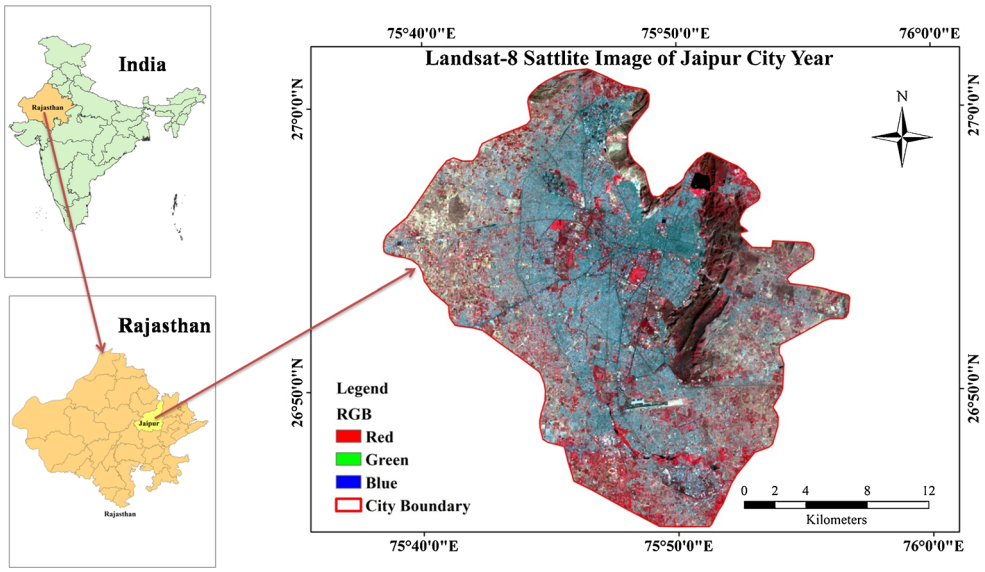

Fig. 1 Location map of study area

longitude (Fig. 1). According to the Jaipur Development Authority (JDA), Jaipur region covers approximately 1464 km^2 geographical areas (JDA, Master Development Plan 2011). In this study, 472-km^2 area is considered for the analysis. The city is located mostly on a flat plain and is surrounded by hills on the north, northeast, and east sides. Due to the hills, the development of the city is more along south and west. Jaipur City has a mixture of built-up areas, low vegetation area, roads, industries, etc. In 2001, the urban population of Jaipur City was 2.3 million which increased to 3.07 million in the year 2011. It constitutes 46.07% of the total population of Jaipur district (General 2001; Census of India (2001 and 2011).

Data and methodology

Data used

Landsat 5 Thematic Mapper (TM) data for April 1993, April 2000, and June 2010 and Landsat 8 OLI April 2015 have acquired from the US Geological Survey (USGS) Global Visualization Viewer, and detail is given in Table 2. The Landsat TM data resolution lies between 30 to 120 m, while Landsat 8 OLI data resolution lies between 15 to 100 m. The detail information related to bands, wavelength, and resolution is given in Tables 3 and 4. In case of Landsat 5 TM, band 5 and band 6 are used for LST estimation. Similarly, band 10 and band 11 of Landsat 8 OLI sensor are used for LST estimation. Field data are randomly taken from Google Earth. ArcGIS and ERDAS IMAGINE geospatial tools are used to calculate the LST, LULC distribution, and other spatial analysis of the study area.

Table 2 Description of satellite data, sensor, and date of acquisition

No. of bands	Satellite data	Sensors	Date of date of acquisition	Path/row
7	Landsat 5	TM	27/04/1993	147/41
7	Landsat 5	TM	14/04/2000	147/41
7	Landsat 5	TM	29/06/2010	147/41
11	Landsat 8	OLI	23/04/2015	147/41

Methodology

For this research, different satellite data are used to estimate the LST and to develop the relationship with LULC of Jaipur City. Landsat 5 TM data are used for the years 1993, 2000,

Table 3 Landsat 5 TM sensor band characteristics and resolution

Band no.	Band information	Wavelength (μm)	Resolution (m)
1	Visible	0.45–0.52	30
2	Visible	0.52–0.60	30
3	Visible	0.63–0.69	30
4	Near-infrared	0.76–0.90	30
5	Near-infrared	1.55–1.75	30
6	Thermal	10.40–12.50	120
7	Mid-infrared	2.08–2.35	30

Table 4 Landsat 8 OLI sensor band characteristics and resolution

Band no.	Band information	Wavelength (μm)	Resolution (m)
1	Coastal aerosol	0.43–0.45	30
2	Blue	0.45–0.51	30
3	Green	0.53–0.59	30
4	Red	0.64–0.67	30
5	Near-infrared (NIR)	0.85–0.88	30
6	SWIR 1	1.57–1.65	30
7	SWIR 2	2.11–2.29	30
8	Panchromatic	0.50–0.68	15
9	Cirrus	1.36–1.38	30
10	Thermal infrared (TIRS) 1	10.60–11.19	100*(30)
11	Thermal infrared (TIRS) 2	11.50–12.51	100*(30)

and 2010 and Landsat 8 OLI/TIRS data is used for the year 2015. The methodology framework of the study is shown in Fig. 2.

Image classification and accuracy assessment

In this study, supervised technique with maximum likelihood classification method is used to classify the study area into five major categories i.e., water body, vegetation, urban settlement, open land, and hilly area/rocky area. The accuracy assessment of classification has been done by the Kappa method (Foody 1992; Ma and Redmond 1995). Total 330 sample sites from Google Earth and ground points are selected for verification as used by Pal and Ziaul (2017). Kappa coefficient (k) for the image classification is as follows:

$$k = \frac{N\sum_{i=1}^{r} xii - \sum_{i=1}^{r} xi + *xi + 1}{N^2 - \sum_{i=1}^{r} xi + *xi + 1}$$

$$k = \frac{(Total\ \text{sum}\ of\ \ correct) - \text{Sum}\ of\ \ the\ \text{all}\ the\ (\text{row}\ and\ \ column\ \ total\ )}{Total\ \ squared - \text{Sum}\ of the\ \text{all}\ the\ (\text{row}\ and\ \ column\ \ total)}$$

Kappa is always less than or equal to 1. High value of Kappa shows more accurate information. According to the

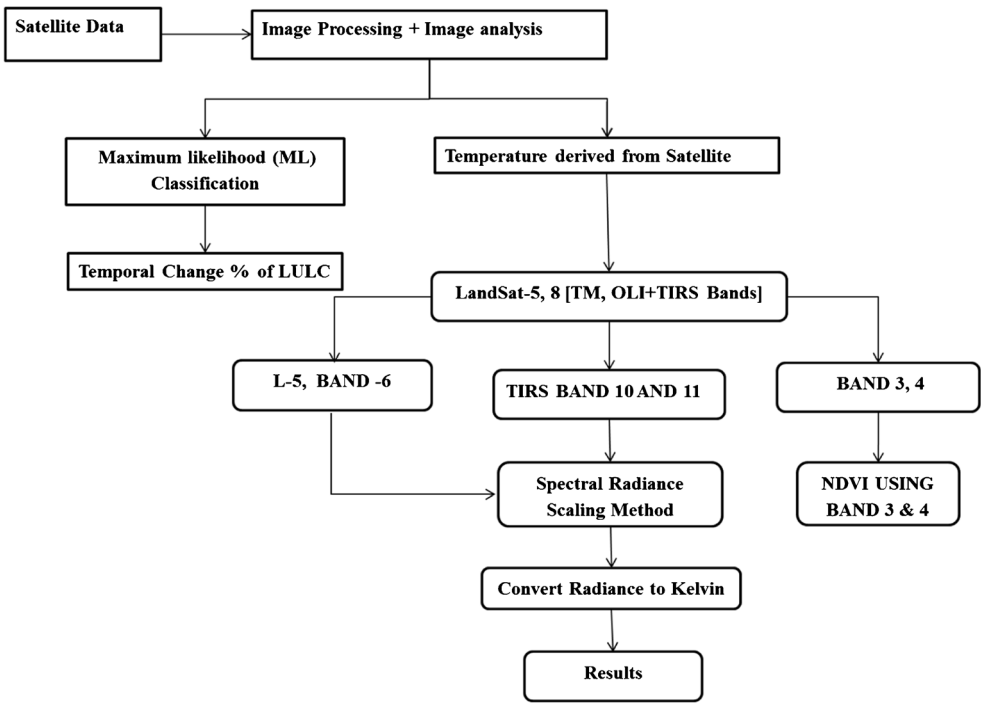

Fig. 2 Methodology framework

Table 5 Accuracy assessment of the land cover types

User accuracy (%)						Overall accuracy	Kappa coefficient
Year	Water	Vegetation	Urban settlement	Open land	Hilly/rocky area		
1993	100	95.4	96.7	97.9	69.8	0.92	0.88
2000	100	100	90.6	93.2	89.5	0.94	0.92
2010	100	94.7	100	96.6	91.2	0.97	0.95
2015	100	95.7	97.2	92.7	88.6	0.95	0.93
Producer accuracy (%)							
Year	Water	Vegetation	Urban settlement	Open land	Hilly/rocky area		
1993	100	98.41	87.88	90.73	91.67		
2000	100	92.71	93.55	94.12	94.44		
2010	100	97.83	98.21	95.45	100		
2015	100	94.74	99.28	86.44	93.94		

Monserud and Leemans (1992), Kappa coefficient between 0.55 and 0.7 represents good agreements, values from 0.7 to 0.85 represent very good agreement, and values higher than 0.85 represent an excellent agreement between image and ground.

