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The idea of State and Women: Scope and Limits of the Feminist Approaches

Samiksha Farakate
Assistant Professor,
Department of Political Science,
Vivekanand College, Kolhapur (Autonomous)

Abstract:

State is the centre and the stage of modern politics. Modern State, as organization of collective power, as arbiter, as allocator is the key agency in social-political processes. State interacts with, operates on, shapes and in turn is shaped by power relations in society. The nature and role of the State have been defined variously from various ideological perspectives. Indian State has been theorised from various perspectives in the discipline of Political Science. State's relationship with women has not been a central theme in the theorization of Indian State. Feminism gives varied and contrasting understandings of State's relationship with women. There is no agreement whether State is an ally of women or the enforcer and upholder of patriarchal power relations that oppress women. The present paper looks at the literature on State in general and the Indian State in particular to map the views on State's relation with women. It identifies the open ends and gaps in our understanding of State vis-à-vis women and attempts to hint at the possibilities of further research in the subject.

Key words: Feminism, State, Women, Theorizations of Indian State

Introduction: Yogendra Yadav (2020: 237), in an attempt to find a balance between defining State as a set of government institutions on one hand and as political community on the other, defines the State as 'continuous public power, distinct from and above both the rulers and the ruled'. The nature and role of the State have been defined variously from various ideological perspectives. It is either considered rooted in or autonomous from society, depending on the theoretical perspective. But Modern State, as organization of collective power, as arbiter, as allocator is the key agency in social-political processes. State interacts with, operates on, shapes and in turn is shaped by power relations in society. We need to see the feminist and other readings vis-à-vis each other to understand their limits, the difference between these approaches and their points of intersection.

Feminist Readings of State

Liberal feminism treats the State as a neutral arbiter and does suggest that increased representation of women in state will lead to greater equality. It undermines the divides in power created by social, economic inequalities. Socialist feminists see patriarchy as a structure aligned with class. Welfare feminists see State as a partner, excusing the effects of the patronising role of the State. Radical feminists see State as essentially patriarchal. Johanna Kantola (2006) concludes that the contexts are of great importance while theorising the 'States'. Underlining the post-structural

understanding that the state is constituted by the discourses that imagine it, she says that the experience of State is different for different for women in different state traditions. The experience of State is also differentiated for different sections of women.

MacKinnon (1983) defines masculinity of State in terms of patriarchal power and interests of men and as a means of perpetuation of power over women – something that is done through concepts, perception and treatment. State is male in the sense that it embodies male point of view. MacKinnon discusses 'maleness' (including that of State) as what benefits men and their place in the power hierarchy. Objectivity and practical rationality implicit in liberal legalism are identified as maleness as they validate conforming to the existing division of power. MacKinnon underlines that the bias towards the powerful is characteristic of both liberal and Marxist State. She says 'embodiment of the male experience of the world' by the State does not merely add to but is core to and structures the inequality of women in the 'modern' world. MacKinnon does not relate the male world view of the state with other aspects of the structuring of power in society that are not the relation between men and women.

Wendy Brown looks (1998) at State as "a significantly unbounded terrain of powers and techniques, an ensemble of discourses, rules, and practices, cohabiting in limited, tension-ridden often contradictory relation with one another." She identifies and explains 'masculinism' in four modes of the functioning of (US) State. She separates the masculinism of the State from the interests of men. The similarities in patterns (multiplicity, plurality, ubiquitous nature) of male and State domination are ascertained. The gender spectrum of State domination is explored in four aspects of State's 'modalities of power', it is separate from but

intersects with other modes of domination and forms part of the whole nature of State power in an unsystematic way. We understand from this theorization the gendered structuring of State power in its different dimensions.

Feminist Readings of Indian State: Some prominent themes in feminist literature on politics in India have dealt with the themes of organizational structures of women's movements, the cross-section of Marxist and feminist struggles, theory and theoretical implications of ecofeminism, the issue of gender and sexuality, laws and women.

Some prominent themes in feminist literature on politics in India have dealt with the themes of organizational structures of women's movements, the cross-section of Marxist and feminist struggles, theory and theoretical implications of ecofeminism, the issue of gender and sexuality, laws and women. Rajeshwari Sundar Rajan (2003) explores the relationship, the essence, and implications of State's citizenship for women. She attempts to analyse the ways in which State deals with women's issues. "'Women's issues' have tended to remain a mere item on the developmental agendas of

postcolonial nations.' (Rajan 2003). She insists that the Sate be seen with the discourse of Nation it inhabits. The book explores various aspects of the relationship between women and the Indian State through a set of case studies. The book also presents a review of important strands of feminist understanding of Indian State. She looks at 'women', aspects of their struggles vis-vis society and State. The Indian State's response as a postcolonial State to women's issues and movements has been 'uneven' (Rajan 2003).

Nivedita Menon (2001) in her essay 'Rights, Bodies and the Law: Rethinking Feminist Politics of Justice' underlines the contrast between the universalization and fixing of identities that the concept of justice embedded in Law and the necessary plurality and fluidity that 'justice' in the feminist sense requires. She calls for deconstructing the associations between female body and the patriarchally structured concepts; in the process Menon hints toward reinterpretation of self (and hence political self) in a way that stretches the assumptions and relations that form the basis of modern State. The present study would like to understand the necessity and availability of frames of operation/ practices that (potentially) manifest such reinterpretation of political self and reimagination of the assumptions of modern State.

Dalit feminist readings emerged prominently in last two decades of twentieth century. They focused on intersectionality of gender and caste. Dalit feminism emphasized the need to uphold 'difference' within feminism and also the epistemic prioritization of Dalit women's point of view. Sharmila Rege underlined the importance of embracing 'Dalit feminist standpoint' as an epistemologically advantageous standpoint to understand the whole gamut of power relations with their intersectionality. Dalit feminism presented a critique of feminism from within feminism.

Anuradha Ghandy has analysed the implications of religious fundamentalist turn in Indian politics for women (Ansari, 2022). Hindutva uses women as political means. She has taken the view that feminism cannot be divorced from anti-class struggles and anti-imperialism.

Vishwnathan (2009) has noted the phenomenon of rising masculinity of Indian State.

Theorizations of Indian State in Political Science: Indian State had been theorised in Political Science within different frameworks of analysis. The initial theorizations after independence focussed on the institutional aspects of the State. The modernization theories focussed on the interaction of modern institutions with the traditional structures and ethos. The liberal framework of these theories assumed that State was autonomous and an embodiment of certain principles. State was defined in terms of its agency (its necessity and role) in pursuing collective social, economic and political goals for and within a plural and developing society. The gendered or the social hierarchical nature of the State wasn't the focus of these theorizations. Its sees women largely as non-gendered citizens. The Marxist theories focused on the social character of the Indian State – the hold of, and relation of dominant 'classes' with the Indian State. The dominant classes are defined variously but from

political economic perspective, e.g. the agrarian elite, the industrial bourgeoisie, the bureaucracy, and the implications of their dominance for State policy, largely economic, are studied. The results of economic agendas of the State for women specifically are not sought to be defined – that analysis remains largely ungendered. The Marxist theorization also happened to operate within the framework of comparisons of the nature and trajectories of the State in the West and the East. It is critiqued that the class character theory treats State as instrument and doesn't do justice to the agency of the political. Gramsci's concept of passive revolution has been explored to understand the political economic transition in India. It fails to account fully for the democratic agency of the masses and the meanings infused by them into the frameworks and structures that get operationalized as and around modern State. The discussion of blurring of boundaries between State and society doesn't particularly focus on the effect of this very important phenomenon on women's issues. The question of how patriarchy as a structure and discourse interacts with, is limited by or captures the state remained unstudied.

Gopal Guru (2011), giving Dalit critique of liberal democracy in India says that the elite and the marginalised classes are associated with democracy in two different ways. The latter viewed it as opportunity to open spaces for dignity, self-esteem and equality. They associated with nationalism by prioritising the struggles for self-respect. Constitutional framework with the promise of equality before the law would enable Dalits to demonstrate their agency. But Indian democracy was viewed by scholarship on Indian State largely in institutional perspective rather than from point of view of 'welfare of human beings'. Guru (2011) centres the idea of self-esteem to assess liberal democracy.

Partha Chatterjee (2012) in his 'Empire and Nation' underlines the theme of subversion of liberal framework that came in response to elitist nation-building. This subversion carried the potential of side-lining the liberal framework for progression in women's issues and further enforcement of oppression for women of all communities involved in community-based engagement with politics.

These theories discuss the scope of agency of the State, its constitution by the interests of different classes. Sometimes it takes shape of the discussion of democratic trajectory of society. The analyses are largely limited to the arena of 'political' processes within the realm of the State.

The stream that focuses on the 'borrowed nature of Statecraft' (Nandy 1989) and nation-state representing the transition from pluralist to centrist consciousness does not account for the potential of liberal constitutional framework adopted at Nation- State level in rendering opportunities of equalities for women (or more likely, at least some sections of it).

Ambedkar has elaborated the role played by the restrictions put on women in the construction and sustenance of caste system. Dr. Ambedkar's hopes for the State in independent India were staked

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on the codification of socio-political justice and the rules of engagement based on those principles through the constitution.

Featuring of women question in the discourse of Indian nation-state: The conflict around the axis of gender has not openly and exclusively played out in India though, as Ramchandra Guha (2007) mentions, it is one 'even more pervasive than others'. As Tharu and Niranjana (1999) point out, the feminist narrative gets appropriated by other politics for their own agendas, hogging and subverting the feminist stands.

The interaction with colonialism and the formation of the ideas of nationhood under colonialism shaped the formative 'national' prism of looking at women's issues. Reforms related to women's lives became the stage for the question for the cultural elite of allowing the British (/modern) State entry into affairs of indigenous society (Kaviraj, 2010). Reform in women's lives were approached in two ways – as a pretext of posturing oneself as a nation that is willing to modernise and wishes to revive an 'imagined' so called 'lost' progressive character of the past. This conception of 'progressiveness' and pro-women reform limited the scope of subjection of women, limited the concept of subjection of women to issues faced by a tiny minority of upper caste Hindu women in the initial period. Women's issues then came to be interpreted differently - as being part of the non-negotiable cultural-private and national sphere, not be touched by the British (and hence any) State (Chatterjee cited in Menon, 2001).

The Caste and communal character of the State shapes its behaviour towards women. Though the intersectionality between caste and gender and communalism and gender has been explored, the caste-patriarchal and communal-patriarchal behaviour of State can be further explored by looking closely at cases. The impact of democratic State politics on caste in terms of 'politicization of caste' has been widely theorised. But, whether this 'politicization of caste', which is largely considered a positive phenomenon (Kothari, 1970, 2012), had any implications for women's progressive liberation within and beyond caste groups has not been commented upon. What the changing nature of Indian State since independence meant for women remains underexplored in theoretical terms beyond observations. The national struggle was not a monolithic movement. It was a collision and exchange between different strands. The potential and relative influence of all major strands post our independence shapes the role of Indian nation (and hence State) towards women. It becomes important to look at the manifestations of these different strands in post-independence politics. The States are an outcome of their formative history and are also a continually changing entities. Hence it becomes important to assess their characteristics in a historical manner to identify the particularity of Indian State. The main theorizations of Indian State did not understand or analyse the political processes with women and their issues as an important lens. Dalit critique of liberal democracy in India subsumes the question of women under analysis of caste behaviour of democratic institutions.

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Women, their status, their oppression featured as a central theme in the pre-nationalist and nationalist struggles in India before independence. It had varied association with the national movement in its different phases and marked different approaches spanning different strands of the movement. The Constitution of India came to represent an amalgam of some of these strands. The study aims to look at the Indian State from the standpoint of its behaviour toward women citizens in multifaceted structuring of power in society.

The question of masculinity of State: MacKinnon (1993) says there no feminist theory of State. Liberal and Marxist theories place women's issues in the already existing ideological propositions. For Mackinnon, radical feminism presents that hope for an independent theory of State. In India, Dalit feminism built the critique of subtle and complex interconnections among power structures leading to the subjection of women. At the same time, ecofeminism underlines the concept of femininity in the context of larger existential crisis coming for ecological challenge. Also, the political debate around environmental crisis can become a potential entry point for understanding the internal contradiction and theoretical limitation of the 'modernist' state and calls for exploration of new theoretical openings.

The studies around Women and the State get divided into State being a companion of women in their struggles for liberation or it being an embodiment of patriarchal, caste and religious structures channelising and strengthening women's subjection in the 'modern' context. To conclude that State is inherently patriarchal denies the theoretical possibility of the autonomy of State that can result from historical conditions or constitutional frameworks. The idea of historicity suggests that we cannot subsume all States under one conception of State. The structural bias of the modern State has been seen as 'masculinity' of the State. It is hypothesized that the established and possible readings of the State do not go beyond the frameworks that are embedded in these power structures.

Conclusion: Johanna Kantola in '*Feminists Theorise the State'* reviews the feminist discourses on State and discusses the case studies from the select countries to make theoretical observations about State's relationship with women. She emphasizes that there cannot be universal feminist theory of State and 'the context' in terms of socio-economic and political history and culture plays an important role is shaping State behaviour toward women. Yet, historicization and particularization do present their own problems. Firstly, modern 'State' is not just a coordinating and regulating agency but represents a moral framework with the realization of certain universal values as its end. Though variation in the frameworks of State-women relationship can be established, the concept of modern State cannot be purged of its moral content. Hence it becomes essential to strive to develop language/idiom in which we can describe, discuss, theorise State's relationship with women. This includes weaving the moral expectations in the construction of the idea, the structure and principles of operation of State – a radical reconstruction of the idea of State in the process of defining it. The

review in this paper underlines the need and opens up the direction for such renewed theorization of the concept of State.

References:

1. Ambedkar, B. R.. 2014. 'Castes in India' *in Dr. Babasaheb Ambedkar: Writings and Speeches Vol.1*. Dr. Ambedkar Foundation, Ministry of Social Justice and Empowerment. P.11.
2. Ansari Halima. 10 January, 2022. Anuradha Ghandy on Hindutva, Women in RSS & a Complete Abolition of Caste. Feminism in India. URL: https://feminisminindia.com/2022/01/10/anuradha-ghandy-hindutva-rss-women-caste/
3. Varadrajan Priya. 8 March. 2021. Bitter Reality: Mass Hysterectomy of Women Workers in Beed's Sugarcane Fields. *Feminism in India*.
4. Brown, Windy. Finding the Man in the State. Feminist Studies, Vol 18, No. 1, 1992, pp 7-34.
5. Curini Luigi and Robert Franzese. 2020. The Sage Handbook of Research Methods in Political Science and International Relations. Sage.
6. Guru Gopal. 2011. Liberal Democracy in India and the Dalit Critique. *Social Research*. Vol. 78, No. 1, pp 99 -122.
7. How Did Ambedkar Imagine India after Independence?. 14 August, 2019. EPWEngage.
8. Hemmings Clare. "A Feminist Politics of Ambivalence". *Estudos Feministas*, Vol 26, No.3, 2018, pp 1-11.
9. Kantola Johanna. Feminists Theorise the State. Palgrave, 2006.
10. Kaviraj Sudipta. The Trajectories of the Indian State. Orient BlackSwan, 2010.
11. Kishwar Madhu. 'Debating Gandhi, a Reader'. *Gandhi on women* in, ed. A Raghuramraju, Oxford University Press, 2006 .
12. Lal, Vinay. Nakedness, Nonviolence and Brahmacharya: Gandhi's Experiments in Celibate Sexuality. *Journal of the history of Sexuality*, Vol 9, No. 1/2, 2000, pp-105-136.
13. MacKinnon, Catharine A. "Feminism, Marxism, Method, and the State: Toward Feminist Jurisprudence." *Signs*, vol. 8, no. 4, 1983, pp. 635–658.
14. Menon Nivedita (ed.) *Gender and Politics in India*. OUP, 2001.
15. Rajan Rajeshwari Sundar, The Scandal of the State: Women, Law and Citizenship in Postcolonial India. Duke University Press, 2003.
16. Robinson Sally. "Deconstructive Discourse and Sexual Politics: The "Feminine" and/in Masculine Self-Representation" *Cultural Critique*, Autumn, No. 13, University of Minnesota Press, 1989. pp. 203-227.
17. Sinha Mrinalini. 'Giving Masculinity a History: Some Contributions from the Historiography of Colonial India.' *Gender & History*, Vol.11 No.3, 1999, pp. 445–460.
18. The Dalit Feminist Standpoint: Revisiting a Debate on Feminism and Intersectionality. EPW Engage.
19. Vishwanathan, Shiv. "Of machismo and politics". *The Economic Times*, ETPrime. 13 April 2009.
20. Yadav Yogendra. Making Sense of Indian Democracy. Orient BlackSwan, 2020.

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Geospatial Examination of Infrastructure Development in Maharashtra: A Comprehensive Analysis

Dr. Shubhangi Kale[1] Dr. Sambhaji Shinde[2] , Dr. Nisha Mugade[3], Dr. G. S. Ubale[4]
[1,3,4] Dept. of Geography, Vivekanand College, Kolhapur (Autonomous)
[2]Shivaji University, Kolhapur

Introduction: -

Infrastructure is the basic physical and organizational structures needs for the operation of society or enterprise, or the services and facilities necessary for an economy to function. The term typically refers to the technical structures that support a society, such as roads, water supply, sewers, power grids, telecommunications and so forth viewed functionally, infrastructure facilitate the production of goods and services; for example, roads enable the transport of raw materials to a factory, and also for the distribution of finished products to markets. In some contexts, the term may also include basic social services such as schools and hospitals. In military parlance, the term refers to the buildings and permanent installations are necessary for the support, redeployment and operation of military forces. Present study, infrastructure will be used in the sense of technical structures or physical networks that support society, unless specified otherwise.

Urban or municipal infrastructure refers to systems generally owned and operated by municipalities, such as streets, water distribution, sewers, etc.

Objectives:-

1. To understand levels of infrastructural development in Maharashtra.
2. To categories district wise spatial distribution of infrastructural facilities and amenities.
3. To analysis of the infrastructural development.

Study Area:-

The state of Maharashtra is the most industrialized, the second most urbanized and judged by the per capita income, the second richest state in India. It is spread over a total area wise; it is the third largest state in India after Madhya Pradesh and Rajasthan. Mumbai, the state capital, is considered the financial and commercial capital of the country.

The state is located between 15° 45’ north to 22° 01’ north latitudes and 72° 45’ east to 80° 45’ east longitudes and falls in the western part of India, the Arabian Sea. With and expansion of about 800 km from the east to west and 700 km from north to south, it has an area of 3, 07,713 sqkm which about 1/10(one tenth) of that of India. The state of Gujarat and the Union Territories of Daman, Dadra and Nagar Haveli are to the North-West; Madhya Pradesh is to the north ;Chhattisgarh to the East; Andhra Pradesh to the South-East and Karnataka and Goa lie to the South of Maharashtra. A 720 km long coastline stretches from Daman in the north to Goa in the south, which falls in resource development zone called the Western plateau and hill regions of

India. Physical division of the state comprise of three parts based on its physical features, viz. Maharashtra plateau, the Sahyadri Range and the Konkan Costal strips as explained below.