Calculation of LST

The calculation of LST was done for different periods using different satellite images i.e., Landsat 5 TM and Landsat 8 OLI. According to the Chen et al. (2006), thermal data are required for the calculation of sensor radiometric calibrations, correlation of atmospheric and surface emissivity, and characterization of spatial land use variability in the area.

For the LST calculation, the spectral radiance scale method is used and it is given as follows:

$$CV_{R1} = \left(\frac{LMAX_\lambda - LMIN_\lambda}{QCALMAX - QCALMIN} \right) * (QCAL - QCALMIN) + LMIN_\lambda$$

where

CV_{R1} cell value as radiance
QCAL digital number
$LMIN_\lambda$ spectral radiance scales to QCALMIN
$LMAX_\lambda$ spectral radiance scales to QCALMAX
QCALMIN the minimum quantized calibrated pixel value (typically = 1)
QCALMAX the maximum quantized calibrated pixel value (typically = 255)

The formula to convert radiance to temperature without atmospheric correction is as follows:

$$T = \frac{K_2}{ln\left(\frac{K_1 * \varepsilon}{CV_{R1}} + 1\right)}$$

where

T degrees Kelvin
CV_{R1} cell value as radiance

ε is emissivity (typically 0.95).

For Landsat 5, value of K1 is 607.76 and K2 is 1260.56.

For Landsat 8 (band 10), value of K1 is 774.89 and K2 is 1321.08.

For Landsat 8 (band 11), value of K1 is 480.89 and K2 is 1201.14.

Table 6 Area coverage (km^2) and percent area (%) of land use classification of different years

Class name	Area 1993	Area 2000	Area 2010	Area 2015	Percent 1993	Percent 2000	Percent 2010	Percent 2015
Water	0.40	4.64	0.88	0.81	0.09	0.98	0.19	0.17
Vegetation	84.45	87.85	88.56	45.68	17.90	18.62	18.77	9.68
Urban settlement	63.87	132.45	166.53	270.47	13.54	28.07	35.29	57.32
Open land	216.30	188.00	159.84	91.54	45.84	39.84	33.87	19.40
Hilly/rocky area	106.87	58.93	56.09	63.39	22.65	12.49	11.89	13.43
Total area	471.89	471.89	471.89	471.89	100	100	100	100

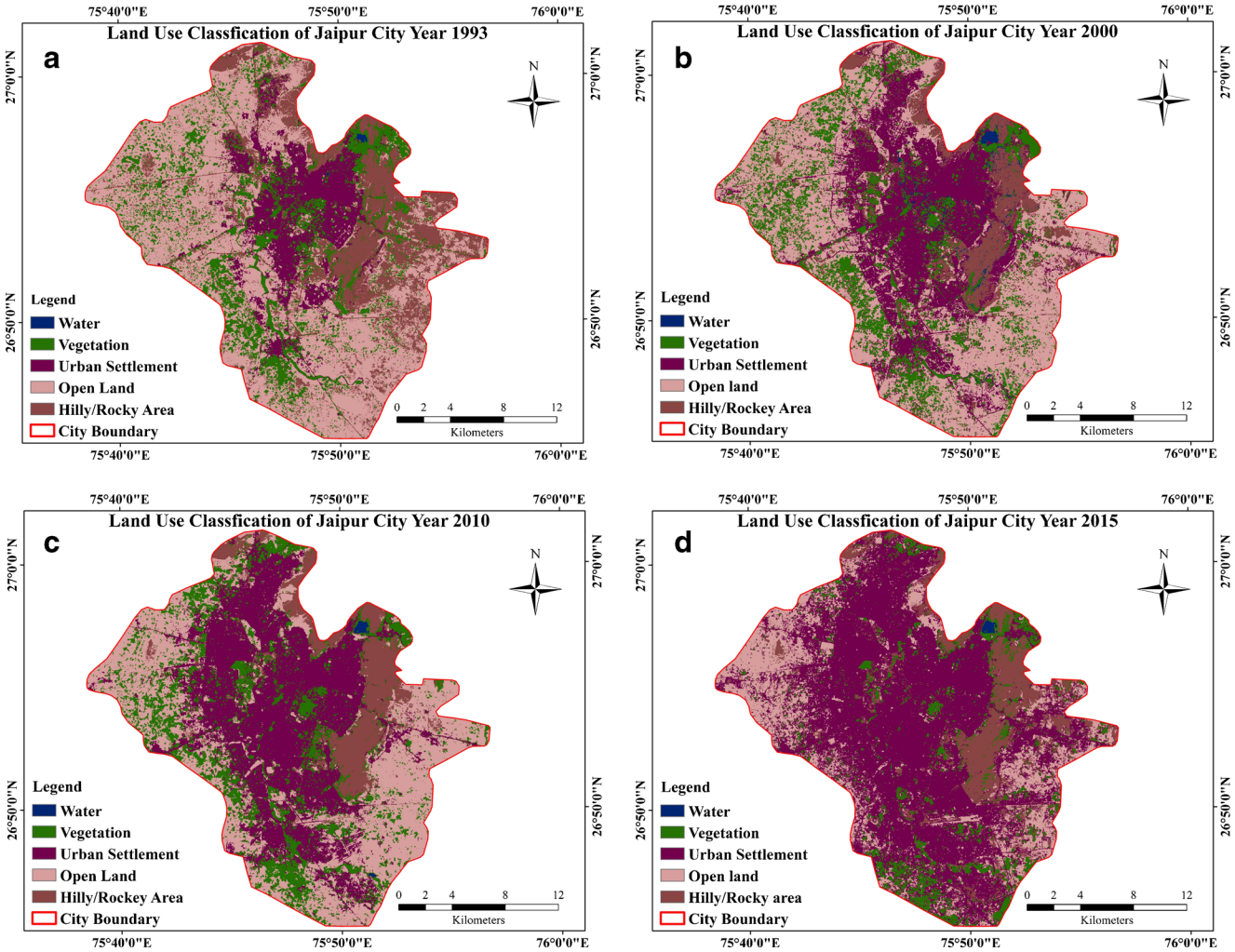

Fig. 3 LULC classification for different years. **a** 1993, **b** 2000, **c** 2010, and **d** 2015

Buffer analysis of settlement expansion for different radial distances

Buffer analysis was done for estimating the expansion of settlement area surrounding the city center. The purpose of the buffer was to evaluate city expansion based on distance factors. Total seven concentric circles are drawn with incremental radius of 2 km from city center. From all the seven concentric circles, total area under settlement is calculated to understand the expansion of the city with respect to city center. Urban expansion is extracted for different time periods in all the seven buffer circles to calculate expansion intensity of Jaipur city.

Linkage of LULC and LST

Land surface temperature of the study area is reclassified in three temperature zones based on equal interval method i.e., high-temperature zone, medium-temperature zone, and low-temperature zone (Liu et al. 2016). INT and INTERSECT functions which are available in ArcGIS tool is used to get the areal distribution of different land use classes under three temperature zones. This is useful to understand the effect of different land uses on the temperature conditions.

Results and discussions

Accuracy assessment of LULC

For the present study, five dominant land use classes are considered i.e., water body, vegetation, urban settlement, open land, and hilly area/rocky area. Land use classifications are done for four different years i.e., 1993, 2000, 2010, and 2015. The classified images were assessed for accuracy based on a random selection of 330 points for each year. The overall

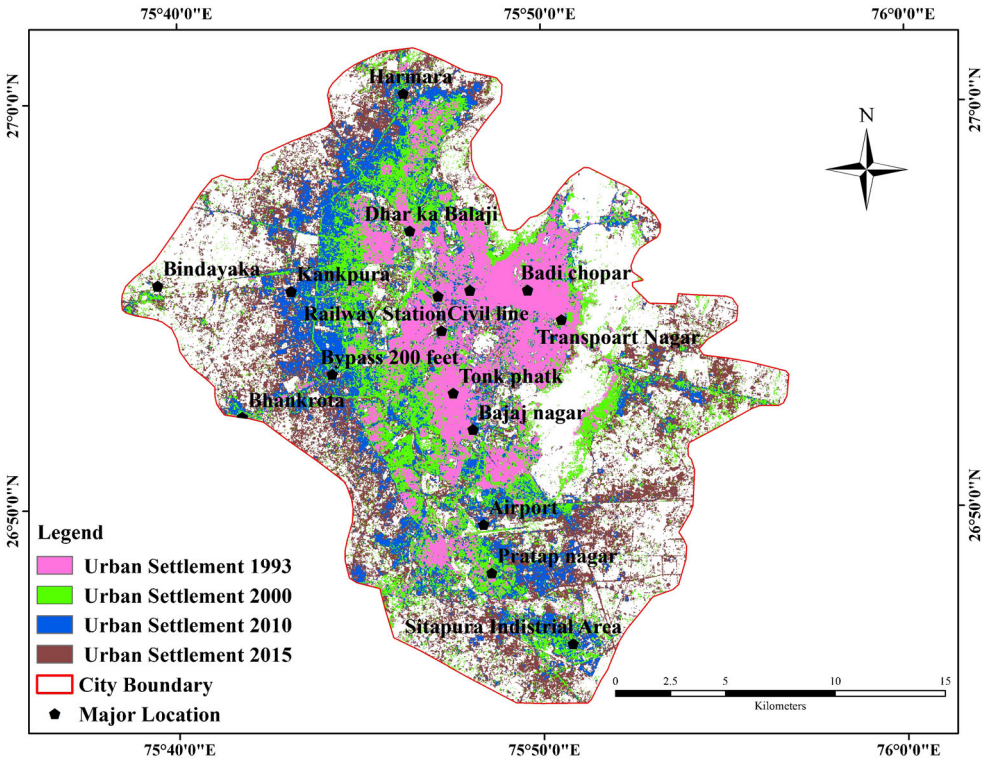

Fig. 4 Expansion of urban settlement for different years and major locations in Jaipur City

accuracy of the classified maps for all the 4 years is found to be 0.92, 0.94, 0.97, and 0.95, respectively. Correspond to it, Kappa coefficients for given years are 0.88, 0.92, 0.95, and 0.93 as given in Table 5. It is found that the accuracy of the classified land use is good in comparison to ground reality.

Percentage distribution of land use classification

The total area under different categories with their percent coverage is given in the Table 6. It is observed that urban settlement of Jaipur City was increased with the time period. In the year 1993, it was 63.87 km^2 which increased to 270.47 km^2 in the year 2015. It means there is area change almost more than four times in the period of 22 years. Compare to total area, almost 57.3% area of study area is under settlement in the year 2015. These changes show that city is growing rapidly and it was much faster after year 2010 compared to other period expansion. Table 6 shows that except settlement class, all other classes are showing decreasing trend. Most of the settlement was done on open land as there is decrease of 26% area under this category. The water body area is limited and it also showing shrinkage with time.

The spatial distribution and patterns of land cover changes for all the 4 years are shown in Fig. 3. Change in urban settlement is clearly observed from the figure. There is high increase in the north, south, and west directions and less development in the east direction as compared to map of the year 1993. Figure 4 shows the expansion of urban area in different years. Less development is observed in the eastern direction due to existence of hilly area. Three major urban expansion corridors are towards Harmara (north), Bhankrota (west), and Pratap Nagar (south) as shown in the figure.

Table 7 presents the percentage wise contribution of different land uses in increase of urban settlement for different years. Comparing the land use of year 2015 with year 1993, it is observed that open land is mainly changed into an urban area followed by vegetation area and hilly/rocky area. For other periods, there is same observation. There is a minor contribution from water bodies to urban settlement.

Table 7 Percentage contribution from other land use to urban settlement area (in percent)

Class name	2000–1993	2010–2000	2015–2010	2015–1993
Open land	55.69	63.79	56.23	59.99
Vegetation	18.66	23.10	35.62	21.97
Hilly/rocky area	25.59	10.91	8.10	18.04
Water	0.06	2.20	0.04	0.003

Buffer analysis of settlement expansion

Buffer analysis is done to understand the urban expansion in Jaipur City. For this purpose, seven concentric circles are

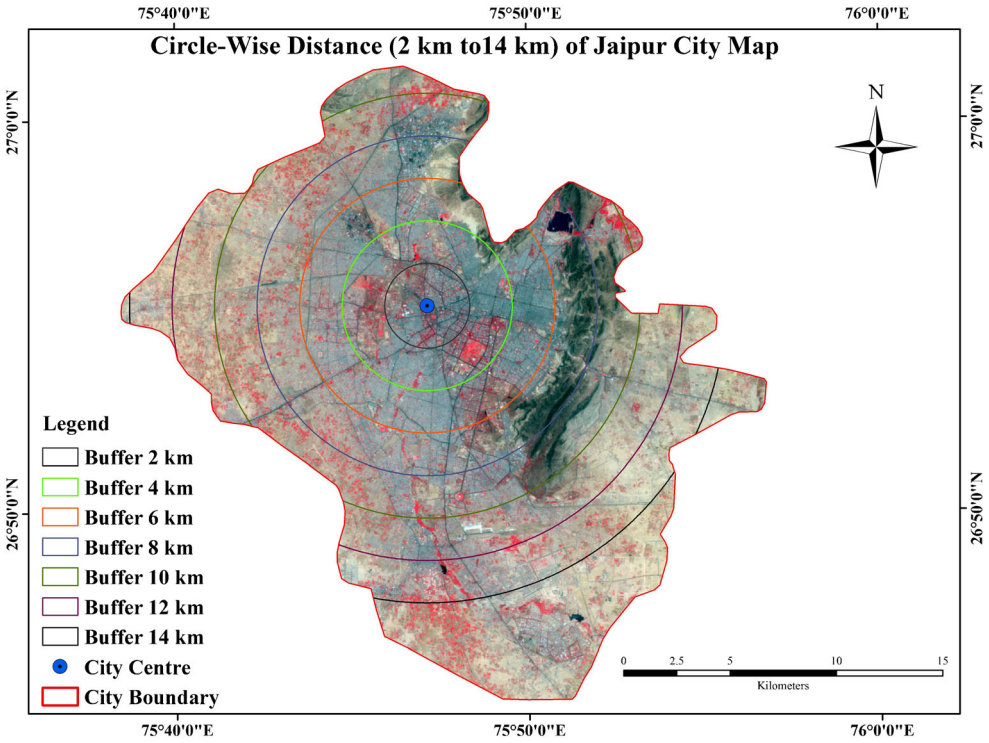

Fig. 5 Buffer analysis of Jaipur City with seven concentric circles

drawn with incremental radius of 2 km considering the Bus stand as city center as shown in Fig. 5.

As shown in Fig. 6, there is a similar pattern of growth with distance away from city center. As observed, there is no much development within the periphery of 2 km but maximum growth is observed within the distance from 4 to 6 km radius of city center. Except year 2015, all the 3 years are showing similar increase in growth area after 6 km diameter. In the period 2010 to 2015, there is high increase in settlement area after 6 km diameter which shows that settlement has taken place away from the city. High increase in settlement area is observed between 8 and 10 km circles. Percentage area changes with respect to radial distance for two different years are given in the Table 8. Area change per year is almost similar for two periods, i.e., 2000–1993 and 2010–2000. But, it was rapidly increased in the period 2015–2010 from 6 km onwards (as shown in italics) and maximum reach to 17.14 km^2/year.

Land surface temperature pattern and linkage with LULC

Spatial distributions of land surface temperature (LST) of Landsat 5 TM and Landsat 8 OLI are calculated for all 4 years (1993, 2000, 2010, and 2015). The LST calculation of 1993 ranges from 25.4 to 46.7 °C; in the year 2000, it ranges from 23.6 to 46 °C, and in 2010, it shows the range 24.5 to 39.2 °C of Landsat 5 TM; in the year 2015, the range of land surface temperature was 24.0 to 37.1 °C of Landsat 8 OLI as shown in Fig. 7. It is analyzed that area coverage between temperature 30–35 °C increased significantly with respect to time. Table 9 shows the basic statistics of land surface temperature for

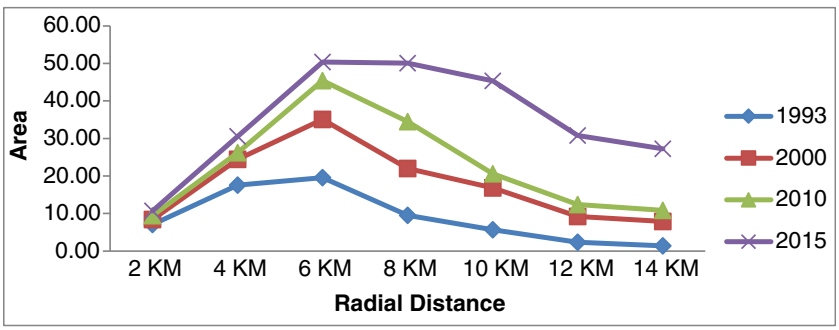

Fig. 6 Urban expansion area with the increasing distance far away from the city center

Table 8 Urban area expansion (km^2) and intensity (km^2/year) during different years

Radial distance	2000–1993		2010–2000		2015–2010	
	Area change	Area/year	Area change	Area/year	Area change	Area/year
2 KM	1.32	0.08	1.05	0.11	1.26	0.25
4 KM	8.17	0.48	2.85	0.29	5.65	1.13
6 KM	23.67	1.39	13.22	1.32	10.55	2.11
8 KM	36.17	2.13	25.67	2.57	26.14	*5.23*
10 KM	47.33	2.78	29.42	2.94	50.94	*10.19*
12 KM	54.20	3.19	32.61	3.26	69.30	*13.86*
14 KM	60.72	3.57	35.57	3.56	85.72	*17.14*

different land use categories in all the 4 years. In the year 1993, maximum temperature is observed in hilly/rocky area (46.7 °C) and minimum temperature is found for water body (25.4 °C). It is observed that minimum value of temperature is found in category "water" for all years. The maximum temperature of year 2000 shows in hilly area and urban settlement, i.e., 47.1 and minimum in water body, and the minimum standard deviation shows in open land. In the year 2010, the maximum (39.2 °C) and minimum (24.7 °C) temperature shows in open land, hilly area, and water body, and minimum standard deviation (0.8) shows in open land; in year 2015, the maximum (37.2 °C) temperature shows in open land and minimum