Maharashtra Plateau: The major physical characteristics of the state include many small plateaus and river valleys. in the north plateau is flanked by Satpuda ranges, which run in the East-West direction in Maharashtra. The river Narmada flows along the north boundary of Maharashtra and other major rivers like Krishna, Godavari, Bhima, Penganga-Wardha and Tapi-Purna have covered the plateau in alternating broad river valleys and intervening highlands.

The Sahyadri Range: The Western Ghats of Maharashtra known as the 'Sahyadri' mountain ranges have an average elevation of 1000-1200 meters above the mean sea level. The Sahyadri hills run parallel to the seacoast, with many offshoots branching eastwards from the main ranges (Satmala, Ajanta, Hrishchandra, Balghat and Mahadeo). The special features are the hills of Trimbakeshwar, Matheran and the Mahabaleshwar plateau. Its high peak is Kalsubai at an altitude of 1650 meters. Most of the rivers in Maharashtra originate in the Sahyadri and then divide to join the eastward and westward flowing rivers. These ranges are also characterized by number of Ghats, the important ones being Thal, Bor, Kumbharli, Amba and Amboli.

The Konkan Coastal Strips: The narrow strips of coastal land between the Sahyadri and the Arabian Sea are called the Konkan coastal strip. It is barely 50 km in width; it is winder in the north and narrows down in the south. River creeks and branches of the Sahyadri, which reach right up to the coast, dissect this coastline. The important creeks in Konkan, Terekhol, Vijaydurg, Rajapur, Raigarh, Dabhol, Daramathar, Thane and Vasai. The rivers of Konkan rise from the cliffs of Sahyadri and have a short swift flow into the Arabian Sea. Some important rivers are Ulhas, Savitri, Vashishthi and Shastri.

Maharashtra has been divided into six divisions for administrative purposes viz. Amravati, Aurangabad, Konkan, Nagpur, Nashik and Pune. The state consists of 35 districts, 33 Zilla Parishads, 353 Tehsils, 27,946 Grampanchayats, 349 Panchayat Samitis, 222 Municipal Councils, 22 Municipal corporations, 3 Nagar Panchayats, 7 Cantonment Boards, 41,095 Inhabited Villages, and 535 Towns. Further, on socio-cultural basis, the state is divided into five regions, namely Greater Mumbai, Marathwada(Aurangabad division), Konkan, Vidarbha(Amravati and Nagpur division) and Western Maharashtra (Pune and Nashik division) (Census, 2011 GoM).

The area and climate of the districts of the state Ratnagiri records the highest average annual rainfall followed by the other districts in the Konkan region. Amravati, Akola and Nandurbar are regions with dry climate and have recorded lower average annual rainfall.

Data Base And Methodology:- Present study is totally based on secondary source of data, which is collected from Census of India, Statistical abstracts of Maharashtra and India, National Sample Survey Organization etc. Statistical methods and composite index has been used as a methodology.

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The indicators of infrastructural development are transport (roads, railways), postal and telegraphic, drinking water, educational, godowns, public latrine and electricity (power supply). All these indicators are calculated for each amenity and facility, relates to composite score of the area and population covered.

Statistical methods have been used in working out a system of weightage, divided from observed data matrix, 'Z' square analysis on objective method for summering the information of a large number of indicators in a fewer number of score; has been used for this purpose. The data matrix in the duration form is obtained by subtracting columns mean (X) from observations in their corresponding columns. This method obviously, has a serious limitations as it begins by equalizing the variances, it seek, to explain. It has been observed that important infrastructure developmental indicators tend to be mutually correlated and show high degree of dispersion in their distribution.

Indicators of Infrastructural Development:-

1. Road
2. Railway
3. Electricity
4. Post Offices
5. Drinking Water
6. Latrine Facility
7. Godowns
8. Schools
9. Hospitals

The district wise spatial distribution of infrastructural facilities and amenities has been categorized at five levels viz., very high, high, medium, low and very low level on the basis of availability of infrastructural facilities and amenities in the state of Maharashtra. In following paragraphs, district-wise distribution has been discussed with a view to examine the concentration of infrastructure facilities and amenities.

Infrastructure Development Indicators: District wise Dispersion of The State: -

The overall distribution of infrastructural facilities is very unequal in the state of Maharashtra. It is found that, there were 3.36 crore census houses in the state, of which 2.98 crore were occupied. The proportion of vacant census houses was 11.30 per cent, of the total number of census houses 52.2 per cent were in the rural areas and 47.80 per cent were in the urban areas out of all occupied census houses 77.80 per cent were exclusively used for residential purpose, 1.80 per cent for both residential and non-residential purposes and the rest 20.40 per cent census houses were used only for non-residential purposes. (State Development Report 2001)

Road network: -

Road network is one of the major infrastructural features for the growth of any region. Roads not only enable the masses to use the public road transport at economical prices but also help in smoothening inter-regional disparities of prices across regions. Inadequacy of roads due to disproportionate growth between the number of vehicles and the growth of road length also has resulted in poor quality of roads in the state. The road length per 100 sq. km geographical area in the state was 87.40 kms. Out of 40412 inhabited villages in Maharashtra, 93 percent by fair weather roads. The remaining 2.23 per cent villages did not have any road connectivity whatsoever. (State development report Maharashtra) The highest proportion of road transport per 100 sq. km is having Sindhudurg, Bhandara and Sangli 2.35, 2.01 and 1.83 score respectively, while the lowest proportion was found in Mumbai, Gadchiroli, Buldhana and Yavatmal district.

Rail connectivity:-

Rail connectivity is one of the second major infrastructural features for the growth of any region. That is an important source of poor people for travels and main heavy large transportation. The highest proportion of rail transport per 100 sq. km is of Mumbai, Raigad, Nagpur and Jalgaon having the score of 49.57, 3.71, 2.70 and 2.01 respectively. Within these districts the lowest proportion was found in Gadchiroli, Kolhapur and Beed districts calculating the score as 0.00, 0.03, 0.03, 0.10 and 0.13 respectively.

Electricity:-

Electricity as the main source of lighting was reported by 83.90 per cent households in the state. Kerosene was the second main source of lighting, but proportion of households reporting use of Kerosene was found to only 14.50 per cent in the state. In urban areas 96.20 per cent and in rural areas 73.80 per cent households reported electricity as source of lighting. The lowest proportion of households reporting electricity as source of lighting individual score was found in Parabhani (0.11), Nanded (0.12), Beed (0.13), Osmanabad and Sindhudurg (0.16). The maximum quantity is found in Raigad (6.71), Mumbai (6.39), Thane (5.30) etc.

Post offices:-

Post offices are good and major infrastructural features for the connectivity of communication of any region. That is important source of communicate to each other in people. It is found that the highest proportion of post offices having Mumbai, Pune, Nagpur, Raigad, Kolhapur, Ratnagiri, Nashik and Thane districts, the score calculated of 23.77, 7.34, 3.60, 3.18, 2.57, 2.50, 2.22 and 2.02 respectively. While the lowest proportion was found in Jalna, Gadchiroli, Latur, Osmanabad, Parbhani, Beed, Wardha and Nanded districts the score calculated of 0.03, 0.04, 0.06, 0.07, 0.11, 0.11, 0.11, 0.13 and 0.13 respectively.

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Tap water:- Tap water was the major source of drinking water having 67.90 per cent. The proportion of households using tap water as main source of drinking water in urban area was 89.10 per cent and in rural areas it was 50.20 per cent. Lowest proportion of households having tap water as main source was reported in Bhandara, Gadchiroli and Sindhudurg districts 0.11, 0.22 and 0.27 respectively. While the highest proportion was found in Mumbai (2.68), Jalgaon (2.24), Kolhapur (2.07), Thane (1.86), Pune (1.85) and Amravati (1.72) calculated score.

Latrine facility:-

About 46.90 per cent households in the state did not have latrine facility within their premise 62.00 per cent rural households and 28.70 per cent urban households. About 34.00 per cent households were resorted to the open detection and 12.90 per cent households reported use of public latrine. The peak proportion of households having latrine facility within the premises was found in Beed (2.18) and while the lowest ratio was found in Sindhudurg (0.23) score.

Godowns:-

Godowns are one of the major infrastructural features important of growth of trades and transport is also agricultural and other necessaries of life storage. It is found that the highest proportion of godowns having Dhule, Akola, Solapur, Jalgaon, Satara and Ahmadabad districts score calculated of 2.92, 2.62, 2.52, 2.34, 2.34 and 2.25 respectively while the lowest proportion was found in Wardha, Sindhudurg, Mumbai, Kolhapur and Jalna districts the score calculated of 0.20, 0.23, 0.26, 0.32 and 0.36 respectively.

Schools:-

Schools are one of the major infrastructural features important in the growth of overall development in the region. It is found that the highest proportion of schools having Thane, Pune, Nashik and Ahmadnagar district the score calculated of 4.57, 3.88, 2.45 and 2.34 respectively. While the lowest proportion was found in Wardha, Osmanabad, Sindhudurg, Jalna and Gadchiroli districts the score calculated of 0.19, 0.26, 0.29, 0.37 and 0.38 respectively.

Hospital:-

Hospital is one the major infrastructural features in the life of human development in the region. On the basis of calculations and observations it is found that the highest proportion of hospitals are in Thane, Mumbai, Nagpur, Kolhapur, Satara, Pune and Jalgaon district, which calculates the score 13.66, 6.48, 5.72, 3.97, 3.1, 2.39 and 2.33 respectively, while the lowest proportion was found in Gadchiroli, Osmanabad, Wardha, Chandrapur, Beed and Nanded districts. The score calculated of 0.02, 0.03, 0.05, 0.07, 0.08 and 0.10 respectively.

Composite Index: - As mentioned earlier, the composite index for the infrastructural development indicators such as road, railway electricity, post offices, drinking water, godowns, schools and hospitals, taken as per the source of infrastructure statistics of Maharashtra 2009-10

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& 2010-11. For the all amenities combined is obtained by aggregating the component indicators. The levels of infrastructural development have been calculated on the basis of composite score of infrastructural amenities of each district. The levels of development have been categorized in five category viz., very high, high, medium, low and very low. It is observed that category of high development is found in few districts of the state as given ahead.

Very High level: -

It is observed that only three districts viz., Mumbai, Thane and Pune districts come under this category. The composite score of infrastructural development is 91.07, 31.41 and 21.94 respectively, which are the total score of all indicators. It is noted that Mumbai district ranks first for all the amenities, followed by Thane and Pune, which shows the very high level development of infrastructural amenities and facilities in the districts.

Table 1

Infrastructure Development In Maharashtra 2011-12

Rank	District	Road Transport Per 100 Sq.Km	District	Rail Transport Per 100 Sq.Km	District	Electricity Consupction of Per Capita Units/KWH	District	No. of Post Officeses
1	Sindhudurg	2.35	Mumbai	49.57	Raigad	6.71	Mumbai	23.77
2	Bhandara	2.01	Raigad	3.71	Mumbai	6.39	Pune	7.34
3	Sangli	1.83	Nagpur	2.70	Thane	5.30	Nagpur	3.60
4	Aurangabad	1.56	Jalgaon	2.01	Satara	3.88	Raigad	3.18
5	Nanded	1.56	Thane	1.78	Wardha	2.70	Kolhapur	2.57
6	Kolhapur	1.53	Chandrapur	1.45	Pune	2.64	Ratnagiri	2.50
7	Satara	1.53	Akola	1.37	Nagpur	2.10	Nashik	2.22
8	Nashik	1.37	Bhandara	1.35	Kolhapur	2.00	Thane	2.02
9	Pune	1.34	Ratnagiri	0.96	Nashik	1.40	Sangli	1.83
10	Solapur	1.34	Solapur	0.80	Aurangabad	1.31	Satara	1.66
11	Ratnagiri	1.31	Latur	0.79	Chandrapur	1.22	Solapur	0.86
12	Beed	1.29	Wardha	0.79	Jalna	1.16	Ahemadnagar	0.74
13	Jalgaon	1.23	Nanded	0.76	Ratnagiri	0.75	Amravati	0.74
14	Nagpur	1.09	Sindhudurg	0.70	Ahemadnagar	0.74	Jalgaon	0.66
15	Dhule	1.06	Parbhani	0.67	Sangli	0.72	Akola	0.49
16	Latur	1.06	Pune	0.64	Solapur	0.61	Aurangabad	0.40
17	Osmanabad	0.98	Amravati	0.57	Jalgaon	0.60	Sindhudurg	0.37
18	Ahemadnagar	0.96	Sangli	0.56	Bhandara	0.40	Bhandara	0.27
19	Raigad	0.93	Nashik	0.47	Amravati	0.31	Chandrapur	0.22
20	Thane	0.93	Satara	0.27	Buldhan	0.26	Yavatma	0.20

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					a		l	
21	Parbhani	0.82	Ahemadnagar	0.26	Dhule	0.23	Buldhana	0.18
22	Chandrapur	0.72	Yavatmal	0.23	Latur	0.22	Dhule	0.18
23	Wardha	0.68	Jalna	0.21	Akola	0.22	Nanded	0.13
24	Jalna	0.62	Dhule	0.19	Gadchiroli	0.21	Wardha	0.13
25	Akola	0.54	Aurangabad	0.19	Yavatmal	0.18	Beed	0.11
26	Amravati	0.50	Buldhana	0.13	Sindhudurg	0.16	Parbhani	0.11
27	Yavatmal	0.48	Osmanabad	0.10	Osmanabad	0.16	Osmanabad	0.07
28	Buldhana	0.40	Beed	0.03	Beed	0.13	Latur	0.06
29	Gadchiroli	0.35	Kolhapur	0.03	Nanded	0.12	Gadchiroli	0.04
30	Mumbai	0.01	Gadchiroli	0.00	Parbhani	0.11	Jalna	0.03
SD		0.53		8.94		1.85		4.42
		147.72		0.28		293.22		10.03
CV		12.15		0.52		17.12		3.17
MH		1.08		2.44		1.43		1.89

Source: Infrastructure Statistics of Maharashtra 2009-10 & 2010-11

Infrastructure Development In Maharashtra 2011-12

Rank	District	Tap Water % of HH Having	District	Public latrine % of HH Having	District	No. of Godowns	District	No. of School
1	Mumbai	2.68	Beed	2.18	Dhule	2.92	Thane	4.57
2	Jalgaon	2.24	Gadchiroli	2.07	Akola	2.62	Pune	3.88
3	Kolhapur	2.07	Osmanabad	2.03	Solapur	2.52	Nashik	2.45
4	Thane	1.86	Dhule	1.91	Jalgaon	2.34	Ahemadnagar	2.34
5	Pune	1.85	Parbhani	1.87	Satara	2.34	Solapur	1.78
6	Amravati	1.72	Yavatmal	1.85	Ahemadnagar	2.25	Mumbai	1.32
7	Nagpur	1.66	Nanded	1.74	Ratnagiri	1.98	Dhule	1.29
8	Raigad	1.55	Buldhana	1.63	Pune	1.58	Satara	1.29
9	Satara	1.53	Jalgaon	1.62	Nanded	1.37	Raigad	1.28
10	Dhule	1.41	Jalna	1.57	Nagpur	1.23	Nagpur	1.12
11	Sangli	1.29	Latur	1.51	Buldhana	1.16	Kolhapur	1.05
12	Wardha	1.15	Akola	1.40	Beed	0.98	Ratnagiri	1.02
13	Nashik	1.14	Kolhapur	1.34	Raigad	0.98	Nanded	0.98
14	Aurangabad	1.11	Chandrapur	1.25	Yavatmal	0.98	Yavatmal	0.93
15	Ratnagiri	1.04	Ahemadnagar	1.13	Thane	0.86	Beed	0.89
16	Latur	0.97	Nashik	1.10	Amravati	0.81	Jalgaon	0.85
17	Solapur	0.92	Aurangabad	1.01	Osmanabad	0.81	Aurangabad	0.84
18	Osmanabad	0.91	Amravati	0.83	Chandrapur	0.76	Akola	0.78
19	Buldhana	0.83	Wardha	0.73	Parbhani	0.76	Parbhani	0.77
20	Ahemadnagar	0.72	Bhandara	0.73	Bhandara	0.70	Bhandara	0.75
21	Akola	0.71	Mumbai	0.60	Nashik	0.70	Amrava	0.68

							ti	
22	Nanded	0.63	Raigad	0.56	Sangli	0.56	Sangli	0.67
23	Yavatmal	0.55	Sangli	0.48	Aurangabad	0.52	Chandrapur	0.52
24	Beed	0.51	Thane	0.42	Gadchiroli	0.43	Latur	0.52
25	Jalna	0.49	Ratnagiri	0.36	Latur	0.43	Buldhana	0.45
26	Chandrapur	0.47	Satara	0.32	Jalna	0.36	Gadchiroli	0.38
27	Parbhani	0.42	Pune	0.27	Kolhapur	0.32	Jalna	0.37
28	Sindhudurg	0.27	Solapur	0.25	Mumbai	0.26	Sindhudurg	0.29
29	Bhandara	0.22	Nagpur	0.23	Sindhudurg	0.23	Osmanabad	0.26
30	Gadchiroli	0.11	Sindhudurg	0.23	Wardha	0.20	Wardha	0.19
SD		0.65		0.65		0.81		1.00
		91.82		78.48		41.41		3245.33
CV		9.58		8.86		6.43		56.97
MH		1.10		1.11		1.13		1.15

Source: Infrastructure Statistics of Maharashtra 2009-10 & 2010-11

Infrastructure Development In Maharashtra 2011-12

Rank	District	No. of Hospitals	District	Comp. Index	
1	Thane	13.66	Mumbai	91.07	
2	Mumbai	6.48	Thane	31.41	
3	Nagpur	5.72	Pune	21.94	
4	Kolhapur	3.97	Raigad	19.47	
5	Satara	3.01	Nagpur	19.43	
6	Pune	2.39	Satara	15.82	
7	Jalgaon	2.33	Kolhapur	14.89	
8	Solapur	1.16	Jalgaon	13.86	
9	Jalna	1.11	Nashik	11.90	
10	Nashik	1.04	Solapur	10.24	
11	Ahemadnagar	1.02	Ratnagiri	10.23	
12	Amravati	0.64	Ahemadnagar	10.14	
13	Aurangabad	0.63	Dhule	9.69	
14	Sangli	0.61	Akola	8.69	
15	Akola	0.57	Sangli	8.56	
16	Raigad	0.56	Aurangabad	7.57	
17	Latur	0.55	Nanded	7.38	
18	Yavatmal	0.52	Amravati	6.79	
19	Dhule	0.50	Chandrapur	6.69	
20	Buldhana	0.46	Bhandara	6.67	
21	Sindhudurg	0.40	Wardha	6.62	
22	Parbhani	0.35	Beed	6.20	
23	Ratnagiri	0.30	Latur	6.12	
24	Bhandara	0.24	Yavatmal	5.93	
25	Nanded	0.10	Jalna	5.91	

26	Beed	0.08	Parbhani	5.89	
27	Chandrapur	0.07	Buldhana	5.51	
28	Wardha	0.05	Osmanabad	5.36	
29	Osmanabad	0.03	Sindhudurg	4.99	
30	Gadchiroli	0.02	Gadchiroli	3.62	
SD		2.80		15.99	
		105.00		0.81	
CV		10.25		0.90	
Maharashtra		1.62		12.95	
Source: Infrastructure Statistics of Maharashtra 2009-10 & 2010-11					

Map No. 2

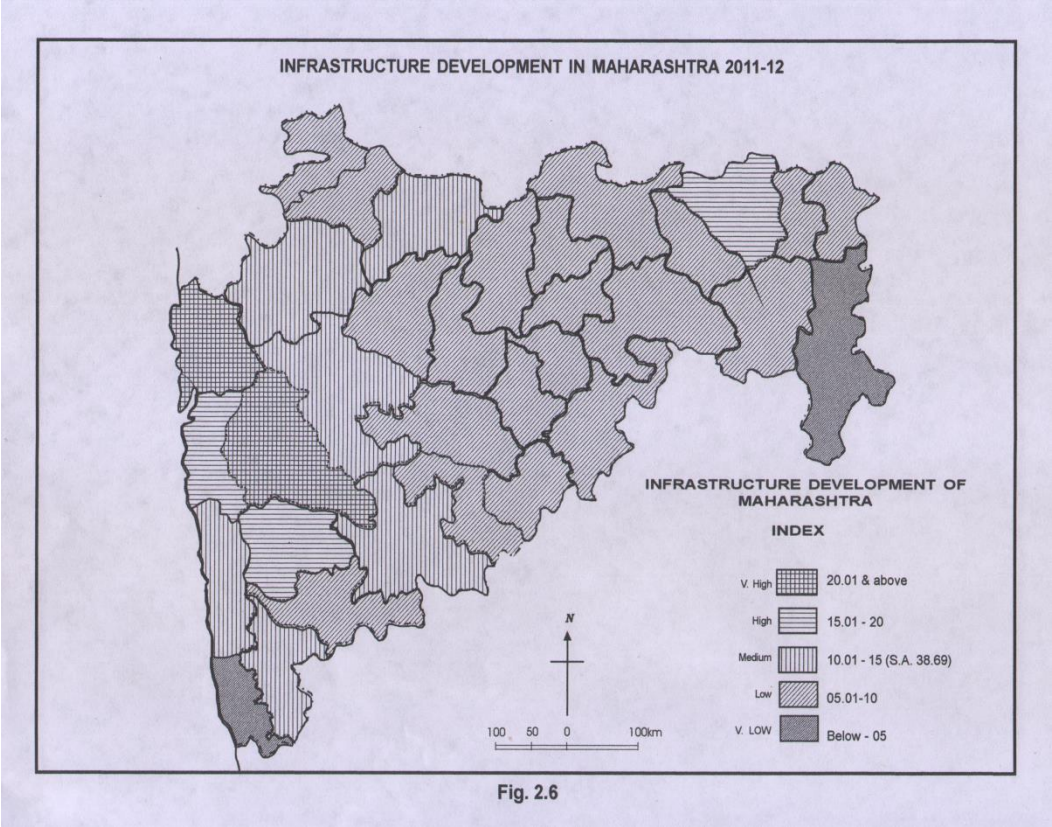

Fig. 2.6

High level:-

The area under high level of development includes of districts, namely Raigarh (19.47), Nagpur (19.43) and Satara (15.82). The districts in this category do not form a belt. The map indicates all districts of high level infrastructural development influenced by proximity large urban centres of Raigarh, Satara and Nagpur.

Medium level:-

For this level the composite score vanes from 10.01 to 15.00. Out of six districts are found in the medium level of infrastructural development in the state. It includes Kolhapur

(14.89), Jalgaon (13.86), Nashik (11.90), Solapur (10.24), Ratnagiri (10.23) and Ahemadnager (10.14) districts. These districts lie in the north and western part of state. The maximum score is observed in Kolhapur (14.89) district and minimum in Ahemadnager district (10.14).

Low level:-

It comparise of a Dhule (9.69), Akola (8.69), Sangli(8.56), Aurangabad (7.57), Nanded (6.79), Chandrapur (6.69), Bhandara (6.67), Wardha (6.62), Bid (6.20), Latur (6.12), Yavatmal (5.93), Jalna (5.91), Parbhani (5.89), Buldana (5.51) and Osmanabad (5.36) indicates, that all the districts of low level category, are situated in the drought prone region of the state.

Very Low Level:-

There are only two districts in this category, which includes Sindhudurg and Gadchiroli. The minimum score of infrastructural development is found in Gadchiroli (3.62) and maximum is observed in the Sindhudurg district.

The above analysis brings out the fact that those districts, which are located very far from economical capital of state similarly, the remote areas of the region come under low levels category. The south-western parts of the state are having very low level of development, where the mountainous undulating tracts effect the infrastructural development of amenities.

On the other hand high level of infrastructural development is observed, in the north-east and northern part, similarly, western part, which are the locations of urban centers besides of river, national and state highways. The Krishna, Panchganga and his tributaries basin origin of fertile soils to grow food similarly, the developing process of various industries, facilitate provide drinking water amenities and the wide space needed for large settlements. Topography facilitates development of transport network.

Conclusion:-

The disparity in infrastructural development is observed in Maharashtra, which is indicating that, some parts of the state are having tremendous development due to developed infrastructural facilities, and some parts are lagging behind, having the reason of lacking all the infrastructural facilities and amenities. Physiographic structure and climate of Maharashtra state has also became dominant factor in determining these levels. It is observed that very high development is only in three districts of Maharashtra. Low level of

development is observed high in the state. So there is need of balanced development to mitigate this inequality.

Suggestions:-

Integration of some of the infrastructure schemes such as constructions of roads with the employment and income generation programmes may help in the alleviation of poverty. Medical facilities and provisions in rural and urban areas should also upgrade. The infrastructure facilities especially power, ports, tap water, public latrine, godowns, telecommunication, transportations, post offices, schools and hospitals should be improved. This would require enlarging the scope of the private sector, which may improve both availability of infrastructural and efficiency through competition. Stakeholders and political willingness to implement the reforms can enable the state to access more funds from the central schemes as has been the case with some other state governments.

References:-

1. Ahuja, N.: Evolution and Population Genetics, Pearl Books, Delhi, 2008.
2. Balshaw, M.: Urban Space and Representation. Sterling, VA:Pluto Press, 2000.
3. Census of India: 2011.
4. Dash, Rupanwita: Environment Sustainability index for India state 2011, Institute for financial Management and Research 24, Kothari Road, Nungambakkam, Chennai 600034, 2011.
5. DROP,Pune: study of Water Sector Projects in Maharashtra (Case Studies of selected Village), Ground Water Survey and Development Agency Government of Maharashtra, 2003.
6. Government of Maharashtra: Report on water auditing of irrigation systems, in Maharashtra, state 2005-10. Publication by water Department, Government of Maharashtra, India, March, 2011.
7. Gurjar, R. K. and Jat, B. C. (2008) Geography Water Resources. Rawat Publication, Jaipur.
8. Infrastructure Statistics of Maharashtra, 2009-10 and 2010-11.
9. Jain, A.K.: Urban Transport Planning and Management, A.P.H.Publishing Corporation, New Delhi, 2009.
10. Kant, S.: Reinventing Regional Development, Rawat Publications, Jaipur and New Delhi, 2002.

11. Kote, R.C. and Wagle, S.M.: Integrated small scale Water resources management in Maharashtra, Published by, BAIF Development Research Foundation, Pune, Sept 2010.
12. Maharashtra Segment Report, Submitted by Rucha Ghate to Center for Multi–Disciplinary Development Research, Dharwar. Invariant dependency on common property Resource, Different stages of development: A case study of water in India.
13. Mehtani, S.: Transport Geography, Commonwealth Publication, Delhi, 2010.
14. National Sample Survey Organization Report.
15. Sangwan, R.S.: Dynamics of Urban Land Use Ecology of Residential Mobility, Commonwealth Publishers, Delhi, 2000.
16. Singh, B.: Urban Infrastructure And Real Estate Management, Surendra Publications, New Delhi, 2008.
17. Singh, B.: Population and Urbanization Changing Perspectives, Aarti Prakashan, New Delhi, 2011.
18. Sodal, S.V.: Reforms Inititives in water Resources Secotor in Maharashtra state, Maharashtra State, India, 2006-09.
19. State Development Report: 2001
20. Sujata, S.D.: Growing Urbanization and Strategies, DPH Pvt. Ltd., New Delhi, 2012.

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Status and Distribution of Mangroves in India: A Review

Dr. Nisha R. Mugade[1] Dr. Shubhangi S. Kale [2]

Vivekanand College, Kolhapur (Autonomous)

Abstract:

Spatial distribution patterns along the Indian coastline, focusing on key regions such as the Sundarbans, Andaman and Nicobar Islands, Gulf of Kutch, Maharashtra, Gujrat and Odisha. Environmental factors, including salinity, tidal range, and sediment type, are discussed as critical influencers of mangrove composition and structure. Satellite imagery analysis, exemplified by Giri et al. (2011), reveals the impact of anthropogenic activities, such as coastal development and aquaculture, on mangrove cover over time. Conservation implications are highlighted, emphasizing the need for tailored initiatives that address specific threats faced by diverse mangrove ecosystems in India. The distribution of mangroves in India reflects a complex interplay of ecological and anthropogenic factors. The study underscores the dynamic interplay of ecological and human-induced factors shaping the fate of mangroves in the Indian context.

Key Words: Mangrove Distribution, Ecosystem, Sustainable Development.

Introduction:

Mangroves are unique coastal ecosystems found in tropical and subtropical regions around the world. They are characterized by the presence of salt-tolerant trees and shrubs that thrive in brackish water and muddy, intertidal areas (Parida, A. K. and Jha, B., 2010). Mangroves are home to a wide variety of plant species adapted to saline conditions. Common mangrove tree species include Rhizophora, Avicennia, and Sonneratia (Malik, A. et. Al., 2015). Mangroves are typically found along coastlines in sheltered estuaries, bays, and tidal flats. They can grow in both muddy and sandy substrates. Mangrove ecosystems support a rich diversity of flora and fauna, including various fish species, crustaceans, birds, and mammals (Rajpar, M. N. and Zakaria, M., 2014). They are often referred to as nurseries for marine life because many fish species use them as breeding and feeding grounds (Félix, P. M. et. Al. 2016).

The dense root systems of mangroves help stabilize shorelines, reducing erosion and protecting coastal communities from the impacts of storm surges and sea-level rise (McIvor, A. L. et. Al., 2012). Mangroves are highly effective at sequestering carbon dioxide (CO2) from the atmosphere. They store large amounts of carbon in their biomass and in the sediments below, making them vital in the fight against climate change (Nyanga, C., 2020). Mangroves provide resources and livelihoods for coastal communities. They are sources of wood, honey, and traditional medicines, and they support fishing and aquaculture industries (Das, S. C., et. Al., 2022). Mangroves, coastal ecosystems of immense ecological and socio-economic significance, stand at the forefront of a precarious balancing act between conservation and degradation. These unique intertidal forests, found

in tropical and subtropical regions, serve as vital buffers between land and sea, offering an excess of benefits to both nature and humanity (Alongi, D. M., 2002).

Conservation of mangroves is imperative due to their role in safeguarding coastal communities from storm surges, erosion, and sea-level rise. These ecosystems house a rich biodiversity, providing habitats for a myriad of species, including fish, birds, and invertebrates (Rashid, S. M. A., 2019). Mangroves play a pivotal role in carbon sequestration, mitigating climate change by storing large quantities of carbon within their biomass and sediments. Furthermore, they offer invaluable resources for local livelihoods, including timber, honey, and traditional medicines (Alongi, D. M., 2020).

Conserving and managing mangroves is essential for sustaining these valuable ecosystems and the benefits they provide to both the environment and local communities. Efforts to protect and restore mangroves are crucial for maintaining coastal flexibility, supporting biodiversity, and promoting sustainable development in coastal areas.

Mangroves In India:

The east coast of India also has significant mangrove cover, especially in the states of Goa, Karnataka, Tamil Nadu, Andhra Pradesh, Odisha, and West Bengal. Mangroves are found along the west coast of India, particularly in the states of Gujarat, Maharashtra, Karnataka, and Kerala. The Sundarbans, a vast mangrove delta, is a unique and ecologically important region shared by India and Bangladesh. The mangroves in these islands contribute significantly to the overall mangrove cover in India. In India, the Sundarbans are primarily located in the state of West Bengal and are known for their exceptional biodiversity. The islands are rich in mangrove ecosystems, and mangrove cover is extensive in the Andaman and Nicobar archipelago. Mangroves in India are primarily distributed along the coastal regions, particularly in the tropical and subtropical areas. The Gulf of Kutch in Gujarat is another area where mangroves are found (India state of forest report 2021).

Research by Saenger and Snedaker (1993) highlights the significance of environmental factors in determining mangrove distribution. Factors such as salinity, tidal range, and sediment type emerge as critical determinants, influencing the species composition and structure of mangrove communities. Human activities, including coastal development and aquaculture, significantly impact mangrove distribution. The work of Giri et al. (2011) employs satellite imagery to delineate the changes in mangrove cover over time, illustrating the direct correlation between anthropogenic activities and mangrove loss. Understanding the distribution patterns of mangroves is pivotal for effective conservation strategies. The research by Polidoro et al. (2010) provides a comprehensive assessment of global mangrove biodiversity, emphasizing the need for conservation initiatives that consider regional variations and address the specific threats faced by different mangrove ecosystems in India. While mangroves face myriad challenges, several conservation initiatives in India strive to

address the issues and restore degraded ecosystems. The work of Raghavan et al. (2008) presents a case study on successful community-based mangrove restoration in the Godavari Delta, underscoring the potential for community involvement in conservation efforts. The vulnerability of mangroves to climate change, including rising sea levels and extreme weather events, adds another layer of complexity to their status. The research by Alongi (2015) explores the potential impacts of climate change on mangrove ecosystems, emphasizing the need for adaptive management strategies. Human activities, including aquaculture, urbanization, and industrialization, pose significant threats to mangrove ecosystems. The research by UNEP (2014) highlights the consequences of anthropogenic pressures, indicating that mangrove degradation in India is often linked to unsustainable development practices and land-use changes. Satellite-based assessments, such as those conducted by Giri et al. (2011), provide critical insights into the changing extent of mangrove cover in India. The study reveals both positive and negative trends, with afforestation efforts and conservation initiatives in some regions counteracted by deforestation in others, emphasizing the dynamic nature of mangrove ecosystems.

Mangroves, integral coastal ecosystems, have faced considerable threats in India, prompting diverse conservation and restoration initiatives. This review explores the ongoing efforts, challenges, and successes in the conservation and restoration of mangroves across the country. Raghavan et al. (2008) present a notable case study on successful community-based mangrove restoration in the Godavari Delta. The study exemplifies the potential for involving local communities in conservation efforts. Community engagement not only aids in restoring degraded ecosystems but also promotes sustainable practices, emphasizing the importance of collaborative approaches. The implementation of Integrated Coastal Zone Management (ICZM) plans is a pivotal aspect of mangrove conservation in India. These plans, often led by government agencies and environmental organizations, aim to balance development and conservation. The work of Nayak et al. (2015) evaluates the effectiveness of ICZM plans, emphasizing the need for adaptive strategies that consider the dynamic nature of mangrove ecosystems. Government-led afforestation and reforestation programs play a crucial role in mangrove conservation. The research by Sridhar et al. (2012) evaluates the success of mangrove afforestation efforts, recognizing them as essential tools for restoring degraded areas. However, the study also underscores the need for careful site selection and consideration of ecological factors for these programs to be effective. Conservation efforts face challenges, including climate change impacts, unsustainable development, and resource exploitation. Alongi (2015) discusses the need for adaptive management strategies that consider the resilience of mangrove ecosystems in the face of changing environmental conditions.

Status Of Mangroves In India: The distribution of mangroves in India exhibits spatial heterogeneity influenced by diverse ecological factors. Along the eastern coast, the Sundarbans, the largest

mangrove forest globally, stands as a prime example of rich biodiversity and intricate waterways. The western coast, including regions like the Gulf of Kutch and the Andaman and Nicobar Islands, showcases distinct mangrove ecosystems, each shaped by specific hydrological and climatic conditions. Mangroves in India are not only ecosystems of ecological importance but also integral to the socio-economic fabric of coastal communities. Understanding their complexities, threats, and conservation potentials is imperative for fostering sustainable coexistence between human activities and these invaluable coastal habitats. Continuous research, community involvement, and adaptive management will be key to ensuring the resilience and longevity of mangroves in the diverse coastal ecosystems of India.

According to the Indian State Forest Report 2021, India's mangrove cover is 4992 square kilometres, or 0.15% of the country's total geographical area. The Sundarbans in West Bengal are the world's largest mangrove forest regions. It has been designated a UNESCO World Heritage Site. In India, there are 34 species of mangroves. Bhitarkanika (Orissa) has 31 species, the Sundarbans have 27, and the Andaman & Nicobar Islands have 24 species (MFF, India. 2010).

Table 1. Mangrove cover in States and UT in India during 1989 to 2019

State/UT	1989	1991	1993	1995	1997	1999	2001	2003	2005	2009	2011	2013	2015	2017	2019
Andhra Pradesh	405	399	978	983	383	397	333	329	354	353	352	352	367	404	404
Goa	3	3	3	3	5	5	5	16	16	17	22	22	26	26	26
Gujrat	412	397	419	689	901	1031	911	916	991	1046	1058	1103	1107	1140	1177
Karnataka	0	0	0	2	3	3	2	3	3	3	3	3	3	10	10
Kerala	0	0	0	0	0	0	0	8	5	5	6	6	9	9	9
Maharashtra	114	113	155	155	124	108	118	158	186	186	186	186	222	304	320
Odisha	192	195	195	195	211	215	219	203	217	221	222	213	231	243	251
Tamil Nadu	47	47	21	21	21	21	23	35	36	39	39	39	47	49	45
West Bengal	2109	2119	1219	2119	2123	2125	2081	2120	2136	2152	2155	2097	2106	2114	2112
A&N Island	973	971	966	966	966	966	789	658	635	615	617	604	617	617	616
Daman & Diu	0	0	0	0	0	0	0	1	1	1	2	1.63	3	3	3
Puducherry	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2
Total	4255	4244	4256	4533	4737	4871	4482	4448	4581	4639	4663	4628	4740	4921	4975

Source: India state of forest report 2021

Very Dense Mangrove comprises 2155 sq. km (43.35%) of the Mangrove cover during 2011 at the West Bengal. There has been a net increase of 54 sq. km in the Mangrove cover of the country as compared to 2019 assessment. The reason for the increase in Mangrove cover in Odisha, is mainly due to the natural regeneration, plantation activities in suitable land like on the banks of the rivers near the estuary and on intertidal mud-flats

associated with the areas that are inundated by sea water on a daily cycle. The increase in Mangrove cover has been observed in the districts of Kendrapara, Jagatsinghpur and Balasore in Odisha. The current assessment shows that Mangrove cover in the country is 4,992 sq. km, which is 0.15% of the country's total geographical area. In Maharashtra, the increase in Mangrove cover is mainly due to natural regeneration. The States that show significant gain in Mangrove cover are i.e.8 sq. km and i.e.4 sq. km Odisha and Maharashtra respectively (Table 1) (India state of forest report 2021).