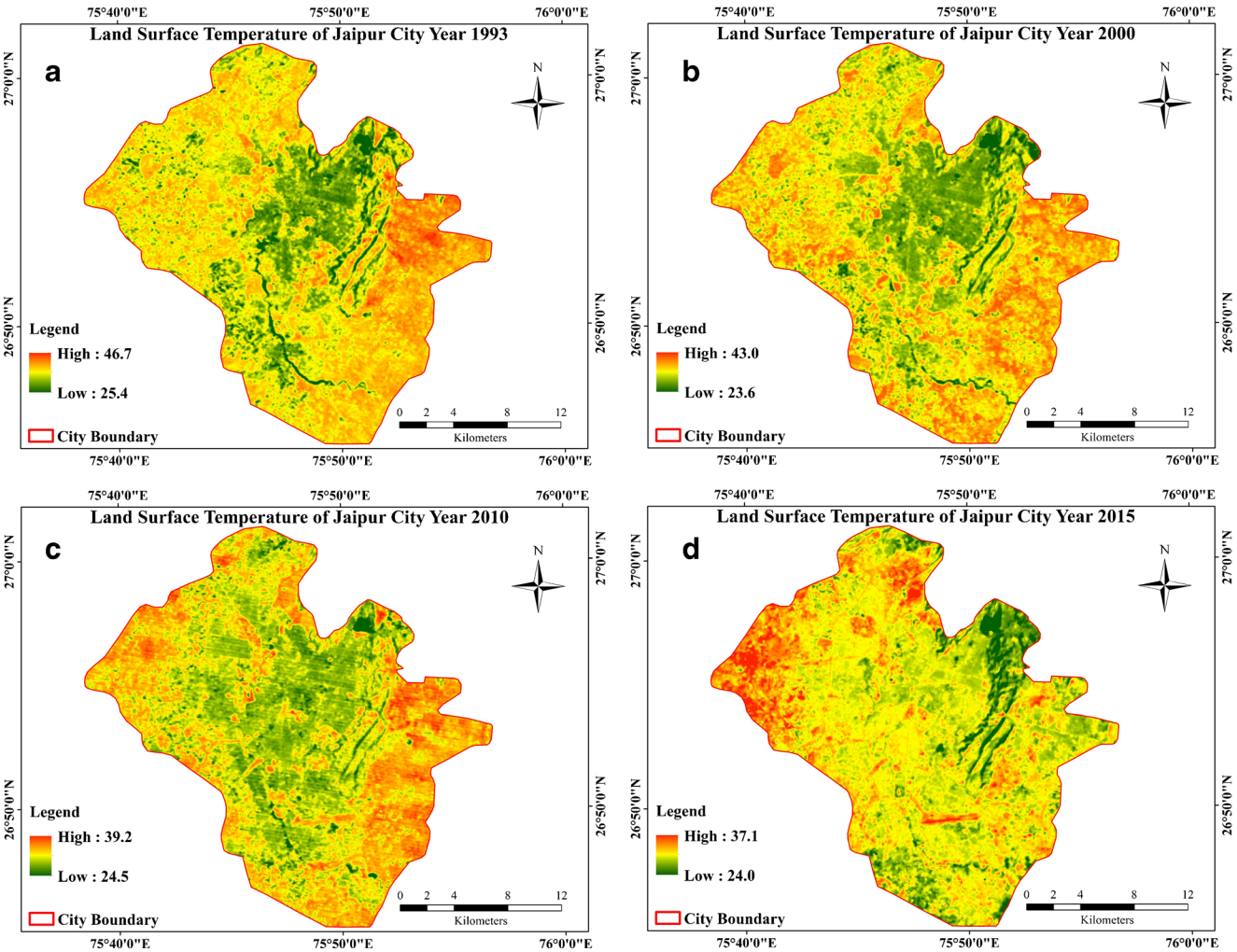

Fig. 7 Land surface temperature. **a** April 1993, **b** April 2000, **c** June 2010, **d** April 2015

Table 9 Statistical characteristics of LST for different land uses in 4 years

Years	Class name	Count	Min	Max	Range	Mean	STD
1993	Water	448	*25.4*	34.1	8.7	27.5	1.8
	Open land	240,331	37.2	44.5	7.2	41.7	0.9
	Hilly/rocky	118,743	34.1	*46.7*	12.6	41.9	1.8
	Urban settlement	70,971	31.6	43.3	11.7	39.0	1.1
	Vegetation	93,828	26.3	45.9	19.7	39.6	1.9
2000	Water	5159	*27.5*	44.4	16.9	37.4	4.2
	Open land	208,893	36.4	46.7	10.3	43.4	1.3
	Hilly/rocky	65,483	33.5	*47.1*	13.6	41.9	2.1
	Urban settlement	147,172	29.6	*47.1*	17.5	40.8	1.6
	Vegetation	97,614	30.1	46.3	16.3	41.0	1.8
2010	Water	976	*24.7*	31.4	6.7	26.5	1.4
	Open land	177,599	31.4	*39.2*	7.9	36.1	0.8
	Hilly/rocky	62,319	26.0	*39.2*	13.3	34.9	1.5
	Urban settlement	185,028	30.6	37.6	7.2	33.8	0.9
	Vegetation	98,399	26.0	38.5	12.5	34.2	1.3
2015	Water	905	*23.9*	27.2	3.3	24.4	0.5
	Open land	100,958	26.1	*37.2*	11.1	32.7	1.2
	Hilly/rocky	73,047	24.3	35.8	11.4	30.8	1.6
	Urban settlement	297,763	24.8	35.8	11.0	31.4	0.8
	Vegetation	51,253	24.1	34.3	10.2	30.0	1.1

Italic values represents the lowest value of minimum temperature and highest value of maximum temperature in different years with respective land use class

(23.9 °C) in water body, and standard deviation 0.5 shows in a water body. Mean temperatures show that in the entire four images, the maximum temperature increased in open land and minimum temperature in water body.

Figure 8 shows the contribution of different land uses on temperature zone and also develops linkage between LULC and LST. It is prepared by taking average of all the four periods. In the low-temperature zone, area coverage of water body is more (57.7%) as compared to other land use classes. In the medium-temperature zone, urban settlement is major part of contribution (57.4%) followed by vegetation class (25.3%). In the high-temperature zone, 58.1% of area is covered with open land and about 16.5% in the class of urban area. Similar observations are found in individual periods.

Conclusion

This study shows the expansion of urban land use of Jaipur City from year 1993 to year 2015 considering the intermediate satellite images. Urban settlement increased from 13.5 to 57.3% in last 23 years. It is observed that open land is mainly changed into urban area followed by vegetation area and hilly/rocky area. Jaipur City expanded along three directions i.e., north, west, and south. There is less development in the eastern direction due to hilly/rocky area and close to green belt. Based on radial analysis, it is observed there is not much development within the periphery of 2 km (close to city center) but maximum growth is observed within the distance from 4 to 6 km radius of city center. In the recent past (period 2010 to 2015), there is high increase in the settlement area after 6 km diameter, which shows that settlement has taken place away from city (8–10 km) due to the availability of open space. Expansion intensity was highest in the period 2015–2010 from 6 km onwards, and maximum expansion intensity reached to 17 km^2/year. Landsat satellite data are used to estimate the LST in the years 1993, 2000, 2010, and 2015. There is less change in extreme temperature range, but more areal increase in mean temperature range (30–35 °C). Urbanization is the main driving process of land cover changes and consequently changes in LST. Land surface temperature is important and critical factor in understanding the energy and water

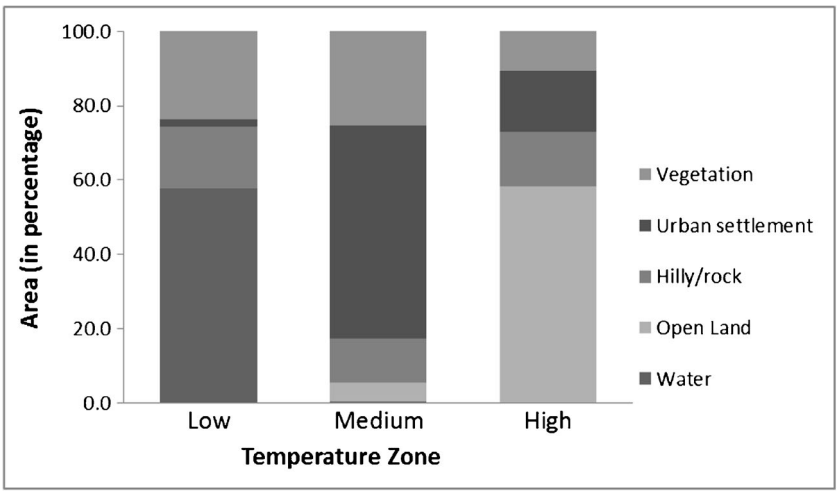

Fig. 8 Percentage of different land uses in three temperature zones

budget at various spatial scales including cities. LST is widely helpful in various studies like climate change, evapotranspiration, hydrology, vegetation, and urban heat island. With change in LULC and LST, there is change in albedo of objects on the earth which in result change the energy budget. It is further recommended to conduct study to develop linkage between four factors i.e., land use change, LST, energy, and water.

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Analysis of Land Change Dynamics and Indices Using Geospatial Technology: A Case of Jaipur City, India

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Abstract- In the past few decades, there was a rapid expansion of urban cities at a global scale which develops the need of monitoring the change in land use and urban settlement area. Remote sensing (RS) is a valuable tool to monitor and understand the causes responsible for Land Use Land Cover (LULC) changes. It can help in the development of city plans and environmental management. In urban areas, there are various factors like increasing population, developmental activities and migration which are further increasing the pressure on city resources and lead to urban expansion. The study is focused on understanding the land use change dynamics of Jaipur city. The LULC maps are prepared for different periods using Landsat-5 and Landsat-8 images for the years 1993, 2000, 2010 and 2015 using maximum likelihood classification method. Major changes are observed in the classes of urban settlement and open land of the study area. In this analysis, different types of indices like Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-up Index (NDBI) and Soil Adjusted Vegetation Index (SAVI) are prepared to identify the vegetation cover, built-up areas of the Jaipur city. The analysis showed that there is an increase in urban settlement and a decrease in natural areas such as open land and vegetation in the city.