Biodiversity Of Mangroves In India:

Figure: Mangroves along Devgad Estuary (Maharashtra)

Mangroves, the dynamic ecosystems bridging land and sea, exhibit extraordinary biodiversity, making them crucial hotspots for ecological research and conservation efforts. The review explores the biodiversity of mangroves in India, delving into key studies that unravel the intricacies of these unique habitats. Mangroves in India boast a diverse assemblage of plant species uniquely adapted to saline and intertidal conditions. Tomlinson's seminal work (1986) on mangrove botany provides a foundational understanding of the varied morphological and physiological adaptations of mangrove plants, emphasizing their role in shaping the distinctive flora of Indian mangrove ecosystems. Kathiresan and Bingham's comprehensive study (2001) on the biology of mangroves highlights the exceptional faunal diversity of these ecosystems. Mangroves in India serve as crucial nurseries for various fish and invertebrate species, contributing significantly to coastal fisheries. The intricate network of roots and water channels provides a sanctuary for diverse marine life, demonstrating the integral link between mangroves and the biodiversity of adjacent marine environments. Indian mangroves are essential habitats for a plethora of bird

species, both resident and migratory. The work of Satyanarayana et al. (2002) documents the avian diversity in the Godavari mangroves, showcasing the significance of these ecosystems as crucial stopovers for migratory birds and highlighting the need for their conservation to safeguard avian biodiversity. Beyond visible flora and fauna, mangrove sediments harbor a rich diversity of microorganisms crucial for nutrient cycling and ecosystem functioning. Kristensen et al.'s (2008) research delves into the microbial communities within mangrove sediments, emphasizing their role in the decomposition of organic matter and nutrient cycling, further underlining the interconnectedness of all components of mangrove biodiversity. Polidoro et al.'s (2010) global assessment of mangrove biodiversity emphasizes the need for conservation actions to preserve these critical ecosystems.

In the context of India, the rich biodiversity of mangroves underscores the urgency of sustainable management practices, taking into account the ecological interdependencies that contribute to the resilience of these habitats.

Regeneration Of Mangrove Cover:

Mangrove ecosystems, critical for coastal biodiversity and resilience, face ongoing threats, necessitating effective regeneration strategies. The review explores key studies on the regeneration of mangroves in India, shedding light on the challenges, successes, and implications for sustainable coastal management. Natural regeneration is a fundamental aspect of mangrove ecosystems. Saenger and Snedaker (1993) provide insights into the natural processes of mangrove regeneration, highlighting the role of seed dispersal, germination, and early growth in the maintenance of healthy mangrove populations. Despite the intrinsic regenerative capabilities of mangroves, anthropogenic activities often hinder natural processes. Jayatissa et al. (2002) assess the impact of human interventions, such as aquaculture and development, on mangrove regeneration, emphasizing the need for sustainable land-use practices to support natural recovery. Efforts to restore degraded mangrove areas are vital for their long-term survival. The case study by Raghavan et al. (2008) on community-based mangrove restoration in the Godavari Delta exemplifies successful restoration initiatives. The study emphasizes the importance of local community involvement in achieving effective and sustainable regeneration outcomes. Climate change poses challenges to mangrove regeneration, particularly with rising sea levels and altered precipitation patterns. Osland et al. (2017) investigate the climatic controls on the global distribution of mangroves, providing insights into how changing climate conditions may impact regeneration processes. Sustainable management practices are integral to successful mangrove regeneration. Krishnan et al. (2010) emphasize the role of effective management strategies in supporting the regeneration of mangrove ecosystems, including habitat protection, reducing pollution, and fostering community engagement.

The regeneration of mangroves in India is a complex and dynamic process influenced by natural and anthropogenic factors. The studies reviewed underscore the importance of understanding these factors, fostering community involvement, and implementing sustainable management practices. As India strives to balance coastal development with environmental

conservation, informed strategies that promote the resilience and regeneration of mangrove ecosystems are crucial for the well-being of both coastal communities and the diverse flora and fauna reliant on these critical habitats.

Conclusion:

While conservation efforts are underway, addressing the challenges of habitat loss, climate change, and human-wildlife conflicts remains crucial for sustaining India's rich biodiversity in the long term. As mangroves continue to face multiple threats, a holistic and collaborative approach remains paramount for the sustainable conservation and restoration of these vital coastal ecosystems in India. The integration of traditional knowledge, community involvement, and innovative conservation strategies can contribute to a more sustainable and harmonious coexistence between humans and the diverse ecosystems of India. Conservation and restoration initiatives for mangroves in India showcase a mix of community involvement, government-led programs, and scientific research. Understanding the current status is fundamental for developing effective management strategies that balance the ecological significance of mangroves with the needs of local communities and the pressures of a changing climate. Recognizing the uniqueness of each mangrove ecosystem and addressing local challenges is essential for ensuring the resilience and sustainability of these invaluable coastal habitats in India. As highlighted by the referenced studies, while challenges persist, there is room for optimism through targeted conservation and restoration efforts. The status of mangroves in India is intricately linked to a dynamic interplay of ecological and human-induced factors. The distribution of mangroves in India reflects a complex interplay of ecological and anthropogenic factors. As highlighted by the referenced studies, understanding these distribution patterns is crucial for informed conservation and management. As India faces with the conservation challenges posed by habitat loss and climate change, understanding and protecting the rich biodiversity of mangroves becomes imperative for ensuring the health and longevity of these critical coastal ecosystems.

References:

1. Alongi, D. M. (2002). Present state and future of the world's mangrove forests. *Environmental conservation*, *29*(3), 331-349.
2. Alongi, D. M. (2015). The impact of climate change on mangrove forests. Current Climate Change Reports, 1(1), 30–39.
3. Alongi, D. M. (2015). The impact of climate change on mangrove forests. Current

Climate Change Reports, 1(1), 30–39.

4. Alongi, D. M. (2020). Global significance of mangrove blue carbon in climate change mitigation. *Sci*, *2*(3), 67.
5. Das, S. C., Das, S., & Tah, J. (2022). Mangrove Forests and People's Livelihoods. In *Mangroves: Biodiversity, Livelihoods and Conservation* (pp. 153-173). Singapore: Springer Nature Singapore.
6. Félix, P. M., Chainho, P., Lima, R. F., Costa, J. L., Almeida, A. J., Domingos, I., & Brito, A. C. (2016). Mangrove fish of São Tomé Island (Gulf of Guinea): new occurrences and habitat usage. *Marine and Freshwater Research*, *68*(1), 123-130.
7. Giri, C., Ochieng, E., Tieszen, L. L., Zhu, Z., Singh, A., Loveland, T., … Duke, N. (2011). Status and distribution of mangrove forests of the world using earth observation satellite data. Global Ecology and Biogeography, 20(1), 154–159.
8. Giri, C., Ochieng, E., Tieszen, L. L., Zhu, Z., Singh, A., Loveland, T., … Duke, N. (2011). Status and distribution of mangrove forests of the world using earth observation satellite data. Global Ecology and Biogeography, 20(1), 154–159.
9. India state of forest report 2021
10. Jayatissa, L. P., Wickramasinghe, W. A. A. D. L., & Dahdouh-Guebas, F. (2002). Mangrove conservation and coastal management in Sri Lanka. Ambio, 31(7–8), 528–530.
11. Krishnan, P., Ramesh, R., & Bhalla, V. (2010). Mangroves of the Andaman and Nicobar Islands: Taxonomy and ecology. Blumea - Biodiversity, Evolution and Biogeography of Plants, 55(1), 1–12.
12. Malik, A., Fensholt, R., & Mertz, O. (2015). Mangrove exploitation effects on biodiversity and ecosystem services. *Biodiversity and Conservation*, *24*, 3543-3557.
13. McIvor, A. L., Spencer, T., Möller, I., & Spalding, M. (2012). *Storm surge reduction by mangroves*. The Nature Conservancy and Wetlands International.
14. Nayak, P., Dadhwal, V. K., & Das, S. (2015). An assessment of the effectiveness of integrated coastal zone management for mangrove conservation: A remote sensing approach. Environmental Monitoring and Assessment, 187(12), 768.
15. Nyanga, C. (2020). The role of mangroves forests in decarbonizing the atmosphere. In *Carbon-Based Material for Environmental Protection and Remediation*. IntechOpen.
16. Osland, M. J., Feher, L. C., Griffith, K. T., Cavanaugh, K. C., Enwright, N. M., Day, R. H., Stagg, C. L. (2017). Climatic controls on the global distribution, abundance, and

species richness of mangrove forests. Ecological Monographs, 87(2), 341–359.

17. Parida, A. K., & Jha, B. (2010). Salt tolerance mechanisms in mangroves: a review. *Trees*, *24*(2), 199-217.
18. Polidoro, B. A., Carpenter, K. E., Collins, L., Duke, N. C., Ellison, A. M., Ellison, J. C., … Yong, J. W. H. (2010). The loss of species: Mangrove extinction risk and geographic areas of global concern. PLoS ONE, 5(4), e10095.
19. Raghavan, R., Dahanukar, N., Tlusty, M. F., & Rhyne, A. L. (2008). Assessing the threats to a threatened species: The sea cucumber fishery and trade in India. Animal Conservation, 11(5), 370–378.
20. Raghavan, R., Dahanukar, N., Tlusty, M. F., & Rhyne, A. L. (2008). Assessing the threats to a threatened species: The sea cucumber fishery and trade in India. Animal Conservation, 11(5), 370–378.
21. Raghavan, R., Dahanukar, N., Tlusty, M. F., & Rhyne, A. L. (2008). Assessing the threats to a threatened species: The sea cucumber fishery and trade in India. Animal Conservation, 11(5), 370–378.
22. Rajpar, M. N., & Zakaria, M. (2014). Mangrove fauna of Asia. *Mangrove ecosystems of Asia: Status, challenges and management strategies*, 153-197.
23. Rashid, S. M. A. (2019). Coastal Biodiversity–A Review. *Report prepared for long term monitoring research and analysis of Bangladesh coastal zone*.
24. Saenger, P., & Snedaker, S. C. (1993). Pantropical trends in mangrove above-ground biomass and annual litterfall. Oecologia, 96(3), 293–299.
25. Saenger, P., & Snedaker, S. C. (1993). Pantropical trends in mangrove above-ground biomass and annual litterfall. *Oecologia*, *96*(3), 293–299.
26. Sridhar, A., Shanmugam, P., & Imran, M. (2012). Mangrove afforestation and reforestation in India: The success story. International Journal of Geomatics and Geosciences, 2(2), 387–401.
27. United Nations Environment Programme (UNEP). (2014). The Importance of Mangroves: A Call to Action. Retrieved from https://www.unep.org/resources/report/importance-mangroves-call-action
28. MFF, India. (2010). Mangroves: Soldiers of our Coasts. New Delhi: TERI, 32 pp

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Efficacy of *Canna indica* L.: A Potential Tool for Phytoremediation

Priya D. Patil

Department of Botany, Vivekanand College, Kolhapur (Autonomous)

E-mail: ppriya.patil@rediffmail.com

Abstract:

The quality of the lithosphere, biosphere, atmosphere, hydrosphere, and biosphere are all impacted by environmental contamination. Over the past 20 years, a lot of work has been done to mitigate pollution sources and clean up contaminated water and land. In both academic and practical circles, phytoremediation is becoming more and more popular since it is less expensive and has fewer negative consequences than chemical and physical techniques. This paper attempted to assess the phytoremediation capacity of the plant *Canna indica* L. Culturing of this plant was done in kitchen waste water for 10 days. Waste water quality was analyzed before and after treatment by analyzing physical chemical properties. In order to know improvement in quality of wastewater different physical chemical parameters was analyzed. *Canna indica* showed an excellent potential of phytoremediation against the kitchen waste water.

Keywords*: Phytoremediation, Canna indica, pollution, waste water*

Introduction:

Phytoremediation is a cost-effective green technology based on the use of plants to remove, metabolize, assimilate, or absorb hazardous materials in soil (Wu *et .al,* 2015). The knowledge that aquatic or semi aquatic plants such as water hyacinth (*Eicchornia crassipes*), pennyworth (*Hydrocotyle umbellate*), duckweed (*Lemna mino*r) and Water velvet (*Azolla pinnata*) can take up Pb, Cu, Fe, and Hg (lead, copper, cadmium, iron, mercury) from contaminated solutions which existed for a long time. This ability is currently utilized in many wetlands, which may be effective in removing some heavy metals as well as organics from water. One phytoremediation method called rhizofiltration uses plant roots to absorb, concentrate, and precipitate metals out of water (Zhu *et .al,* 1999). Because they have larger surface areas for metal sorption and longer, tougher, and typically fibrous roots, terrestrial plants are thought to be better suited for rhizofiltration (Dushenkov *et .al,* 1995). *Canna indica* L. (Cannaceae) is an excellent option for removing heavy metals from contaminated water. Because it possesses a number of crucial characteristics of plants appropriate for phytoremediation.

Phytoremediation is proposed as a cost-effective plant based approach of environmental remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to detoxify various compounds. The concentrating effect results from the ability of certain plants called hyper accumulators to bioaccumulate chemicals.

Several field trials confirmed the feasibility of using plants for environmental cleanup. This study threw light on potential of *C. indica* for phytoremediation. The highlight made through this work with continued screening of the species *Canna indica* with a high potential for contaminant uptake and will contribute to the development of new and more effective phytoremediation approach.

Material and Methods:

Phytoremediation of domestic kitchen wastewater was done by using plant *Canna indica* L.

Experimental set up: The plants were collected from nearby areas, then they are washed thoroughly with tap water to the prior to the experiment. Collected plants are grown in 250 ml beakers filled with wastewater. The above setup was kept for 10 days and sample analysis was done. The parameters taken for assessment were pH, Electrical conductivity, total dissolved solids (TDS), COD, alkalinity and acidity. Wastewater must be tested with different physical-chemical parameters. Some physical parameters should be performed for testing of its physical appearance such as temperature, colour, odour, pH, TDS etc. while chemical tests should be performed for its COD, alkalinity, acidity etc. The results of the analysis of wastewater samples are expressed in terms of physical and chemical units of measurement.

Methods:

pH (APHA 1992):

pH was determined at the site by the potable water analyzer (systronics) and was confirmed by electrometric pH meter. The probe was immersed directly in the water collected in a wide mouthed sampling bottle at the sampling site immediately after collection for a period of time sufficient to permit constant reading.

Electrical conductivity (APHA 1992):

Conductivity is the capacity of water to conduct electric current and varies both with number and types of ions in the solution. The values of conductivity and TDS are interrelated.

Conductivity meter, was used to measure conductivity and expressed as m mhos or μ mhos/cm or as μS/cm.

Total dissolved solids (TDS) (APHA, 1992):

An electronic probe, which measures TDS was used. The values are expressed as mg/L of water. The probe was immersed directly in the water collected in a wide mouthed sampling bottle at the sampling site immediately after collection for a period of time sufficient to permit constant reading.

Alkalinity (APHA,1992):

Alkalinity was measured by *Sulphuric* acid titration method. The alkalinity of water is a measure of its capacity to neutralize acids. The alkalinity of water sample is recorded as follows**:**

P (phenolphthalein alkalinity), mg/L= A * 1000 / ml of sample

T (total alkalinity), mg/L= B * 1000 / ml of sample

In case $H_2 SO_4$ is not 0.02 N, then the following formula is applied

Alkalinity, mg/L = A / B * N * 50000 / ml of sample

Where,

A = ml of required to change from pink to colourless with phenolphthalein indicator

B = ml of $H_2 SO_4$ required to change from yellow to pinkish orange with methyl orange indicator

N = Normality of $H_2 SO_4$ used

Chemical Oxygen Demand (COD) Open Reflux method, using potassium dichromate (APHA, 1992):

COD is the oxygen required by the organic substances in water to oxidize them by a strong chemical oxidant. This shows the oxygen equivalent of the organic substances in water that can be oxidized by a strong chemical oxidant such as potassium dichromate in acidic solution. COD is the measure of oxygen consumed during the oxidation of the oxidisable organic matter by a strong oxidising agent. Potassium dichromate ($K_2 Cr_2 O_7$) in the presence of sulphuric acid is generally used as an oxidisng agent in the determination of COD. The sample is treated with potassium dichromate and sulphuric acid and titrated against ferrous ammonium sulphate (FAS) using ferroin as an indicator. The amount of ($K_2 Cr_2 O_7$) used is proportional to the oxidisable organic matter present in the sample.

COD value is calculated as,

COD (mg/L)=(Volume of titrant used in blank – volume of titrant used in sample) * N of FAS * 8 * 1000 / volume of sample taken.

Results And Discussions:

A experiment was designed to check the phytoremediation properties of *Canna indica* (Figure 1) on kitchen waste water.

Fig. 1: Experimental set-up for phytoremediation with *Canna indica* L. pl

Phytoremediation of wastewater was done using *Canna indica* L. The results of the study are given in table 1. Different parameters showed gradual change after treatment with the plant. In this study the plants the plant *Canna indic*a L. are collected from Kolhapur region. Both physical and chemical parameters were observed. Odour in domestic wastewater was caused due to decomposition of organic matter or from the substances added to the wastewater. There has been change in odour of waste water after the treatment with the plant. Colour of the wastewater which is typically of grey in color has been changed to normal. In the chemical and biological activities of water bodies, temperature place in wide. It always got influenced by external environmental conditions. So, there is radiation in temperature values in the culture of the plant.

Conductivity of water depends upon concentration of the salt ions and water temperature. Electrical conductivity of water helps to indicate waters purity. The pure water always has lower conductivity. As the concentration of dissolved ions increases, the ability of water to conduct electrical current also increases. It has been observed that, the conductivity got reduced in wastewater treated with *Canna indica* L. Total dissolved solids (TDS) value is an important parameter in drinking water and other quality standards. In the present study, TDS value had decreased from the first day in treated water. pH in water gives a straight picture of its acidic or alkaline nature and considered to be a significant parameter in water quality assessment. In the present study, slight variations were observed in pH values. pH values after treatment was decreased slightly. pH values got increased in first few days then it got reduced with slight variations. Acidity is the quantitative capacity of aqueous media to react with OH^- ions or to accept electrons.

In present work, acidic value gradually decreased after treatment of ten days. Total alkalinity is a measure of the buffer capacity of the water. Alkalinity is a measure of buffering capacity of water and is important for aquatic life in a freshwater system because it equilibrates the pH changes that occur naturally as a result of photosynthetic activity of phytoplankton (Kaushik and Saksena, 1989). In general, alkalinity should not be less than 30 mg/L and values higher than 400 to 500 mg/L are considered too high. Alkalinity after the treatment was reduced due to the absorption of dissolved solids.

COD is a measurement of oxygen consumed during the oxidation of oxidizable organic matches by using a strong oxidating agent. The higher value of chemical oxygen demand indicates that higher organic pollution in water sample. After treatment with plant, COD values have increased from the day of treatment.

DAY	pH	TDS	CONDUCTIVITY	ACIDITY	ALKALINITY	COD
DAY 1	6.2	53.9	70	40	120	58
DAY 2	5.8	49.2	41	21.3	105	92
DAY 3	5.7	42.4	39	18	92	142
DAY 4	5.6	36.51	35	17.2	65	188

DAY 5	5.6	33.4	32.5	16.5	51.25	161
DAY 6	5.5	20.79	27	15.2	40.75	153
DAY 7	5.4	20.6	26.5	15.6	35.6	139
DAY 8	5.4	20.51	26.1	13.5	31.3	132
DAY 9	5.2	20.3	25.4	12.6	28.7	125
DAY 10	5.2	19.25	25	10	19.25	124

TABLE 1: Chemical analysis of water sample after treated with plant *Canna indica* L.

Phytoremediation of domestic sewage water was done by using the plant *Canna indica* L. Different parameters a showed a gradual decrease after the treatment. The physical and chemical characters worship and absurd during those days of treatment. Temperature of water is an important parameter, which place a vital role in aquatic system. Temperatures always get influenced by external environment. pH explains certain significant biotic and abiotic ecological characteristics of aquatic systems in general. pH balance in an ecosystem is maintained when it is within the range of 5.5 to 8.5 (Chandrasekhar *et al.*, 2003). The Environment Protection Agency of United State's criterion for pH of fresh water aquatic life is 6.5 to 6.9. According to WHO (1998) safe pH limit is 7 to 8.5. But ISI (1991) range is 6.5 to 8.5. A pH range of 6 to 8.5 is normal according to the United States Public Health Association. When compared to all these Standards pH observed in treated waste water which was found within the permissible limit.

Electrical conductivity of water on the first day was higher, but after the treatment with *Canna indica*, there was a significant decrease in the electrical conductivity values. Electrical conductivity of water is dependent upon the concentration of dissolved ions and water temperature. As the concentration of dissolved ions increases, the ability of water to conduct electric current also increased. Electrical conductivity is a basic index to select the suitability of water for agricultural purposes (Kataria *et al*., 1995). EC in water is due to ionization of dissolved inorganic solids and is a measure of total dissolved solids and salinity. (Bhatt *et al*.,1999). Salts that dissolve in water break in to positive charge and negative charge ions. Dissolved solids affect the quality of water used for irrigation or drinking. They also have a critical influence on aquatic biota, and every kind of organism has a typical salinity range that it can tolerate. Moreover, the ionic composition of the water can be critical. These observations pointed out that EC is a highly variable factor in freshwaters. Conductivity is highly dependent on temperature. With decrease in concentration of dissolved ions and water temperature due to treatment with *Canna indica* L. electrical conductivity decreased.

Total dissolved solids content of water are defined us residue which is left upon evaporation at 103 degree celsius to 105 degree Celsius. It is aggregated amount of enter floating, suspended and dissolved solids present in water sample. TDS value concentration of dissolved solids is an important parameter in drinking water and other water quality standards.TDS values exhibited has been decreased after the treatment. Oxygen content is important for direct need of many organisms and affects the solubility and availability of many nutrients and therefore the most

significant parameter affecting the productivity of aquatic systems (Wetzel, 1983). DO is the sole source of oxygen for all the aerobic aquatic life and hence it is considered as an important measure of purity for all waters. Also the chemical oxygen demand of water was increased after the treatment with the plant and this indicate the wastewater has undergone to purification. The results showed that the conductivity, turbidity, TDS, DO and alkalinity is above the ISI standard. Other parameters such as pH and COD are below the permissible limit.

Conclusion:

Phytoremediation is a sustainable method for treating kitchen wastewater, according to the results of first and final treatment processes that took into account factors like pH, turbidity, TDS, COD, and BOD. Water quality was found to be improved and kitchen waste water treated with *Canna indica* plants. Over the duration of the experiment, water quality parameters like turbidity, TDS, COD, BOD and TDS revealed a considerable reduction. All along the trial, the pH of the water stayed in the range that was best for plant development and nutrient uptake, showing that the plants could flourish and successfully filter impurities out of the water. This process does not require high energy inputs, maintenance cost. The results of this study suggest that, *Canna indica* plant has the potential to be a cost-effective and environmentally friendly method for treating kitchen waste water. Treated wastewater can be reused for irrigation, washing, flushing tanks, plantation and other purposes.

References:

1. (APHA).American Public Health Association, American Water Works Association(AWWA) and Water Environment Federation (WEF). 1992. Standard Method for the Examination of Water and Wastwater.19th edition.Washington D.C.
2. Bhatt, L. R., P. Lacoul, Lekhak and P. K. Jha, 1999. Physico-chemical characteristics and phytoplanktons of Taudaha Lake, Kathmandu, *Poll. Res*. 18 (4), pp. 353-358.
3. Chandrasekhar, J. S., Babu and R. K. Somasekar, 2003. Impact of urbanization on Bellandur Lake, Bangalore – A case study, J. *Environ. Biol. 24 (3),* pp.223-27.
4. Dushenkov, S., Kumar, P.B.A. N., Motto and H., Raskin, I. (1995) Rhizofiltration: the Use of Plants to Remove Heavy Metals From Aqueous Streams. Environmental Science Technology 29(5), 1239-1245.
5. Kataria, H. C., . Iqubal and A. K. Sandilya, 1995. Limno-chemical studies of Tawa Reservoir, *Indian J. of Envtl Prtcn. 16 (11),* pp. 841-846.
6. Kaushik, S. and Saksena, 1989. Physico-chemical factors and the aquatic density of a pond receiving cotton mill effluence at Gwalior, MP State, India, Acta Botanica Indica 19, pp.113-116.
7. Wetzel, R.G., 1983. Recommendations for future research on periphyton: Wetzel, R.G. (Ed*), Periphyton of freshwater ecosystems*, Dr. W. Junk, The Hague, pp. 339-346.

8. WHO, 1998: Guidelines for drinking water quality, 2nd edition World HealthOrganization, Geneva.
9. Wu Z., Bañuelos G.S., Lin Z.Q., Liu Y., Yuan L., Yin X., and Li M. 2015. Biofortification and phytoremediation of selenium in China. Front. Plant Sci. 6(6): 136.
10. Zhu, Y.L., Zayed, A.M., Quian, J.H., De Souza, M. and Terry, N. (1999) Phytoaccumulation of trace elements by wetland plants: II. Water hyacinth. Journal of
11. Environmental Quality, 28 (1), 339-344.

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Study on Women Empowerment through Cookery and Bakery Skill Women development through cookery and bakery skill – A case study

Urmila Khot
Associate Professor
Vivekanand College Kolhapur (Autonomous)
Eamil:uskhot1008@gmail.com

Abstract: The aim of the study was to find impact of imparting cookery and bakery skill to women by either government or private institutions. In order to collect primary data the questionnaire was prepared and data collected with direct visit and interaction along with women. The study consist of the annual income raised during financial year, changes in their decision making capacity and confidence level, problems faced during inception of the business, employment generated due to acquired skill, women empowerment and contributions to the society and economic development of the country. It was overall concluded that almost 100% of women are earning as per their business set up and time devoted for the day. They got recognition in the society and few got awards for their contributions. Another important aspects in terms of contribution to the society was the employment generation and contributions towards economic development of the country. If similar skilling has been done in scale it would benefit to women fraternity and support towards employment generation and contribute to economic development.

Keywords: Bakery, Cookery, Skill, Women Empowerment

Introduction:

Government of India has initiated mission Skilling India to empower the people of the country with skill sets which make them more deployable in their work environment either organized or unorganized. It has also encouraged aspirants to seek required skill set in their domain of interest either through government/private training sector or at work place with earn while learn.

India is a country today with 65% of its youth in the working age group. This demographic advantage can only be obtain through skill development of the youth. It would add economic growth of the country in general and their personal growth in particular. (Skill Developement, n.d.)

The Indian food industry is considered as one of the sunrise sectors due to its high growth potential and profitability. The Indian food processing industry accounts for 32 per cent of the country's total food market and is ranked fifth in terms of production, consumption, export and expected growth. It contributes 8.8% of gross value addition in Manufacturing, 13% of India's export and almost 6% of Industrial Investment. India is not only a large producer of food but also has vast and growing consumer base along with. But Despite its strong agricultural production

base, a significant amount of food produce gets wasted in India due to inadequate infrastructure. (Resources, n.d.)

The major segments in the food processing sector in India comprise of fruits and vegetables, dairy, edible oils, meat and poultry, non-alcoholic beverages, grain-based products, marine products, sugar and sugar-based products, alcoholic beverages, pulses, Aerated beverages, Malted beverages, Spices, and Salt. Out of these segments, Dairy (16%), Grain-based Products (34%), Baker-based products (20%), and fish and meat products (14%) contribute to a major portion of industry revenues, apart from the manufacture of beverages.

India is the second largest producer of Fruits and Vegetables (F&V), accounting for 82 million tonnes and 10.9% of global fruit production, and 47 million tonnes and 8.4% of vegetables production. The prominent processed items are fruit pulps and juices, fruit-based ready-to serve beverages, canned F&V, jams, squashes, pickles, chutneys, and dehydrated vegetables.

It is estimated that the level of processing in F&V is about 2% and the wastage is about 25%. Juices and drinks from F&V dominate the produce in the organised sector, whiles pickles dominates the produce in the unorganised sector. (Resources, n.d.)

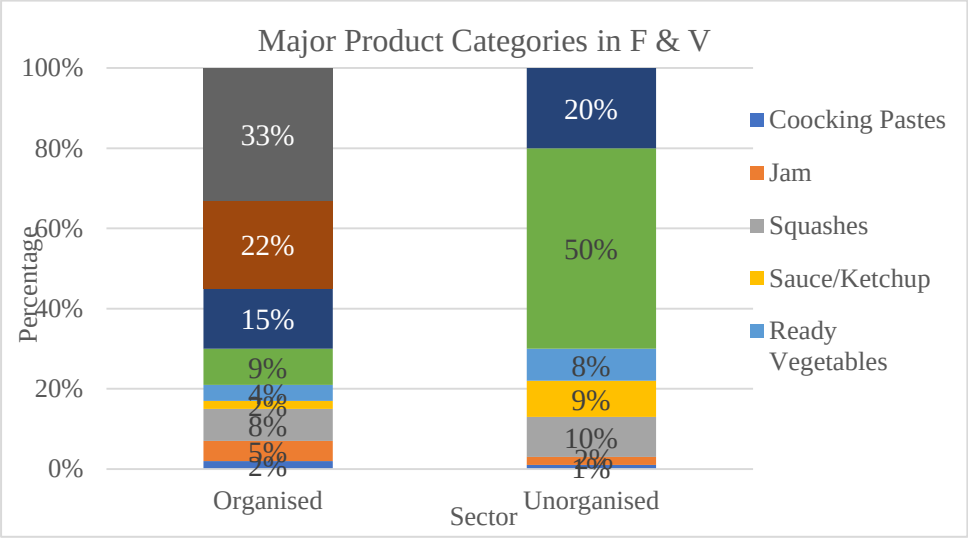


Figure 1 Major Product Categories in F & V

Source: FICCI Knowledge Paper on 'Processed Food and Agribusiness'

Projected Industry Size and Human Resource Requirements:

The Food Processing Industry is expected to grow from Rs. 3,600 billion in 2008 to over Rs. 15,600 billion by 2022. For the projected growth in the Food Processing Industry, it is expected that the requirement of human resource would increase from about 8.5 million in 2008 to about 17.8

million in 2022, an incremental human resource requirement of about 9.3 million persons15 till 2022. (NSDC)

Table 1 Projected size and human resource requirement for the Food Processing Industry (in '000 persons) till 2022

Sector	Size of Industry (Rs. Billion)					Human Resource and Skill Requirement				
	2008	2012	2018	2022	CAGR	2008	2012	2018	2022	Incremental (In '000 persons)
Fruit and Vegetables Processing	159	259	543	887	13.1%	140	183	273	357	216
Dairy Products	572	881	1686	2597	11.4%	1126	1385	1887	2320	1194
Bread and Bakery	714	1137	2288	3646	12.4%	3420	4348	6235	7928	4508

Source: ASI, NSSO, MOFPI Vision 2015, IAMR study on Food Processing Sector, and IMaCS analysis

Aims and the Objectives of the study:

The aim of this research was to study holistic changes in the women after acquiring required skills and either working as entrepreneur or doing job. By considering the need of imparting skill to women's in the area of food industry in general and bakery and cookery in particular. It was decided to identify the women those who acquired the skills either from government or private institutes in addition to where they work. Further it was decided to map the changes happened in their life.

The objectives of the study

1. To quantify the enhancement in the income of their family
2. Improvement in the confidence and decision making capacity
3. To identify the problem faced as women
4. To quantify the contributions towards society and nation

Research Methodology:

Research methodology was envisaged to study the impact of skill acquired women on their holistic development on the following aspects and analysis was done.

Geographical area:

Ichalkaranji city and nearby villages area demarcated to study impact of skill acquired bakery and cookery women's. Ichalkaranji has been considered as the Manchester of Maharashtra and major citizens involved in the textile business. Most of population come under lower and middle income group. It was reported that consumption of bakery and cookery items are reasonably high as compared to other part of nearby districts.

Sample collection:

Women having age group of 18 to 40 was selected for study having bakery and cookery skill pursued either from government and private institutes.

Data collection:

Data collection has been done through primary surveys using schedule method. Questionnaire has been prepared to collect information related to family background, income, problem faced as women, confidence and decision making capacity and contribution towards society and family. Data gathered through direct interview.

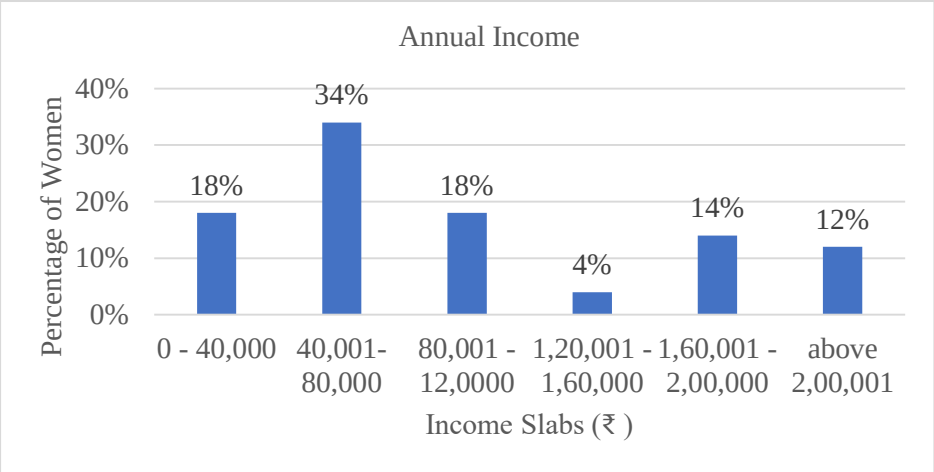
Data analysis:

Primary data collected through questionnaire was tabulated using excel software and different graphs were plotted. With reference to graph, analysis was done on the basis of the objectives of the study.

Results & Discussions:

Data analysis has been done on the basis of objective of study. Results discussed on the basis of the following

1. Contribution to family income



It has been observed form the Fig 2 that annual income of 100% skilled women has increased due to skill acquired in the cookery and bakery. 18% women's earned up to 40000, 34% from 40001 to 80000,18% from 80001 to 120000,4% from 120001 to 16000,14% from 160001 to 200000 and 12% above 200000 respectively.

2. Decision making power

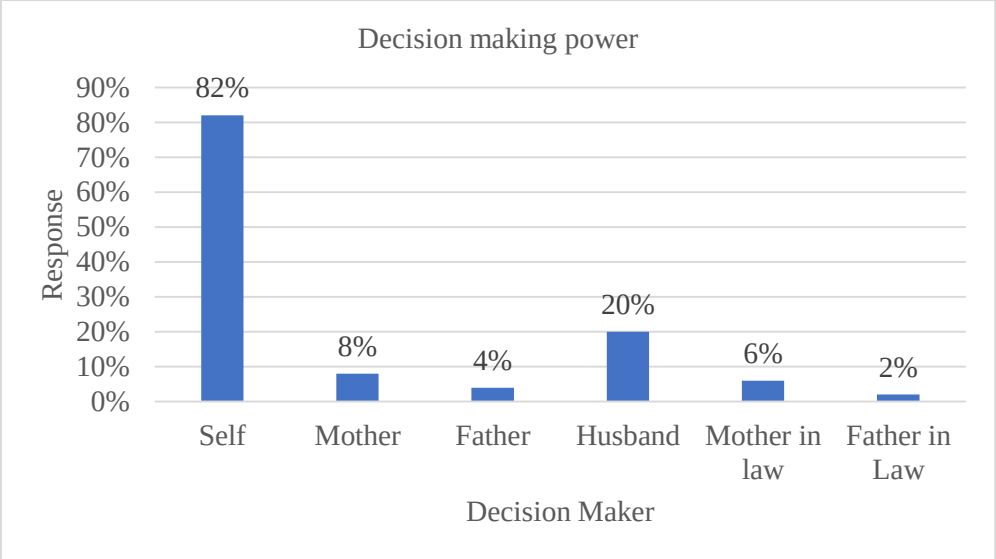


Figure 2 Decision making capacity of Women

Fig. 3 shows that 82% of women took their decision by own. Earlier they were dependent on their family members. It happens due to their self confidence in decision making which would help to support their family business.

3. Problem faced during inception:

The study was conducted to identify problem faced during starting of the business being as women. According data related to capital investment, business opportunity, competition and any other issues faced by the women were studied at length.