Index Terms-Land use/cover, urban expansion, classification, NDBI, NDVI

1. INTRODUCTION

The half of the world's population are urban dwellers and the urban population is expected to reach up to 81% by the year 2030 (Montgomery, 2007). According to the World Bank (2011), the urban population has increased at a proportion of 28.3% in 1950 to 50% in 2010. Urbanization is responsible for declination of natural vegetation cover; alteration in the type of land use; and some significant changes in the prevailing environmental and climatic conditions. RS and GIS techniques are important for comprehensive LULC mapping and detailed understanding of land use changes at various scales (Selçuk et al., 2003). NDVI has a vast application spectrum in the broad range of studies (Brandt et al. 2015, Chen et al. 1998; Santos and Negri, 1997; Zhang et al. 2009). Tian et al. (2014) explained the different types of land use in India during the period 1880-2010 using historical records and satellite data. Karanam and Babu Neela (2017) used the multi-temporal data of Landsat TM data and calculated the BUI, NDVI, and NDBI in the urban area. Guha et al., (2018) used the Landsat-8 images and estimated the relationship between LST, NDVI, and NDBI of the Naples city in Italy. In semi-arid regions, it is of high importance to monitor vegetation to reduce the impacts of drought. SAVI vegetation index is of greater relevance than NDVI in these regions. The NDVI and NDBI are also useful to investigate the influence of vegetation and built-up on Urban Heat Island (UHI). Jayakumar & Arockiasamy (2003) used the remote sensing and GIS technique for LULC mapping and change detection in parts of Eastern Ghats of Tamil Nadu. The objective of the study is to identify different land use pattern and their change detection along with the development of indices to monitor changes in vegetation and built-up areas. Table 1 provides a list of some selected research work carried out in the Jaipur city.

Table 1: List of studies carried out in Jaipur city

Study Title	Data used	Area	References
Change Detection Techniques for Monitoring Spatial Urban Growth	LANDSAT (MSS & TM)	Jaipur	Gupta (2011)
Estimate of Urban Sprawl and LULC Change using Remote Sensing and GIS Techniques	LISS-II, LISS III & LANDSAT-TM	Jaipur	Sankhala & Singh (2014)
Urban Heat Island and Land Use	LANDSAT-7 ETM+ TM	Jaipur	Jalan & Sharma (2014)

2. STUDY AREA

Jaipur city is well known as the Pink City and the capital of Rajasthan state. The city is located in the northeastern part of Rajasthan, located 26.92° N latitude and 75.82° E longitude with an average elevation of 431 m (Figure 1). The city of Jaipur has a mixture of built-up areas, low vegetation area, roads, and industries. In the year 2001, the urban population of Jaipur city was 2.3 million, which increased to 3.07 million in the year 2011 (Census of India 2011).

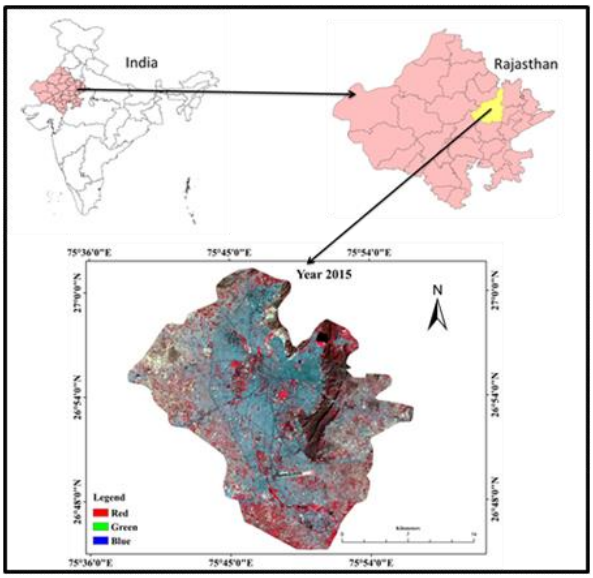

Figure 1. Location Map of Study Area

3. METHODOLOGY AND DATA USED

3.1. *Satellite Data Information*

In this study, Landsat 5 Thematic Mapper (TM) data of 27th April 1993, 14th April 2000 and 29th June 2010; and Landsat 8 OLI data of 23rd April 2015 datasets are used for the preparation of LULC maps and the development of different indices of the Jaipur city. These images are downloaded from the Global Land Cover Facility (http://www.glcf.umd.edu/index.shtml) and (http://www.landcover.org/), United States Geological Survey (USGS) Earth Explorer (http://edcsns17.cr.usgs.gov/NewEarthExplorer/) and Glovis (http://www.glovis.usgs.gov).

3.2. *Image classification and accuracy assessment*

The supervised technique of image classification was used to classify images into five major categories i.e., Waterbody, Vegetation, Urban Settlement, Open Land, Hilly area/rocky area. The Kappa method was used to assess the accuracy of the classification using the samples sites from google earth. Kappa coefficient (k) for the image classification is as follows (Foody 1992):

$$k = \frac{(Total\ sum\ of\ correct) - Sum\ of\ the\ all\ the\ (row\ and\ column\ total)}{Total\ squared - Sum\ of the\ all\ the\ (row\ and\ column\ total)} \quad (1)$$

3.3. *Change dynamics*

A convenient way to assess the post-classification change dynamics is to identify the thematic change based on change statistics. ArcGIS software was used to calculate the thematic change and see the dynamics of land cover change of Jaipur City from 1993 to 2010. The change dynamics are observed in the different years by giving different codes to land use for different period. Example of change dynamics for the period 1993-2000 is explained here. In the year 1993, number code of 1,2,3,4, and 5 are assign to different land uses, whereas code of 8,14,20,26, and 32 are assigned to land use for the year 2000 (Table 2). The study considered the changes in valid classes which convey a significant change in the year wise land use. Table 2 represents the changes of classes into the different classes by the help of a spatial analyst tool in the ArcGIS software. Code 9 shows that there is no changes in the water body class and similar is the case for other classes (code 16, code 23, code 30 and code 37). On the other side, code 11 shows the water class changes in urban settlement class. Only the areas with a change in land use are taken to visualize in the map and see the overall dynamic of change in the Jaipur city.

Table 2: Change dynamics of different land use classes

Class Name	Code	Water	Vegetation	Urban Settlement	Open land	Hilly/rock area
		1	2	3	4	5
Water	**8**	9	10	11	12	13
Vegetation	**14**	15	16	17	18	19
Urban Settlement	**20**	21	22	23	24	25
Open land	**26**	27	28	29	30	31
Hilly/rocky area	**32**	33	34	35	36	37

3.4. *NDVI calculation*

Vegetation cover plays a fundamental role in minimizing environmental issues in urban areas. According to the Batista et al., 1997, the NDVI values ranges from -1 for non-vegetated areas to +1 for vegetation. For the NDVI calculation red band and visible spectrum band and the NIR band are used. The NDVI calculation formula is given in equation 2:

$$NDVI = \frac{(Band\ 4 - Band\ 3)}{(Band\ 4 + Band\ 3)} \quad (2)$$

3.5. *NDBI Calculation*

NDBI is a widely-used index for estimation of built-up area. NDBI values are depending on the spectral signature, range from medium IR band to near IR band. This index is useful for human mapping settlements and surrounding constructions. The values of NDBI vary from -1 to +1 (Zha et al., 2003). The positive value indicates highly built-up areas, whereas the negative values represent other land cover types. Equation 3 shows the formula for calculating the NDBI.

$$NDBI = \frac{MIR\mu m - NIR\mu m}{MIR\mu m + NIR\mu m} \quad (3)$$

3.6. *SAVI Calculation*

SAVI is used in areas where vegetative cover is low (< 40%). The SAVI is calculated by using equation 4 (Huete, 1988):

$$SAVI = (1 + L) * (band4 - band3)/(band4 + band3 + L) \quad (4)$$

where, L is a correction factor of the SAVI calculation. SAVI ranges from 0 to 1. Value 0 shows the very high vegetation cover and 1 shows the very low vegetation cover. If the L values come to 0.5, it shows the intermediate vegetation cover, and when the L value is equal to zero, the SAVI becomes same as NDVI.

4. RESULTS AND DISCUSSION

4.1. *LULC and accuracy assessment of Jaipur city*

In this study, the Landsat-5 and 8 satellite data were used to classify the major land use classes, i.e. Water body, Vegetation, Urban Settlement, Open Land, Hilly area/rocky area. These major LULC classes were calculated for four periods, i.e. 1993, 2000, 2010 and 2015 to understand the changes in LULC classes of different periods which is shown in Figure 2. The classified images were intended for the accuracy based on a random selection of the points for each period. The overall accuracy along with Kappa coefficients for all four years is given in Figure 3.

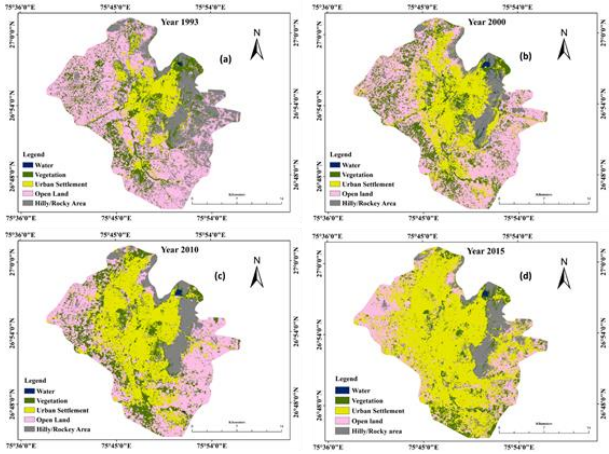

Figure 2. LULC Classification of years (a) 1993 (b) 2000 (c) 2010 (d) 2015 (Chandra et al. 2018)

Table 3 shows the percentage changes in the various classes; the maximum positive change is shown in the class of urban settlement, i.e. 57.39%, that explains the urban area expansion. Open land was converted to different classes, but most of the area was turned into the urban settlement, and the open land shows the decreasing trend in the image classification, i.e. 45.84, 39.48, 33.85 and 19.37% in 1993, 2000, 2010 and 2015 respectively.