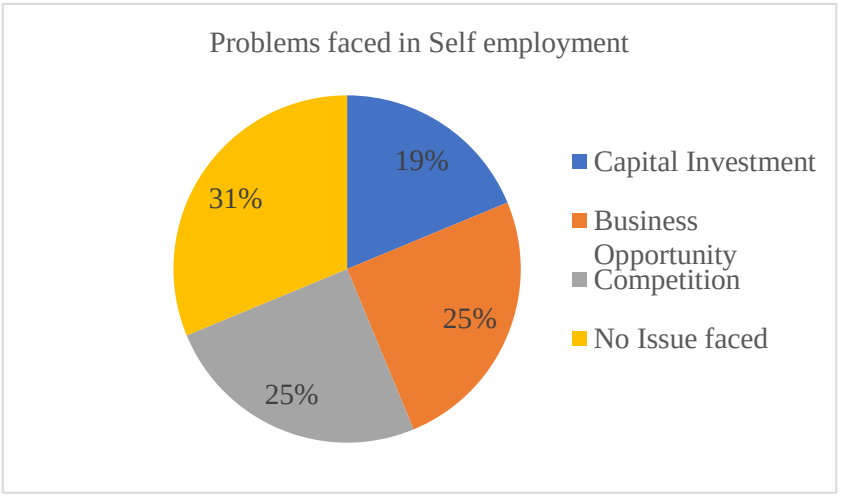
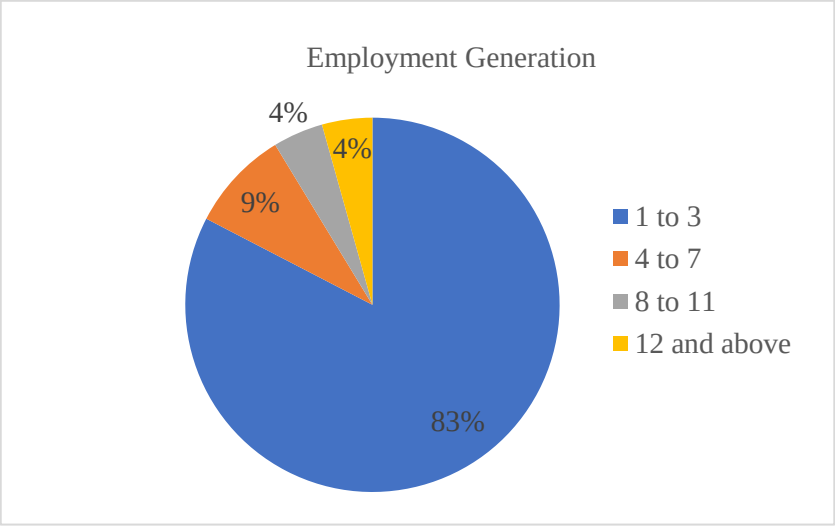


Figure 3 Problems faced by women

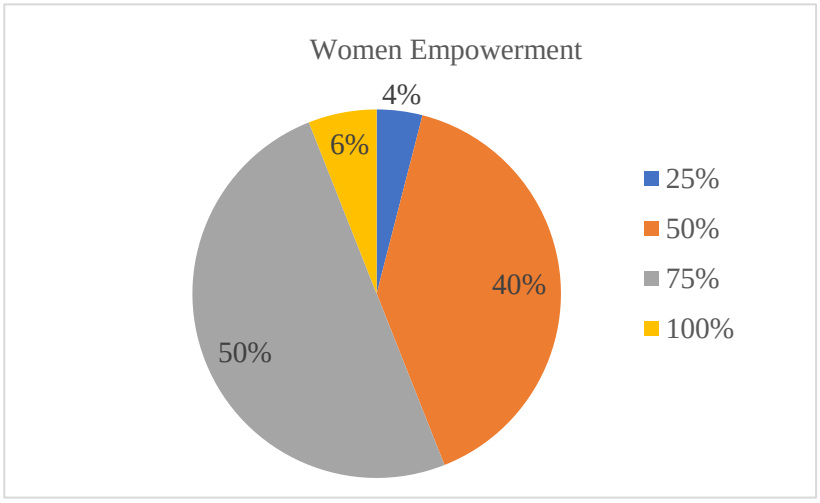
Fig.4 shows that, only 19% of the women faced to raise capital investment, 25 % to find business opportunity, 25% find competition among others and 31% did not faced any problem to start their business.



4. Employment generation:

Figure 4 Employment Generation due to Skill

How much employment could be generated by the skill acquired by cookery and bakery was identified through questionnaire. It feel very interested to present with reference to fig. 5 that 83 % of women created employment opportunity between 1 to 3, 9% between 4 to 7, 4% generated between 8 to 11 and 4% women generated employment for more than 12 persons.



5. Women Empowerment

Figure 5 Women Empowerment

Fig 6 highlights that, 6% women feel that they are empowered 100%, 4% women feels that 25% and 40% feels that they are empowered with 50% and 50% feels they are empowered with 75%. Overall it was observed that almost all women feel they are empowered.

Conclusions and Suggestions:

The Study on Women Empowerment through Cookery and Bakery Skill acquired was conducted using primary data collected through direct question answer with women. It was concluded with different parameters as follows

1. 100% of women start earning from 24000 to 200000 per annum.
2. 100 % women earn confidence and 82% of them start taking decisions on their own.
3. 98% of women start spending money in their interest.
4. 100% women got recognitions in the society and recipient of different awards at their places.
5. 50 % of women involved in the self-help groups as a member and office bearers and got benefits for their business promotion in the society.

Overall it shows that if such skill sets are provided to the women in big scale it would definitely contribute to their family, society and the economic development of nation.

References:

1. NSDC. (n.d.). Human Resource and Skill Requirements in the Food Processing Sector (2022). IMACS.
2. Resources. (n.d.). Retrieved from FICSI: Food Industry Capacity and Skill Initiative: http://www.ficsi.in/
3. Skill Developement. (n.d.). Retrieved from Ministry of Skill Developement and Entrepreneurship: https://www.msde.gov.in/skilldevelopment.html

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Promotion of Sports through Films: A Review of Some Films

Arya Kiran Patil
Vivekanand College,
Kolhapur (Autonomous)

Abstract:

India is a country full of diversity. In India you get to see prosperity in economic, social, educational, cultural, geographical, sports aspects. But not everything in this realm reaches the microscopic level of human society. Government implements many schemes and programs from time to time for the development of the society, but the promotion and dissemination of these schemes are often not done at the micro level. But through films, various schemes and programs are conveyed to people at a faster speed. Film is known as an effective audiovisual medium. Film helps to bring about social change in the society, hence the promotion of sports through films has been presented in this research paper.

Key Words :- Movies, gender, Sports, Propaganda, Broadcast etc.

Introduction :-

Although diversity exists in India in the 21st century, today gender inequality is strongly felt in the field of sports as in other fields due to the patriarchal system. But to remove this disparity, in fact, today film has become an important and effective medium for promoting and spreading the sport. Through many films it helps to shed light on the life story of sportswomen who have contributed to India today. It is certain that the society is aware of their struggle.

Research Methodology :

Secondary sources have been used for the present research paper. In this, the spread of the sport through films and the women athletes who have contributed to India are taken up in this research paper.

Objectives:

1) To study the promotion of sports through movies.

2) To study the careers of female athletes who have contributed through films.

Description:

Films play a unique role in making known things that are generally unknown. As a part of that, the researcher has chosen the topic of sports promotion through films for research. For this research paper the researcher is reviewing five films and some of the findings from these reviews are as follows,

In 2007, the movie 'Chak De India' was released. The film is based on a women's hockey team. Women's hockey team is considered secondary when it comes to competing at the national level, women's sportsmanship is considered secondary, but the women's hockey team belied this

stigma and won through the relentless practice and hard work of the women. Truly won the World Cup for India.

The movie 'Mary Kom' was released in 2014. The film revolves around the unusual story of a girl from an ordinary family who struggles with financial circumstances and wins an Olympic medal. Through this film, the pinnacle reached by such unequal individuals in the face of difficulties and problems reaches the elements of the society and certainly encourages many individuals and elements of the society.

The movie 'Dangal' was released in 2016. Indian culture is patriarchal. In many states of India, the girl child is still rejected. Challenging the patriarchal mindset and breaking the bonds of norms and traditions, the Phogat sisters have debunked the misconception that girls are simple, straightforward and fragile. Mahavir Singh Phogat introduced girls to wrestling with the aim of changing society's view of underestimating girls and empowering them to defend themselves. The Phogat sisters made the discrimination against girls secondary in developed states like Haryana. Overall, through such films, it is strongly felt that girls have started playing wrestling, which is known as a manly sport, with equal vigour.

In 2019, ‘Saand Ki Aankh’, a film based on rifle shooting, was released. It is the women of the Tomar family who are deprived of rights and authority in the household. Due to the patriarchal system and the position of the head of the family, women have always been given a secondary position in the household. The women of this family, which cultivates discrimination between men and women and gender discrimination, practice rifle shooting by defying all restrictions and gain fame in the society. Through such films bound women will definitely be encouraged to achieve their goals.

The movie 'Rashmi Rocket' was released in 2021. This movie is related to athletics. When a girl from a normal family does something unusual, certain elements of society come into play. The film shows that we are sometimes deprived of our sport due to many reasons like rich-poor gap, common man's limit of winning, abuse of office, false allegations, corruption in sports, financial situation. It is certain that the gender inequality in sports is exposed to the society through this kind of film.

Conclusion :-

Films have become an effective medium in today's era. Many elements of the society are encouraged for social awareness through many films. Through movies, the society has started to become aware that women can make a successful career in the world of sports as well. Films like Dangal, Meri Kom, Saand Ki Aankh, Rashmi Rocket, Chak De India have shown the success stories of many legendary female athletes of India. It is certainly a matter of praise that those who defied the constraints imposed by the society to maintain their existence in the sports world, achieved their goals and overcame the difficulties and problems of life. But a few years ago, the participation of girls in

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sports was very less, but nowadays it is seen that the participation of girls in sports has increased. Along with that earlier sports were considered only for high families, certain caste-religion. But today sports are reaching a micro level especially in rural and remote areas and new players are emerging from it. Obviously, they have an important role in making the country famous. That is why such effective films are sure to inspire many sportswomen in the country in the future.

References:-

Famous movies have been included for this research paper.

1. Chak De India - 2007
2. Mary Kom – 2014
3. Dangal - 2016
4. Sand Ki Aankh - 2019
5. Rashmi Rocket – 2021

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A Comprehensive Literary Review On The Posthumanism Reflected In Philosophy And Literature

Dr. Kavita Tiwade, Associate Professor, Department of English,
Vivekanand College, Kolhapur (Autonomous)
Email: kavitatiwade@gmail.com
Mrs. Shubhada Sachin Yadav, Assistant Professor, Department of Humanities and Sciences, School of Engineering and Technology,
Dr. D.Y. Patil Agriculture and Technical University
Talasande, Kolhapur.
Email: shubhadayadav123@gmail.com

Abstract:

Posthumanism is an opposite philosophical conception to humanism. It is an umbrella term that covers different philosophies like Antihumanism, Cultural Posthumanism, New materialism, Transhumanism and Artificial Intelligence (AI) Takeover. It has significant and relevant implications in the present as well as the future of mankind. Beyond postmodernist studies, the theory of posthumanism has been developed and expanded by several cultural theorists. Posthuman or post-human is a concept originating in the fields of science fiction, futurology, contemporary art and philosophy that denotes a person or entity that exists in a state beyond being human. The common and general theme of posthumanist study is to understand the process of posthumanisation and identify its critical impact on human being. The term Posthumanism is applicable to the extensive range of theoretical aspects of science, technology, philosophy, literature, critical theory and sociology. In the sphere of Literature, Posthumanism has acquired a significant position in science Fiction and Digital Literature. The present research is an attempt to make a comprehensive literature review on the reflection of the post humanist approach in philosophy and literature.

Key Words: Posthumanism, Antihumanism, Transhumanism, Science Fiction, Digital Literature, Philosophy, Technology, Futurology, Artificial Intelligence (AI).

Introduction :

Posthumanism is a theoretical concept which is considered as a reaction to the challenging inherent assumptions within the humanistic and enlightenment thoughts. Posthumanism represents an evolution of thought beyond the contemporary social boundaries and is predicated on the searching of truth within the postmodern context. It rejects previous attempts to establish 'anthropological universals' that are infused with anthropocentric assumptions. The common and general theme of posthumanist study is to understand the process of posthumanisation and identify its critical impact on

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human beings. Posthumanism attempts to explicate how change is enacted in the human world due to tremendous technical advancement. The posthumanist study deals with the questions subsequently emerging with respect to the current use and the future of technology in shaping human existence.

The term Posthumanism is applicable to the extensive range of prevailing theoretical aspects of science, technology, philosophy, literature, critical theory and sociology. Posthumanism attempts to explicate how change is enacted in the human world due to tremendous technical advancement. The common and general theme of posthumanist study is to understand the process of posthumanisation and an attempt to identify its critical impact on human beings. The term Posthumanism is applicable to the extensive range of theoretical aspects of science, technology, philosophy, literature, critical theory and sociology. Posthuman is a concept originating in the fields of science fiction, futurology, contemporary art and philosophy that denotes a person or entity that exists in a state beyond being human.

Posthumanism: Invention of Theory :

Posthumanism is a philosophical term that was first invented by the postmodern theorist **Ihab Hassan**, in his article entitled ***Prometheus as Performer: Towards a Posthumanist Culture?*** (1977). He used the term posthumanism to describe an era of the techno-scientific revolution, in which 'the human form - including human desire and all its external representations - may be changing radically, and must be revised. Ihab Hassan has used the popular mythological figure of Prometheus as a metaphor to indicate the emergence of 'Posthumanist Culture.' Hassan argues about the **'Death of Man.'** He considers that in posthumanist culture; death of man is associated with the both death of Humanism and the rise of the machine. In this article, Ihab Hassan describes Posthumanism as,

"Humanism may be coming to an end as humanism transforms itself into something one must helplessly call Posthumanism."

Philosophical Posthumanism:

Posthumanism is an opposite philosophical conception to humanism. The philosophical strand which relies on the Cultural posthumanism examines the ethical implications of expanding the circle of moral concern and extending subjectivities beyond the human species. Advocates of the posthuman discourse contend that new developments and technology have superseded the conventional human model put forth by Enlightenment philosophy. Theorists who complement as well as contrast Hassan include Michel Foucault, Judith Butler, cyberneticists such as Gregory Bateson, Warren McCullouch, Norbert Wiener, Bruno Latour, Cary Wolfe, Elaine Graham, N. Katherine Hayles, Benjamin H. Bratton, Donna Haraway, Peter Sloterdijk, Stefan Lorenz Sorgner, Evan Thompson, Francisco Varela, Humberto Maturana, Timothy Morton, and Douglas Kellner.

Posthumanism in Literature: Science Fiction :

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In the sphere of Literature, Posthumanism has acquired a significant position in the genre Science Fiction and Digital Literature. Recently, the writers of science fiction have amazingly created a new posthuman world in their fictional world to justify the drastic, dangerous and horrible effects of technical advancement on human beings. The literary genre, Science Fiction has many sub genres like Time Travel, Cyberpunk, Superhuman, Social Science Fiction, Space Opera, Hard Science Fiction, Soft Social Science Fiction, Military Science Fiction, Anthropological Science Fiction, Alternate History, Comic Science Fiction, Apocalyptic Science Fiction, Feministic Science Fiction, Bio-punk, Diesel-punk, Steam-punk, etc. All these sub genres strongly relate with the posthuman themes. Film adaptations of some Sci-fi novels on posthuman themes have created a horrified but marvelous effect on the audience.

Literary creation of extraterrestrial life, space travel, parallel universe, futuristic setting, futuristic science and technology, paranormal abilities, technological advancement, scientific innovations ,aliens, supermen and other mutations, men like God and God like men, robots, hominids, sentient machines and artificial intelligent, prediction of wars near and far, imaginary living ways and ways out, natural disasters and manmade disasters, uses and misuses of science and technology and possible new world are the characteristics of Science Fiction. Moreover, the works of 'Posthuman' authors have attained a word-winning, best- selling status and achieved notable awards and prizes. Posthuman literature reflects the symbolic hybrid i.e. a mixture of human and non-human characters which has finally been accepted as the tale of the dark future humanity or dangerous end of humanity.

Literary Review on Posthumanism in Philosophy and Literature

"As the archaeology of our thought easily shows, man is an invention of recent date. And one perhaps nearing its end" - Michel Foucault

The great philosopher **Michel Foucault** marked posthumanism within a different framework that separated humanism from enlightenment thought. In the most popular philosophical work, *The Order of Things: An Archaeology of the Human Sciences,* Foucault reports about the birth and forthcoming demise of Man as an object of study for science and philosophy. The above thought-provoking quotation reflecting the emergence of posthumanism is the part of the conclusion of his book *The Order of Things: An Archaeology of the Human Sciences.*

"Where humanists saw themselves as distinct beings in an antagonistic relationship with their surroundings, posthumans regard their own being as embodied in an extended technological world."- Robert Pepperell

The great philosopher **Robert Pepperell** has written a book *Posthuman condition: Consciousness Beyond the Brain* first published in 1990 which is often replaced for the term Posthumanism. The philosophical work Posthuman Condition argues that it is very difficult to tackle the questions about the concepts of human existence, inherited from humanism in this posthuman era of intelligent

machines, organic computers Synthetic creativity, genetic modification. These technical miracles have proven human superiority but ironically these inventions are causing the 'The End of Man'. Human beings are really proficient in creating entities that surpass our own intellect and skills then the penalties for humanity are nearly unimaginable.

N. Katherine Hayles, a scholar of the history of technology, cultural studies and literary criticism, writes about the struggle between different versions of the posthuman as it continually co-evolves alongside intelligent machines in her book *How We Became Posthuman*. According to Hayles, posthumanism is characterized by a loss of subjectivity based on bodily boundaries. Hayles's view of posthuman is often referred to as technological posthumanism. She deliberates her view on posthumanism by translating human bodies into information. The extensive use of technology in contemporary society and in the upcoming future complicates this relationship between human and non-human species. How We Became Posthuman, provides an indispensable account from the birth of cybernetics to artificial life of humanity. She discusses the arrival of virtual age and unknown destination of humanity and tries to investigate the destiny of embodiment in the information age.

Ted Schatzki, a great philosopher, suggested two philosophical varieties of posthumanism as objectivism and an emphasis of social practices over individuals. Science fiction authors like Greg Egan, H. G. Wells, Isaac Asimov, Bruce Sterling, Frederik Pohl, Greg Bear, Charles Stross, David Simpson, Neal Asher, Ken MacLeod, Peter F. Hamilton and authors of the Orion's Arm Universe have created an outstanding mark with their works related to posthuman futures and themes. Many researchers across the world have studied posthumanism. Hence, posthumanism has been welcomed as a new theoretical standpoint that has the potential of inspiring scholars studying many distinct fields ranging from cultural studies to education and from sociology to literary studies and arts. Such inspiration will inevitably affect the literary analyses that will be conducted in the future. Here it is intended to review the relevant literature regarding the research topic.

Ricardo Gil Soeiro in his project work, *Posthumanism: Posthumanist Literary Imagination* aims at the exploration of the ways in which posthumanist literary imagination contributes to the critical awareness of the limits of traditional anthropocentric and humanistic assumptions. Posthumanism is thus drastically stimulating boundaries between the human and the non-human, the self and the other, the organic and the technological domains. The present project is significantly conducting case-study analysis of paradigmatic literary works reflecting post-dualistic and non-hierarchical issues such as otherness, subjectivity and ethics. This project offers a multi-layered posthumanist approach for re-thinking of far-reaching debates on the future of humanism and a prompt reassessment of posthumanist theory.