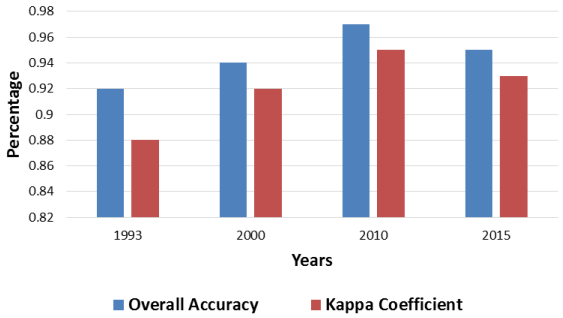

Figure 3. Accuracy assessment of the images in the different years (a) 1993 (b) 2000 (c) 2010 (d) 2015

Table 3: Year-wise percentage changes in the different land use classes

Class Name	1993	2000	2010	2015
Water	0.09	0.98	0.19	0.17
Vegetation	17.90	18.62	18.77	9.66
Urban Settlement	13.54	28.07	35.31	57.39
Open land	45.84	39.84	33.85	19.37
Hilly Area	22.65	12.49	11.88	13.40

Table 4 shows the class wise value changes of different land use when compared in different years. The urban settlement shows the maximum changes due to the growth of urban population and the count value of the urban settlement increases in all four images. Open land area converted into the other land use classes like urban settlement, vegetation, water, and hilly area. The vegetation cover pixel values and hilly area values show the maximum coverage in the area. Analysis of all the years assessed (1993 to 2015) show that the maximum change observed is one of open land to build–up area. Table also presents the change of one landuse to another and change matrix for different periods.

Table 4: Thematic change dynamics of the different land use classes (W-Water, V-Vegetation, US-Urban Settlement, OL-Open Land, HA-Hilly Area)

Year 1993-2000

Reclassify Values	Year	2000				
		8	14	20	26	32
Class Name	1993	W	V	US	OL	HA
W	1	403	0	45	0	0
V	2	2695	48657	15179	16944	10353
US	3	968	2389	65835	359	1420
OL	4	107	35711	45296	149778	9439
HA	5	986	10857	20817	41812	44271

Year 2000-2010

Reclassify Values	Year	2010				
		8	14	20	26	32
Class Name	2000	W	V	US	OL	HA
W	1	749	991	1508	76	1835
V	2	83	50061	15805	27382	4283
US	3	111	11537	116602	11790	7132
OL	4	32	28781	43646	128201	8233
HA	5	1	7029	7467	10150	40836

Year 2010-2015

Reclassify Values	Year	2015				
		8	14	20	26	32
Class Name	2010	W	V	US	OL	HA
W	1	744	101	54	0	77
V	2	108	29862	43815	15799	8741
US	3	6	2225	177684	2861	2240
OL	4	21	12791	69159	78484	16885
HA	5	1	7029	7467	10150	40836

Year 1993-2015

Reclassify Values	Year	2015				
		8	14	20	26	32
Class Name	1993	W	V	US	OL	HA
W	1	357	71	6	0	14
V	2	477	16045	51091	14405	11773
US	3	58	1055	68093	390	1374
OL	4	2	21560	139537	65543	13478
HA	5	4	11892	41950	21166	43563

The urban settlement shows the maximum changes due to the growth of urban population and the count value of the urban settlement increases in all four images. Open land area converted into the other land use classes like urban settlement, vegetation, water, and hilly area. The vegetation cover values and hilly area values show the maximum coverage in the area. Analysis of all four years (1993 to 2015) showed that the maximum change observed is one of open land to build–up area which is represented by the color yellow.

ArcGIS software was used to reclassify the image, in this process the old value of the land used classification remained the same, and new values were changed according to the different classes. Figure 4 shows the thematic change dynamics of different land use classification in the year 1993, 2000, 2010 and 2015 and these land use changes show an increase in the urban area of the Jaipur city.

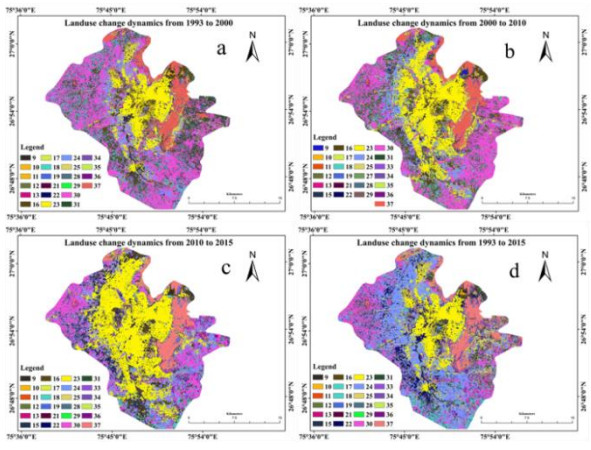

Figure 4. LULC Reclassify value change (a) 1993-2000 (b) 2000-2010 (c) 2010-2015 (d) 1993-2015

Different color coding showing the different land-use classes like yellow color indicates the urban settlement; the blue color shows the water body etc. The study is mainly concerned with evaluating the expansion of urban settlement in the Jaipur city.

4.2. *Changes in Normalized Difference Vegetation Index (NDVI)*

In this study, NDVI was calculated for different periods, i.e., 1993, 2000, 2010 and 2015. NDVI values range from -1 to +1 and different geographical feature shows the different NDVI values. The different layers were classified to extract the different vegetation cover of Jaipur city. The extracted layers of NDVI were spatially compared with the color composite image of Landsat-5 and Landsat-8. The range of NDVI in the year 1993 was -0.01 to 0.71, the year 2000 was 0.63 to -0.01, the year 2010 was 0.04 to 0.56 and year 2015 the range of NDVI was -0.24 to 0.70 (Figure 5). The larger NDVI value shows the good and massive density of vegetation. The negative to zero values range of NDVI indicate minimal vegetation.

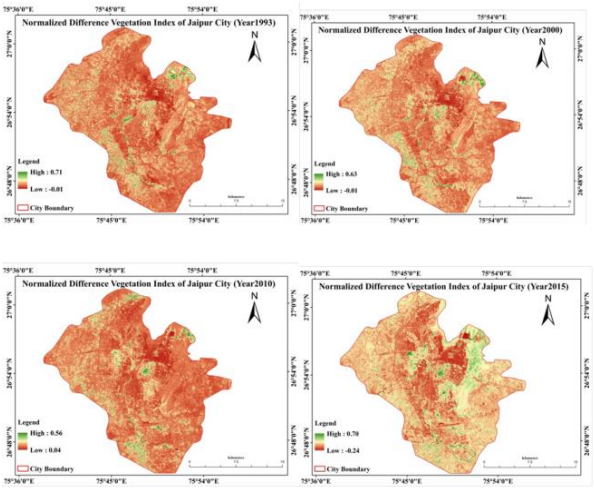

Figure 5. NDVI map of Jaipur city of the year (a) 1993 (b) 2000 (c) 2010 (d) 2015

4.3. *Changes in Soil-Adjusted Vegetation Index*

The spectral indices to be calibrated and the variations of soils are normalized and do not affect the measurements of the vegetation canopy. These improvements to NDVI are convenient because SAVI accounts for variations in soils. For this study, SAVI was used to see the vegetation area in the city like NDVI but it is used in areas where vegetation cover is low (< 40%). In the year 1993, the SAVI was -0.005 to 0.50, the year 2000 was -0.005 to 0.44, the year 2010 was 0.024 to 0.43 and in the year 2015 the SAVI was -0.118 to 0.52 (Figure 6).

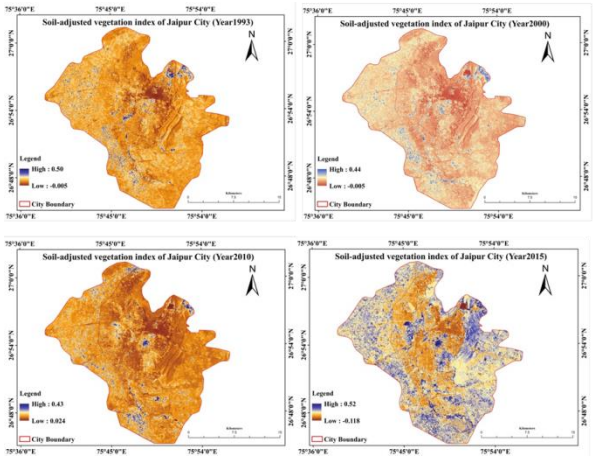

Figure 6. SAVI map of Jaipur city of the year (a) 1993 (b) 2000 (c) 2010 (d) 2015

4.4. *Changes in Normalized Difference Built-up Index*

NDBI has been used for mapping of urban built-up areas by using the Landsat-5 and Landsat-8 data. The main advantage of using NDBI is the unique spectral response of built-up area and other land covers. In the Jaipur city, the NDBI varied from -0.55 to 0.5 for the all the considered years. Figure 8 shows the increases in the built-up area in the city, in the year 1993, the NDBI was -0.55 to 0.22, in 2000 it was -0.50 to 0.50, in 2010 it was -0.32 to 0.26 and 2015 the NDBI was -0.55 to 0.34 (Figure 7).

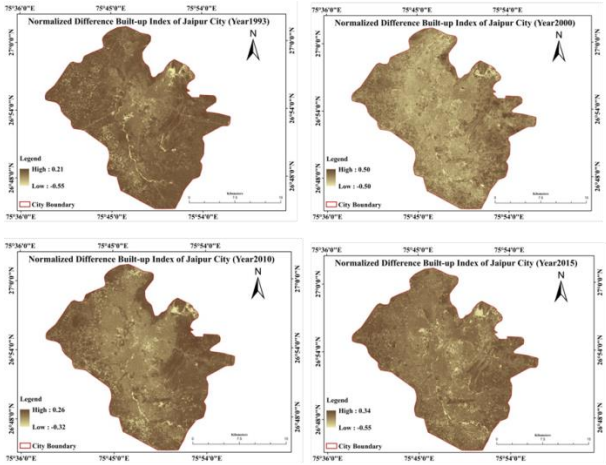

Figure 7. NDBI map of Jaipur city of year (a) 1993 (b) 2000 (c) 2010 (d) 2015

5. CONCLUSION

This study shows that the city of Jaipur is expanding, which in turn may be the result of increasing city population and other economic activities. The open area and vegetatation area are converted into the urban area. In this study using Landsat 5 and Landsat 8 image of the year 1993, 2000, 2010 and 2015 were used to evaluate the relationship between LULC, NDVI, NDBI, and SAVI of the Jaipur city. The conclusion drawn from the study conducted showed that the maximum percentage of the open land class was converted to urban settlement, consequently leading to an extension of urban land. This conversion rate was amplified from 2010 to 2015. The rate of change from vegetation class to urban settlement was constant throughout the study period except the year 2015. The urban settlement has increased and the values of NDVI and SAVI have decreased in the city due to the loss of vegetation area and urbanization. Urbanization is the primary driving process of land cover changes.

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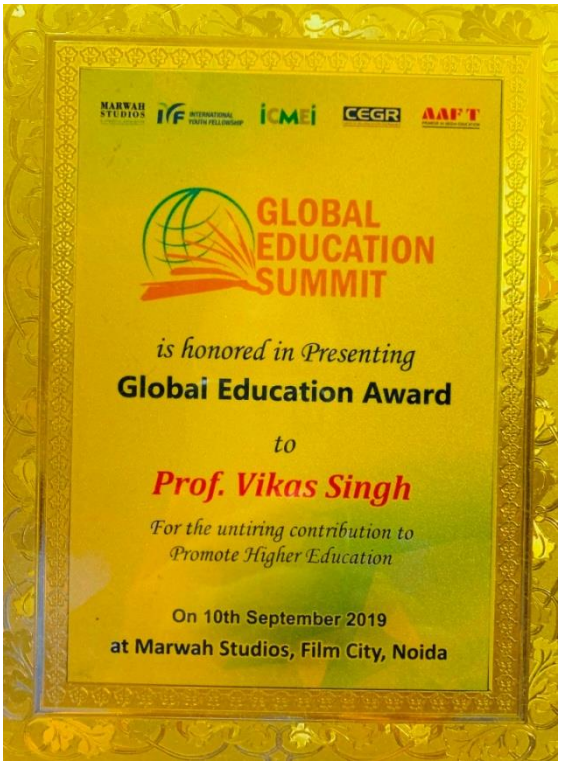
Sheet 3.3.2



Sheet 3.4.4

First Impression: April, 2019

Spirituality Beyond Repertoire: Leadership and Happiness Perspectives

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Analyzing the Spiritual Connotation of Happiness in Films

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E-mail: vikasingh82@gmail.com

Spiritual means relating to deep feelings and beliefs, especially religious beliefs.[1] Connotation means a feeling or idea that is suggested by a particular word although it need not be a part of the word's meaning, or something suggested by an object or situation.[2] Happiness means a feeling of pleasure or satisfaction.[3] Collecting together, this paper is analyzing the connotation, spiritually to explore the happiness in films.

In his book, *The Art of Happiness*,[4] world's great spiritual leader-Dalai Lama with his practical wisdom and advice on how we can overcome everyday human problems and achieve lasting happiness. The concepts that the principle of life is happiness, that happiness is firmed more by the situation of one's mind than by one's outer environment, circumstances, or events—in any case once one's fundamental survival desires are met and that happiness can be attained through the efficient instruction of our hearts and minds.

Happiness is subjective. Indeed, nearly all scientific efforts to evaluate happiness purely rely on self-reports. One study tool, for example, asks public to rate their satisfaction with life on a level of 1 to 10. Other studies have tried more intended events of happiness by observing heart rate, blood pressure, brain activity, and hormone levels. How do these scientists attempt to rouse those happy physiological reactions in a lab? Typically they do it by demonstrating study participants happy films. In one study, for instance, researchers attempted to encourage happy feelings in a group of society by showing them clips from the film 3 Idiots (2009, Rajkumar Hirani) and Chachi 420 (1997, Kamal Haasan). It works: Studies consistently show that watching happy films stimulates feelings of happiness in spectators.

In an article, *What Movies Make you Happy?*[5] Jeremy Adam Smith shares the 10 films that inspire and elevate him and states,

But why do these films make us happy? At the most basic level, of course, seeing a film's protagonist achieve happiness can trigger feelings of happiness in the viewer for the simple reason that humans are so wonderfully tuned to each other's feelings that even a one-dimensional image can trigger empathic connection. Happiness is like a virus that movies can help spread.

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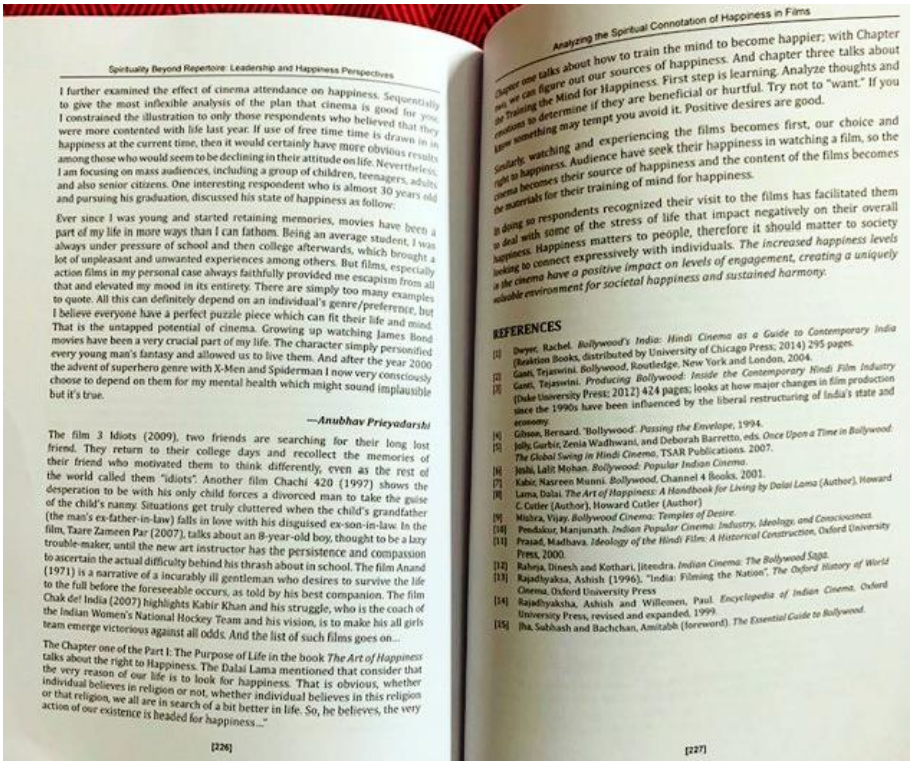
[1] https://dictionary.cambridge.org/dictionary/english/spiritual
[2] https://dictionary.cambridge.org/dictionary/english/connotation
[3] https://dictionary.cambridge.org/dictionary/english/happiness
[4] The Art of Happiness: A Handbook for Living by Dalai Lama (Author), Howard C. Cutler (Author), Howard Cutler (Author)
[5] https://greatergood.berkeley.edu/article/item/what_movies_make_you_happy



Spirituality Beyond Repertoire: Leadership and Happiness Perspectives

I further examined the effect of cinema attendance on happiness. Sequentially to give the most inflexible analysis of the plan that cinema is good for you, I constrained the illustration to only those respondents who believed that they were more contented with life last year. If use of free time time is drawn in in happiness at the current time, then it would certainly have more obvious results among those who would seem to be declining in their attitude on life. Nevertheless, I am focusing on mass audiences, including a group of children, teenagers, adults and also senior citizens. One interesting respondent who is almost 30 years old and pursuing his graduation, discussed his state of happiness as follow:

Ever since I was young and started retaining memories, movies have been a part of my life in more ways than I can fathom. Being an average student, I was always under pressure of school and then college afterwards, which brought a lot of unpleasant and unwanted experiences among others. But films, especially action films in my personal case always faithfully provided me escapism from all that and elevated my mood in its entirety. There are simply too many examples to quote. All this can definitely depend on an individual's genre/preference, but I believe everyone have a perfect puzzle piece which can fit their life and mind. That is the untapped potential of cinema. Growing up watching James Bond movies have been a very crucial part of my life. The character simply personified every young man's fantasy and allowed us to live them. And after the year 2000 the advent of superhero genre with X-Men and Spiderman I now very consciously choose to depend on them for my mental health which might sound implausible but it's true.

—*Anubhav Priyadarshi*

The film 3 Idiots (2009), two friends are searching for their long lost friend. They return to their college days and recollect the memories of their friend who motivated them to think differently, even as the rest of the world called them "idiots". Another film Chachi 420 (1997) shows the desperation to be with his only child forces a divorced man to take the guise of the child's nanny. Situations get truly cluttered when the child's grandfather (the man's ex-father-in-law) falls in love with his disguised ex-son-in-law. In the film, Taare Zameen Par (2007), talks about an 8-year-old boy, thought to be a lazy trouble-maker, until the new art instructor has the persistence and compassion to ascertain the actual difficulty behind his thrash about in school. The film Anand (1971) is a narrative of a incurably ill gentleman who desires to survive the life to the full before the foreseeable occurs, as told by his best companion. The film Chak de! India (2007) highlights Kabir Khan and his struggle, who is the coach of the Indian Women's National Hockey Team and his vision, is to make his all girls team emerge victorious against all odds. And the list of such films goes on...