Arda Arikan, in the study on Posthumanism, *Posthumanism and Literary Theory* published in 2019 discusses posthumanism. According to him Posthumanism is a literary theory which focuses

upon its relationship with other contemporary theories from a historical and philosophical perspective. This posthumanist spirit has affected people who are already aware of oppressive and hegemonic discourses of post-colonialism that oppress and silence the disadvantaged such as ethnic or religious minorities and LGBT members, peace builders and activists struggling for the rights of refugees all are represented in various literary texts.

Sunyoung Ahn explores the great cultural and political significance of the posthuman concept in early twenty-first-century novels. These representations are noteworthy due to their capacity to expose the questions like transgress attitudes of human privilege, and notions of the future of humanity and cultural construction of human identity in the most famous work *The Human against itself: Posthumanism in Contemporary Novels.* Thinkers of posthumanism have taken up these questions very enthusiastically for the research and discussions. The primary argument is that human superiority over nonhumans is an illusion and consequently human superiority is an illusion. It is further explained that the power dynamics and socioeconomic landscapes in which humans assume the superior position of holding power over nonhumans are rejected by posthumanism. The eminence of the human in the world is significantly abridged as their trajectory of life is contingent upon the dynamic and material reality.

The life-affirming posthumanism demotes the human subject and allocates excessive high level to all nonhuman things. The human, however an essential part of the life, is not considered as the dominant figure of the universe but merely a part of the larger environment. Humans can never dominate it entirely. The persistent mission of the posthumanist scholarship is an attempt to eradicate the human from the center of the earth for the ethical remediation purpose. In posthumanism, the human is still considered as the independent subject in the universe which is capable of detaching itself from the surrounding world.

Posthumanist Aspects in Select Novels of Kurt Vonnegut by J. X. Herbert, Dr.Suresh Frederick portrays Posthumanism as an emerging anthropocentric philosophy that investigates the impact of science and technology on humans. This paper is a critical analysis of Kurt Vonnegut's selected novels *Galapagos* and *The Sirens of Titan.* Kurt Vonnegut has used some fictional and prophetic scientific elements which predict the impact of scientific and technical inventions on human lives. Kurt Vonnegut deals with space travel and human life on Mars in T*he Sirens of Titans* with a posthumanist perspective. Advancements in technology and its excessive use gives birth to antihuman bodies which is a very dangerous thing for humanity This synchronising aspects of posthumanism in the novels of Kurt Vonnegut's have been evaluated and widely explored in this research work.

Posthumanism is an 'opportunity' with their imminent challenges for the future of the humanities. These challenges refer to the loss of traditional values or transformation of traditional subjects and objects of humanist perspective into posthumanism. This view is signified by Ivan

Callus, Stefan Herbrechter & Manuela Rossini in their research work *Introduction: Dis/Locating Posthumanism in European Literary and Critical Traditions.* Accepting these challenges might expand the scope of humanities; like rebirth of the humanities in new forms such as the medical humanities, digital humanities, the environmental humanities, the neuro-humanities etc. These disciplines can be grouped under the umbrella term of 'posthumanities' and play a crucial role in providing guidance and critical commentary for all posthumanist practices in diverse domains.

The Palgrave Handbook of Posthumanism in Film and Television is edited by Michael Hauskeller, Thomas D. Philbeck and Curtis D. Carbonell is. This handbook is structured in eight parts. The Part I is titled as 'Paving the Way to Posthumanism: The Precursors' stresses upon the intellectual influences which have given birth to the posthumanist discourse. The concepts of Deleuzian posthumanism like 'bodies without organs', 'desiring machines,' 'individuated entity' 'transhumanist notions of the self' are critically acclaimed and highlighted. The second part titled as Varieties of People-to-Come: Posthuman Becomings focuses on the imaginative factors related to the different ways of the posthuman and transhuman future which is already in the process. The third section Machines: Posthuman Intellect focuses on the Rise of Artificial intelligence (AI) and its consequences. Part IV, Body and Soul: Posthuman Subjectivities concentrates on virtual reality and actual reality.

Part V Better Humans: Posthuman Capacities addresses technological modification represented in film and television as a phenomenon of human enhancement. Part VI is Creating Difference and Identity: Posthuman Communities. This section explores the social dimension of posthumanism with the community of human, non-human and post-human creatures. This section is an attempt to find reliable solutions to the question -What kind of communities are possible and/or desirable in a posthumanist world? Part VII -Us and Them: Posthuman Relationships concentrates upon Anat Pick's statement about narratives of screened animals. The last section is Part VIII – More Human than Human: Posthuman Ontologies. This final section examines the construction of the posthumanist frameworks with strong evidence through the use of SF examples, ontological influences and themes.

Reading Posthumanism: Contemporary Fiction and Critical Theory by Luke Hortle studies the recent theoretical debates about posthuman and posthumanism. Posthumanism is carried out by both literature and theory. In a conceptual framework it tries to explore the prominence of the posthuman in fiction. The central argument or theme of this thesis is the cultural and political work related to the posthuman characters and themes shown in the novels. It argues that novels about the posthuman theme interfere with theoretical projects within the Western cultural imagination. This thesis broadly investigates the persistent portrayal of the posthuman as a queer figure in the selected novels. This queer manifestation of the posthuman is aggressive in its commotion of any normal sense

of the human future. The complexities and ambiguities underlying in cultural, traditional literary works with human as a central theme are the main issues related to the detailed textual analysis of the posthuman in contemporary literature particularly novels and film adaptations.

Conclusion:

Thus many researchers, philosophers, literary authors, literary critics and scholars of various domains of knowledge have reflected their prominent opinions about the emergence of Posthumanism as a reaction to humanism. The above review is an attempt to signify the dark future of humanity in the era of meticulous advancement of science and technology. The above review of philosophical works, literary works and research works stress upon the arguments such as 'human versus non-human', 'natural versus artificial', 'alive versus non-alive' and 'biological versus mechanical'. This view predates most currents of Posthumanism which have developed over the late 20th century in somewhat diverse but complementary domains of thought and practice.

References :

1. Atwood, Margaret. The Year of the Flood United Kingdom: Bloomsbury Publishing.2009
2. Badmington, Neil. Posthumanism Readers in Cultural Criticism: Palgrave, Macmillan.2000.
3. Foucault, Michel. The Order of Things: An Archaeology of the Human Sciences. New York: Pantheon.1971.
4. Pepperell, Robert. The Posthuman Condition: Consciousness Beyond the Brain by Intellect Books, Bristol, U.K., 2003.
5. Hayles, N. K. How we became Posthuman .74th ed. University of Chicago Press.1999.
6. Soeiro, Ricardo Gil. Vibrant Matter: Posthumanism as an Ethics of Radical Alterity. *Revista 2i: Estudos de Identidade e Intermedialidade* 2, no. 2: 191–204.2020.
7. Arikan, Arda. Posthumanism and Literary Theory.
   5th International Language, Culture and Literature Symposium. ISBN: 978-605-84052-6-4.2019.
8. Hortle, Luke. Reading the Posthumanism: Contemporary Fiction and Critical Theory.https://figshare.utas.edu.au/articles/thesis/Reading_the_posthuman_contemporary_fiction_and_critical_theory/23239505.2023.
9. Badminton, Neil. Posthumanism: Alien Chic and the Other Within. New York, USA: Routledge. 2004.
10. Badmington, Neil. Posthumanism. Routledge Companion to Science and Literature, edited by Bruce. Rossini Clarke, Manuela. New York, USA: Routledge.Bogue, Ronald. 2011.
11. Ahn, Sunyoung. The Human Against Itself: Posthumanism in Contempory Novels. University of Minnesota.2015.

12. Frederick, Suresh. Herbert, J. Speculating the Posthuman Scenario of Man vs. Machines in Kurt Vonnegut's Player Piano. Journal of Language and Linguistic Studies, 17(4), 22503-2511.2021.
13. Callus, Ivan. Herbrechter, Stefan. Rossini, Manuela. Introduction: Dis/Locating Posthumanism in European Literary and Critical Traditions. European Journal of English studies. Vol.18. Issue 2. European posthumanism.2014.
14. Hauskeller, Michael. Philbeck, Thomas Carbonell, Curtis D. Palgrave Handbook of Posthumanism in Film and Television. Palgrave Macmillan Publications.2015.
15. Deleuze on Literature. London, UK: Routledge.Bogue, Ronald. 2007.

Webliography:

www.britannica.com
https://shodhganga.inflibnet.ac.in/handle
https://ardaarikan.weebly.com/uploads/1/0/2/9/10295113/posthuman_lit_theory.pdf
https://en.wikipedia/wiki/multiculturalism
https://www.enotes.com/topics/multiculturalalism
https://www.post-humannovel.com

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Analysis of Rainfall Variability in Kolhapur District

Dr. Govardhan S. Ubale1

1Associate Professor, Department of Geography

Dr. Shubhangi Kale, Dr. Sunil G. Bhosle3 Dr. Siddharth S. Ghoderao4

, Vivekanand College, Kolhapur (Autonomous) Maharashtra.

2,3,4Assistant Professor, Department of Geography,

Vivekanand College, Kolhapur (Autonomous) Maharashtra

Abstract:

All living things, including animals, plants, people, and agriculture, depend on water as a basic resource. Water also has an impact on the nation's industrial and commercial sectors. Kolhapur, sometimes referred to as southern region of Maharashtra. The studied area's physical environment, the presence of the Sahyadri highlands, foothills, plains and shifting climatic conditions all contributed to the varied and irregular pattern of rainfall distribution. It has been discovered that while August rainfall is growing in tehsils, the proportion of June, July, and September rainfall to the annual rainfall is declining. In 2023 Kolhapur has received very less rainfall. Also according to tehsil there is diversity in this. Rainfall is more in some tehsils and rain has decreased in more places. So it is necessary to study its details.

Introduction:

It is important to find out if the features of the Indian summer monsoon are altering in relation to climate change. The rainfall during the Indian summer monsoon, which lasts from June to September, is essential for the nation's hydrological planning, disaster relief, and economic growth. Despite the expansion of the service sector, India's economy remains heavily rely on agriculture. The country faces severe challenges from crop failure, drought, and even catastrophic situations like starvation brought on by insufficient or weak monsoons. Consequently, it's critical to keep a careful eye on the country's daily, weekly, monthly, and seasonal rainfall variations.

Humans require water for fundamental needs such as drinking, agriculture, industry, etc. The country's industrial sector, farming practices, and other economic sectors have all been impacted by the distribution of rainfall. Since Indian agriculture depends only on the monsoon, rainfall or precipitation has been the most significant element influencing agricultural productivity and advancement in the Indian subcontinent. Rainfall is distributed unevenly and varies from tehsil to tehsil within the research region. Large-scale precipitation occurs throughout the monsoon season in the studied region. Water use is therefore crucial to agricultural productivity.

Study Area:

The Kolhapur district is a part of Deccan plateau and western Maharashtra and extremely southern part of Maharashtra state is Kolhapur district lies between 15˚ 43' north to 17˚ 17' north latitude and 72˚40' east to 74˚ 42' east longitude. The Kolhapur district comprises 7620 sq. km area which is 2.5 % of the state. The general height of the district is 1000 mtrs and administratively divided into 12 tehsils supports 38, 74,015 population (2011). In general the physiographic arrangement of the district has Sahyadri hills in a north-south direction, plateau area situated to the east of the Sahyadri hills and eastern plain area and Belgum district of Karnataka state in the south. The climate of Kolhapur is generally temperate. Minimum temperature of the district is 14 c and maximum is 36.9 o c. The average annual rainfall is 1881.1 mm. The decadal growth rate (2001-2011) of population is 17.85 per cent. From the Kolhapur district around 70% of total population lives in rural area.

Objectives:

1) To study the rainfall distribution in Kolhapur district.
2) To study the tehsil wise variability of rainfall distribution in Kolhapur district.

Data Base And Methodology:

The socioeconomic abstract of the Kolhapur district (2020) provided the majority of the secondary data used in this study, which also employed the annual rainfall dada for the years 2023 to conduct its inquiry. For basic information, the Kolhapur district gazetteer is also utilized. In addition to using basic statistical methods like mean and percentage to understand the distribution of rainfall and its properties, tehsil-wise variability is determined by calculating the departure from average rainfall. The choropleth map technique was also used to display the variability of rainfall.

Discussion:

The rainfall distribution in Kolhapur district for 2023 is depicted in the bar graph above. Additionally, Gaganbavada tehsil (3444.1mm) has recorded the most rainfall during this time, followed by Bhudargad tehsil (1715.6mm) and Shahuwadi (1487.6mm), respectively. Karveer tahsil, Kagal received average 750 mm rainfall. Ajara, Chandgad and Radhanagri tehsils received 1000mm to 1400mm rainfall. The least amount of rainfall received by Shirol tehsil (494.9 mm).

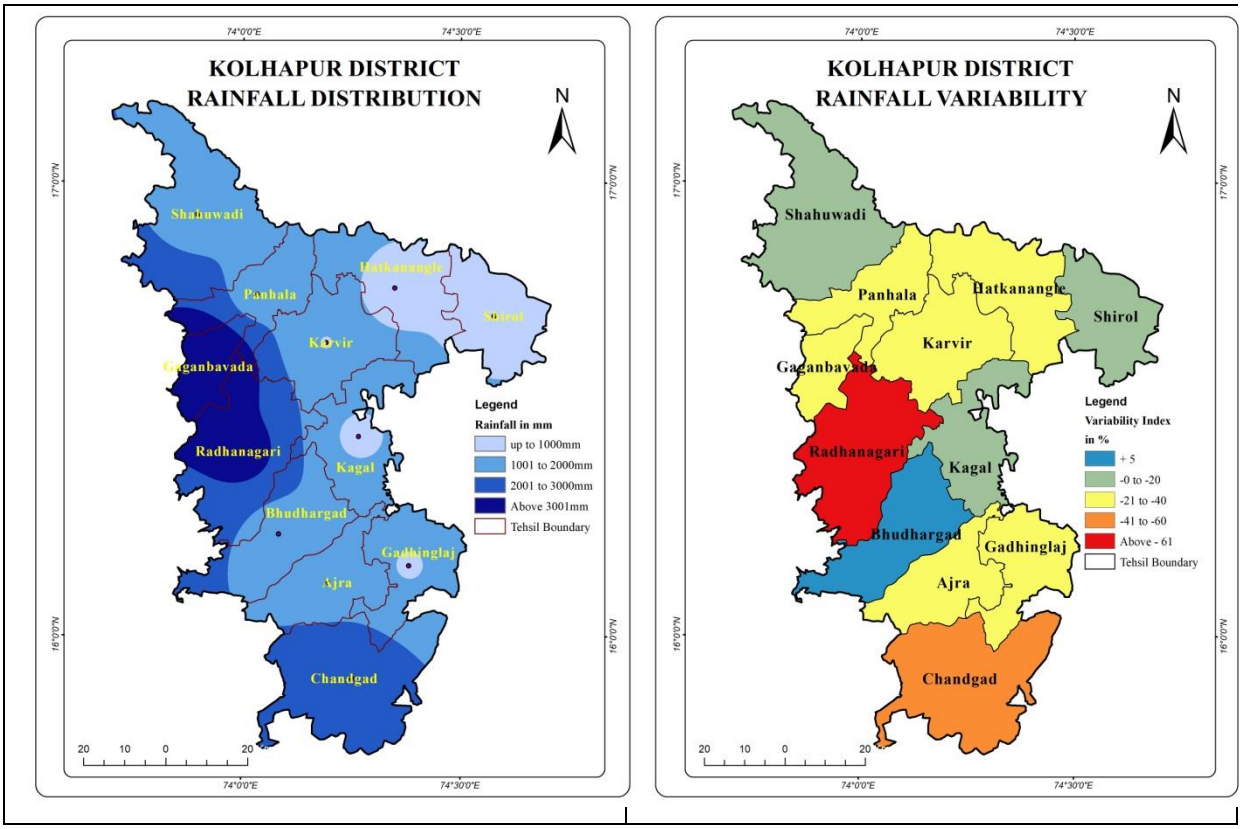
Rainfall distribution in Kolhapur district (2023)

Sr. No.	Tehsil	Normal Rainfall	Actual Rainfall	% To Normal
1	Hatkanangle	668.0	512.5	76.7
2	Shirol	570.6	494.9	86.7
3	Panhala	1611.6	1067.5	66.2
4	Shauwadi	1787.4	1487.6	83.2
5	Radhanagari	3574.5	1348.3	37.7
6	Bavda	5507.9	3444.1	62.5
7	Karveer	982.6	757.9	77.1
8	Kagal	792.0	756.8	95.6
9	Gadhinglaj	932.9	659.7	70.7

10	Bhudargad	1592.0	1715.6	107.8
11	Ajara	1874.4	1354.7	72.3
12	Chandgad	2783.3	1424.0	51.2
Kolhapur District		1881.2	1048.2	55.7

Source- *Indian Metrological Department (IMD), Pune*

Rainfall distribution and Rainfall variability in Kolhapur district (2023)



Source- *Indian Metrological Department (IMD), Pune*

The rainfall distribution in Kolhapur district for 2023 is depicted in the bar graph above. Additionally, Gaganbavada tehsil (3444.1mm) has recorded the most rainfall during this time, followed by Bhudargad tehsil (1715.6mm) and Shahuwadi (1487.6mm), respectively. Karveer tahsil, Kagal received average 750 mm rainfall. Ajara, Chandgad and Radhanagri tehsils received 1000mm to 1400mm rainfall. The least amount of rainfall received by Shirol tehsil (494.9 mm). Kolhapur District's average rainfall being around 1881.2 mm. Using a choropleth map, it displays the rainfall distribution by tehsil in the Kolhapur district for 2023. There has also been rainfall of up to 3000 mm in the tehsils of Gaganbavada (3444.1). The range up to 1000 mm rainfall presented in the Hatkanagale (512.5), Shirol (494.9), Karveer (757.9), Kagal (756.8) , Gadhinglaj (659.7).

Rainfall Variability:

Rainfall data for 2023 for each tehsil in the Kolhapur district is computed to determine rainfall variability. Additionally, variability was computed using the following method, which compared the average rainfall of the district to the average rainfall of the tehsil.