The Chapter one of the Part I: The Purpose of Life in the book *The Art of Happiness* talks about the right to Happiness. The Dalai Lama mentioned that consider that the very reason of our life is to look for happiness. That is obvious, whether individual believes in religion or not, whether individual believes in this religion or that religion, we all are in search of a bit better in life. So, he believes, the very action of our existence is headed for happiness..."

[226]

Analyzing the Spiritual Connotation of Happiness in Films

Chapter one talks about how to train the mind to become happier; with Chapter two, we can figure out our sources of happiness. And chapter three talks about the Training the Mind for Happiness. First step is learning. Analyze thoughts and emotions to determine if they are beneficial or hurtful. Try not to "want." If you know something may tempt you avoid it. Positive desires are good.

Similarly, watching and experiencing the films becomes first, our choice and right to happiness. Audience have seek their happiness in watching a film, so the cinema becomes their source of happiness and the content of the films becomes the materials for their training of mind for happiness.

In doing so respondents recognized their visit to the films has facilitated them to deal with some of the stress of life that impact negatively on their overall happiness. Happiness matters to people, therefore it should matter to society looking to connect expressively with individuals. *The increased happiness levels in the cinema have a positive impact on levels of engagement, creating a uniquely valuable environment for societal happiness and sustained harmony.*

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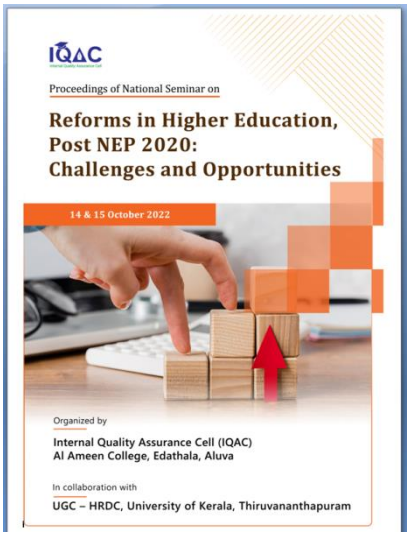

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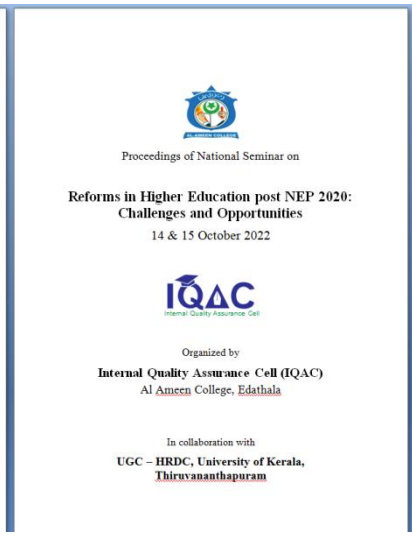

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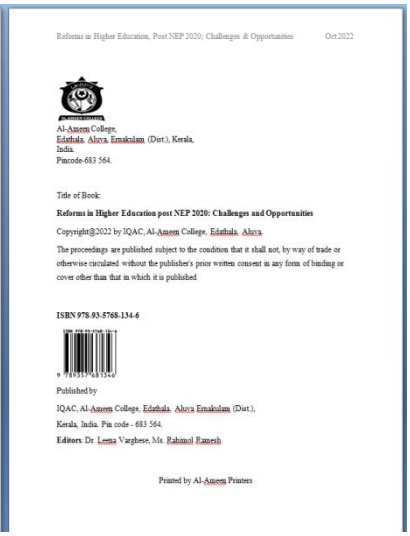

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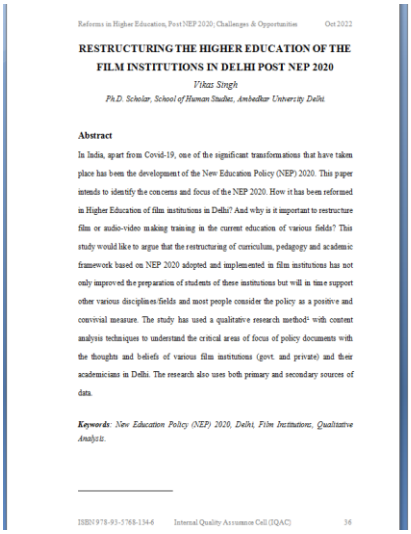

RESTRUCTURING THE HIGHER EDUCATION OF THE FILM INSTITUTIONS IN DELHI POST NEP 2020

Vikas Singh
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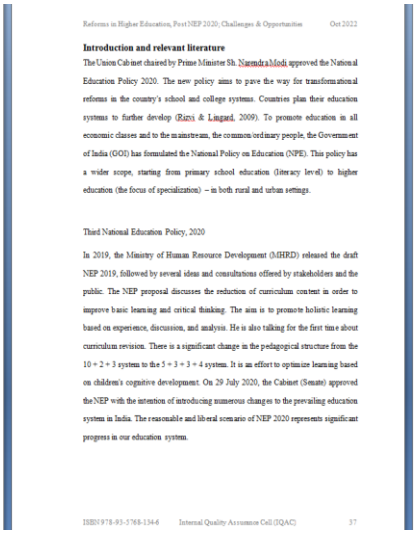
Abstract

In India, apart from Covid-19, one of the significant transformations that have taken place has been the development of the New Education Policy (NEP) 2020. This paper intends to identify the concerns and focus of the NEP 2020. How it has been reformed in Higher Education of film institutions in Delhi? And why is it important to restructure film or audio-video making training in the current education of various fields? This study would like to argue that the restructuring of curriculum, pedagogy and academic framework based on NEP 2020 adopted and implemented in film institutions has not only improved the preparation of students of these institutions but will in time support other various disciplines/fields and most people consider the policy as a positive and convivial measure. The study has used a qualitative research method[2] with content analysis techniques to understand the critical areas of focus of policy documents with the thoughts and beliefs of various film institutions (govt. and private) and their academicians in Delhi. The research also uses both primary and secondary sources of data.

***Keywords**: New Education Policy (NEP) 2020, Delhi, Film Institutions, Qualitative Analysis.*

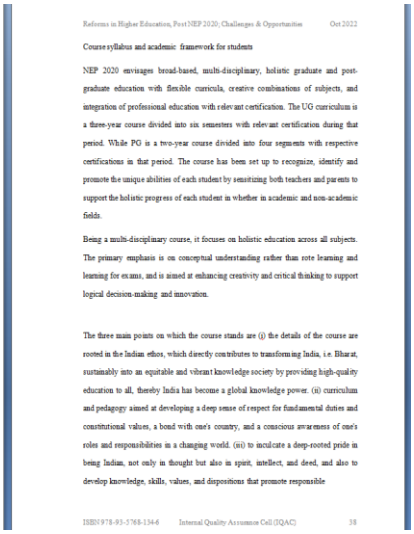


Introduction and relevant literature

The Union Cabinet chaired by Prime Minister Sh. Narendra Modi approved the National Education Policy 2020. The new policy aims to pave the way for transformational reforms in the country's school and college systems. Countries plan their education systems to further develop (Rizvi & Lingard, 2009). To promote education in all economic classes and to the mainstream, the common/ordinary people, the Government of India (GOI) has formulated the National Policy on Education (NPE). This policy has a wider scope, starting from primary school education (literacy level) to higher education (the focus of specialization) – in both rural and urban settings.

Third National Education Policy, 2020

In 2019, the Ministry of Human Resource Development (MHRD) released the draft NEP 2019, followed by several ideas and consultations offered by stakeholders and the public. The NEP proposal discusses the reduction of curriculum content in order to improve basic learning and critical thinking. The aim is to promote holistic learning based on experience, discussion, and analysis. He is also talking for the first time about curriculum revision. There is a significant change in the pedagogical structure from the 10 + 2 + 3 system to the 5 + 3 + 3 + 4 system. It is an effort to optimize learning based on children's cognitive development. On 29 July 2020, the Cabinet (Senate) approved the NEP with the intention of introducing numerous changes to the prevailing education system in India. The reasonable and liberal scenario of NEP 2020 represents significant progress in our education system.



Course syllabus and academic framework for students

NEP 2020 envisages broad-based, multi-disciplinary, holistic graduate and post-graduate education with flexible curricula, creative combinations of subjects, and integration of professional education with relevant certification. The UG curriculum is a three-year course divided into six semesters with relevant certification during that period. While PG is a two-year course divided into four segments with respective certifications in that period. The course has been set up to recognize, identify and promote the unique abilities of each student by sensitizing both teachers and parents to support the holistic progress of each student in whether in academic and non-academic fields.

Being a multi-disciplinary course, it focuses on holistic education across all subjects. The primary emphasis is on conceptual understanding rather than rote learning and learning for exams, and is aimed at enhancing creativity and critical thinking to support logical decision-making and innovation.

The three main points on which the course stands are (i) the details of the course are rooted in the Indian ethos, which directly contributes to transforming India, i.e. Bharat, sustainably into an equitable and vibrant knowledge society by providing high-quality education to all, thereby India has become a global knowledge power. (ii) curriculum and pedagogy aimed at developing a deep sense of respect for fundamental duties and constitutional values, a bond with one's country, and a conscious awareness of one's roles and responsibilities in a changing world. (iii) to inculcate a deep-rooted pride in being Indian, not only in thought but also in spirit, intellect, and deed, and also to develop knowledge, skills, values, and dispositions that promote responsible