Variability of Rainfall = X - % of precipitation from mean x100

Here,

X = Mean of Rainfall of Kolhapur district

Kolhapur District: Tehsil wise Rainfall Variability in Percentage (2023)

Sr. No.	Tehsil	Actual Rainfall	% To Normal	Variability in %
1	Hatkanangle	512.5	76.7	-23.3
2	Shirol	494.9	86.7	-13.3
3	Panhala	1067.5	66.2	-33.8
4	Shauwadi	1487.6	83.2	-16.8
5	Radhanagari	1348.3	37.7	-62.3
6	Bavda	3444.1	62.5	-37.5
7	Karveer	757.9	77.1	-22.9
8	Kagal	756.8	95.6	-4.4
9	Gadhinglaj	659.7	70.7	-29.3
10	Bhudargad	1715.6	107.8	+7.8
11	Ajara	1354.7	72.3	-27.7
12	Chandgad	1424.0	51.2	-48.8
Kolhapur District		1048.2	55.7	-44.3

Source- *Compiled by researcher*

The Kolhapur district's tehsilwise rainfall variability is seen in this figure. Additionally, it has demonstrated how rainfall occurs unevenly and differs from tehsil to tehsil. Kolhapur district has -44.3 % rainfall variability. Devgad tehsil (37.7) has the least amount of rainfall or the biggest variability, which is almost -62% of the district's normal rainfall. The rainfall variability in Chandgad tehsil is high—48.4%. The Kagal tehsil had the lowest variability, at -4.4%. Shirol tehsil (-13.3%). One of the tehsil has received more rainfall than normal that is Bhudargad tehsil (107.8%) and variability is +7.8 %. Where there is less rainfall, there is more unpredictability in the rainfall, but here there is also variability from the monsoon and the presence of the ocean.

Conclusion:

The research area has a wide range of rainfall, and because the monsoon's intensity and regularity fluctuate, so does the rainfall's spatial distribution from tehsil to tehsil. The monthly and yearly rainfall is displayed in several ways. It was shown that the Gaganbavada tehsil has the most rainfall. Shirol tahsil receives the least amount of rainfall, with Kolhapur District's average rainfall being around 1048.2 mm. The Radhanagari tehsil has the greatest rainfall variability, with rainfall there varying by almost -62% above the district average. The rainfall variability in Chandgad tehsil is high—48%. The Bhudargad tehsil has the lowest variability in 2023.

References:

1) Kremer, H, Pacyna, J, and Pirrone, N, (2002): Regimes of regional and global change. Journal of Reg. Environmental change 3: 2-4pp.
2) Gadgil, A,(2002): Rainfall characteristics of sever rainstorms of India. Theoretical And Applied Climatology, v. 50, pp. 95-100.

3) Hire, P. S, and Gunjal, R. P, (2007): Detection of changes in the annual rainfall of the Nashik District: Maharashtra. Maharashtra Bhugolshashtra Parishad, v. 20 No. 1, pp. 3-7.

4) Hire, P. S, and Gunjal, R. P,(2007): Regimes Characteristics of Rainfall of the Nashik District: 29th National conference of Maharashtra Bhugolshashtra Parishad, ISBN 978-93-81354-40-7,pp.74-85.

5) Ubale G., Patil R., (2022): Study of Rainfall variability in Sindhudurg district, Maharashtra, The Konkan Geographer, ISSN 2277-4858, pp.94-97.

6) Pardishi R., Dhayagode N., Shinde N., (2013): Climatic and Water Impact on Drought prone area in Solapur district. 29th National conference of Maharashtra Bhugolshashtra Parishad, ISBN 978-93-81354-40-7, pp.143-146.

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Challenges Faced by Married Female Students in Higher Education

Mr. Ashish Bhasme

Assistant Professor, Department of Economics,

Vivekanand College, Kolhapur

Email:ashish.bhasme@gmail.com

Mrs. Komal Oswal

Assistant Professor, Department of Sociology

Shivaji University, Kolhapur.

Email:oswalkomal9@gmail.com

Abstract:

The importance of education has been recognized by every civilization. Prior to the twentieth century, only a few females were granted access to education. Despite of the recognition of the significance of female education, there are many barriers in their way to higher education to give their cent percent input for the betterment of society in Indian context. Married females are expected to prioritize looking after domestic work and children then education. Females who enroll for higher education after marriage have to perform multiple roles and are also faced with multiple problems too. For this study, researchers have used primary as well as secondary data. Researchers found that most women face the problem of unable to concentrate on academic work due to domestic work. They are expected to perform each and every ritual of all the festivals, even the guests need to be attended and attendance in various ceremonies is a must. If the woman is working then she is overburdened with all the three responsibilities. As a researcher, we suggest that, socialization of both boys and girls should be the same, scholarships or fellowships beneficiaries should be increased and minimum age of marriage should be increased.

Keywords: Female students, higher education, socio-economic challenges.

Introduction:

Education has been long recognized as a vital key for the development of the nations. It is one of the major instruments for bringing about social, political, economic, scientific and technological development of any country. For this simple reason, both developing and advanced nations invest a larger proportion of their annual budget in educational sector of their economy.

Education is a key that provides opportunities for self-awareness and self-fulfillment to every individual. Importance of education has been recognized by every civilization. It is a fundamental right and contributes significantly in achieving equality, peace and development. It provides equal opportunities to human beings to play a vital role in society. It is believed to provide knowledge and resources that hold capacities for economic empowerment, for better livelihood and social

development. It is one of the most far-reaching requirements for development, alleviating poverty, improving health and quality life, reducing gender disparities and enhancing economic productivity.

Prior to the twentieth century, only a few females were granted access to education. The number of illiterate women were naturally more as they have never been sent to school or they had no access to education. It was at this time; women were victims of all types of discrimination and were marginalized by social and cultural practices especially in traditional Indian society. They were the victims of all forms of socio-cultural constraints. Indian society which was male dominated patriarchal society denied access to women's education as the fortunate male members of the family were to be educated.

Thanks to the efforts of Savitribai Phule and Mahatma Phule to initiate female education. It is rightly said by Mahatma Phule "if you educate a boy, you educate a single person but if you educate a girl, you educate whole family". Women's education is a must for progress and prosperity of a nation. The present scenario depicts that women in the entire world have established themselves as managers, bankers, teachers, doctors, pilots and so on. According to Chowdhary and Rahman (2009) through higher education women are able to internalize the particular culture of their society in which they are expected to be a good wife and wise mother.

Despite of the recognition about the significance of female education, there are many barriers in their way to higher education to give their cent percent input for the betterment of society in Indian context. The mind set of society hampers the attitudes of higher education, for females specifically. Females after marriage are given less opportunities for higher education. Married females are expected to prioritize to look after domestic work and children then education. Females who enroll for higher education after marriage have to perform multiple roles and are also faced with multiple problems too.

The involvement of females in higher education is increasing but the proportion is very small. With this background the study is designed to explore social, cultural, economic and domestic problems of married females.

Review of Literature:

1) Chigona and Chetty (2007), their research paper deals with the student mothers, who face a lot of challenges in pursuing higher education. The paper identified that lack of time to study and do academic home assignments is one of the major challenges confronting a student-mother. They face challenge to balance their child care and academic work. The cause of the challenge was financial problems which made young mothers to neglect quality child care services since they cannot pay the fees for it. On the other hand, the paper also revealed that there were mothers who were able to deal with the situation and were able to blend their course work with their family life without any breaks.

2) C. Gopalakrishnan and K.Shunmuga Priya (2014) this research paper deals with average age at marriage of the girls. In the paper there were 1/4th respondents who were pregnant and about 40 percent had undergone an abortion. The paper also reveals that the educational performance has decreased after marriage the reason being obvious not able to concentrate in their studies. The paper finally concludes that counseling of various safety methods of conception and also some counseling of students in their institutions.
3) Patricia Mawusi and Esther Manieson (2015) their research study has made an attempt to identify the domestic and academic issues that a married woman faces in tertiary institutions. The research paper observed that taking care of family members was difficult due to school related activities and this was a major domestic challenge and their major academic challenge. The effects of these challenges were low concentration in lectures and low performance. The suggestions of the research paper were if the pressure from households should be minimized and even reducing the number of programs which have to be covered at the university can help them to handle the situation.
4) Dr. Malik Ghulam Behlon, Dr. Najeebullah and Iqra Irfan (2016) in their paper researchers try explain the problems of married women education in Pakistan: Academic, Social and Cultural Context, focuses to explore the social, cultural, financial, academic problems of married women in higher education. The paper concluded that women particularly married women are denied of education due to socio-economic, religious, and cultural factors. It is believed by certain conservative families that think that higher education will bring moral deprivation, grant unrestricted freedom, and unnecessary delay in marriages. The research paper recommends that seminars and focus group discussions are needed to change the perceptions of society about female education, especially among married women.

Objectives of the Study:

1) To study the socio-economic background of the married female students.
2) To find out the challenges faced by married female students in higher education.
3) To explore the solutions for the problems faced by the married female students.

Research Methodology:

The present study is descriptive in nature. The study is based on both Primary as well as secondary data. Primary data is obtained using an interview schedule and informal discussion with the respondents. The secondary data is collected through book, e-journals, magazines, and websites etc. or any other authentic source. The universe of the study is students studying in Shivaji University, Kolhapur, Maharashtra. The respondents pursuing Master's degree, PG Diplomas or M.Phil./Ph.D. degrees were interviewed virtually. The respondents studying in social sciences, law, commerce and management are the sample for the study. The sample size

comprises 35 respondents who are married since at least 1 year to obtain a mature response. Snowball sampling technique was used for the collecting primary data.

Data Analysis and Interpretation:

Socio-Economic status of the respondents:

Here researchers tried to find out social and economic status or background of respondents.

1)Maximum respondents are from the age group of 26-35, that is 68.57%.

2)Out of 35 respondents 57.14% women are completed 4-9 years of their marriage. This reveals that they have good marital experience and they can make a balance between academic and domestic work.

Table No. 1: Family Monthly Income

Sr. No.	Income in Rupees	No. of Respondents	%
1	Below 10,000	3	8.57
2	10,000-20,000	8	22.86
3	20,000-30,000	11	31.43
4	More than 30,000	13	37.14
Total		**35**	**100**

Source: Primary Data

Above table no. 1 shows that 31.43% respondents belong to Rs. 20,000- 30,000 per month and 37.14% belong to more than Rs. 30,000 per month family income.

3)Out of 35 respondents 22 are pursuing M.Phil. or Ph.D., 11 are pursuing master's and only 2 respondents are engaged in other courses like PG diploma.

4)Researchers found that almost 46% husbands have completed graduation, 28.57% have completed post-graduation while 5.71% having doctorate degree. So, this data shows that, though husbands who have completed their graduation inspire their wife for enrolling for masters or doctorate degrees.

5)Out of 35 respondents 77% respondents are residing in joint family while 23% are residing in nuclear family. Maybe respondents residing in joint families having difficulty to maintain a balance between domestic and academic works.

6)Around 80% respondents having 4 to 6 family members in their family. Where 43% women are having two children, and 28% are single child women.

7)23% respondents are working and maximum women are of the opinion that, their job negatively affects their academic performance.

8)Only 18% respondents are availing the facility of scholarship or fellowship.

Challenges faced by married female students:

1)As a married female student, the respondents are facing the following major problems while she is engaged in higher education.

Table No. 2: Problem faced by married woman

Sr. No.	Problems	%
1	Financial Problem	17.14
2	Ignoring domestic work due to academic work	60.00
3	Lack of time to look after husband & family members	40.00
4	Problems in child-rearing responsibility	51.43
5	Lack of support from husband and in laws	31.43
6	Spending more time out due to academic work	42.86
7	Family planning	8.57

Source: Primary Data

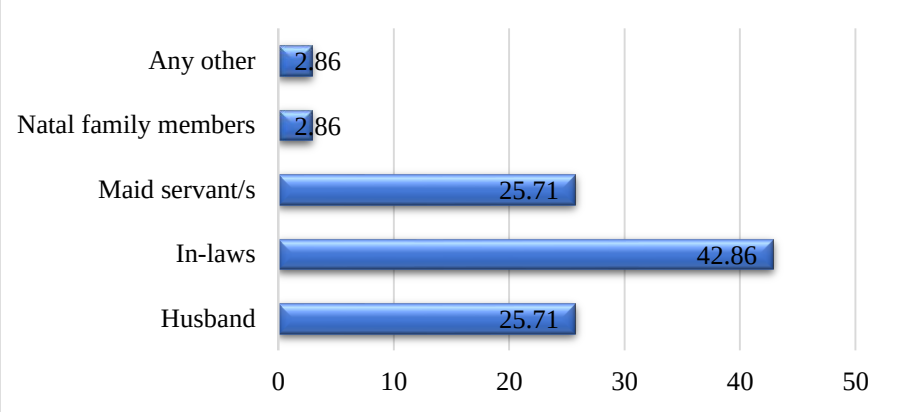
Maximum (60%) respondents do not give proper time for domestic work due to academic work. And 9% women are facing a family planning problem which can ultimately result into reproductive health issues.

2)In-laws of 43% respondents having favorable attitudes while in-laws of 29% respondents having neutral attitudes towards higher education.

3)Only 14% are victims of sexual harassment and from these 11.43% are harassed by their classmates or fellow students.

4)Out of total respondents 80% say that different socio-cultural activities like festivals, ceremonies, guests, other rites and rituals have negative consequences on their academic performance.

Graph No. 1: Help in Domestic Work



Source: Primary Data

5)43% respondents are major helped by their in-law in their domestic work. And 26% are helped by their husband and maid servant/s respectively.

Table No. 3: Financial support for education

Sr. No.	Financially Support	No. of Respondents	Percentage
1	Husband	32	91.43
2	Yourself	1	2.86
3	Your parents/ Natal family	2	5.71
	Total	**35**	**100**

Source: Primary Data

Maximum respondents were financially supported by their husbands, that is around 92%.

Conclusion and Suggestions:

It can be concluded that, the problems faced by married women are varied. Most women face the problem of unable to concentrate in academic work due to domestic work. The dual role expected from a woman is in a way very demanding. Women should be freed to a certain extent from the household responsibilities. In the process of virtual interviews one of the points raised was married women were unable to attend the workshops or any such kind of training programs which are held out of town, due to their homely responsibilities. The attitudes of in-laws include that the women can pursue her higher education but not at the cost of household responsibilities. They are expected to perform each and every ritual of all the festivals, even the guests need to be attended and even the attendance in various ceremonies is a must. So, all this, needless to say has an impact on her academic performance as well as academic work. Again, if the woman is working then she is overburdened with all the three responsibilities.

The following are the suggestions on the basis of the study-

1) Minimum age of marriage should be increased: - the minimum age of marriage which is 18 for girls should be increased as one cannot complete the higher education at such a young age. The minimum age should be extended to 25 years for girls and 27 years for boys respectively. If this minimum age will be extended then we can expect a rise in higher education for girls which again will help the females to be economic independent and will ultimately increase the national income of the country.
2) Socialization of both boys and girls should be the same. In today's time both boys and girls should be trained in domestic work as girls are expected to. Husbands should contribute in household work equally. So that, the women taking education and working are helped and supported by the husbands. Henceforth, domestic work will not negatively affect the academic performance of the women.
3) Certain social policies should be formulated by the government for the betterment of women.
4) Scholarships or fellowships beneficiaries should be increased and women should be encouraged to pursue higher education through such schemes, and if women are supported with fellowships, then women would be self-reliant and be able to engage a helper for her domestic work which will ultimately positively affect her academic performance.

References:

1. Chigona and Chetty (2007), Girls Education in South Africa: Special consideration to Teen mothers as Learners, Journal of Education, Vol-3(1).

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

2. C. Gobalakrishnan and K. Shunmuga Priya (2014), Problems Faced by Married Girl students in their daily life: A Situational Analysis, International Journal of Research in Applied Natural and Social Sciences, Vol-2, Issue 2, PP 151-156.
3. Patricia Mawusi and Esther Manieson (2015), Issues and Challenges confronting married women in tertiary institutions, International Journal of Education, Learning and Development, European Centre for Research Training and Development, Vol-3, No.-9, PP 19-27.
4. Dr. Malik Ghulam Behlol, Dr. Najeebullah, Iqra Irfan (2016), Problems of Married Women at higher education in Pakistan: Academic, Social and Cultural Context, International Journal of African and Asian Studies, Vol- 20, PP 106-115.
5. www.researchgate.com
6. www.scholer.google.co.in

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E- Commerce and Rural Economy

Mr. Annasaheb B Wasekar.

Asst. Professor, Dept. of Economics.

Vivekanand College, Kolhapur (Autonomous)

Email:vasuab007@gmail.com

Abstract:

In the era of Artificial Intelligence and Technology driven economies the powerhouse of economic development is shifted from agriculture to technology. One of the major part of worlds development go through heavy use of technology-based service sector. If we look at the Indian economy, around 55% of the GDP Share comes from service sector. The modern approach of market was tremendous revolutionary in nature. The traditional method of fulfil need of consumer is to produce, and sale through different stages and canales with the use of intermediate. But in now days the business to consumer model gets more attention. In India the worlds giant companies enter in the market to sales the goods and services direct to consumer from production house. In primary stage these e commerce companies only focus on urban areas which is just around 25 % of total population area. But in now days the phase is changed as per increasing competition. Now the e commerce inters in rural area with big force to catch the new fish. In these phenomena the not only private sector the public sector also competes the market with their services

In this research paper the main focus is on how the e-commerce works in rural India.

Keywords: E-Commerce, Digital Economy, Public Sector, Consumer.

Introduction:

India is one of the largest prospective consumer markets in the World. The high no of middle-class consumer base which characterised by purchase goods and services as per their income in verities, leads to increase in no of service provider. The digital connectivity revolution in India leads to attach the economy to the world economy. the diversify consumer base attract many international giants to invest their money in the Indian economy. Many of the companies use consumer data collected from their resource for digital marketing. The first e commerce phase started in India in 1995 when the internet service was provided by the companies. After Economic revolution of 1991 the MNCs came in India with their goods and services. And with the help of internet the scale of these companies was flourished in the economy especially in urban area.

If we classify Indian economy in two major parts named Urban and Rural economy, we clearly seen that each economy was based on different core segment. Low-income level, low purchasing power, low literacy rate, traditional markets, inadequate social facilities was characterised by the rural economy. these problems also faced by the e-commerce companies to reach in rural areas

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hence in first ten to fifteen years of e-commerce the rural area is just ignored. But in recent changes in internet penetration, rural banking, infrastructure development, market connectivity increased by government projects along with private players. These lead to heavy increase in e commerce transaction in rural area in recent years. Due to different government initiatives like e governance, digital services, free hand to 4G, 5G internet facility the e-commerce companies are in the strong position to increase their scale of market.

Meaning Of E-Commerce:

E-commerce is the buying and selling of goods and services over the internet. The electronic gazette's ware used to perform the transaction. It consists of computers, tablets, smartphones, and other smart devices. In current situation every good and service we can by through these types of marketing chains. The e-commerce companies use B-B, B-C, C-C, C-B Models of marketing

Objectives Of The Study:

The study has following objectives:

1. To study the history and current situation of e-commerce in Indian economy
2. To study the opportunities of E-Commerce in Rural sector of India.
3. To identify the challenges faced by E-Commerce in Rural Sector.

Research Methodology:

This research paper is descriptive in nature. The secondary data will collect from various websites, research articles, books and statistical reports

History and milestones in e-commerce revolution

1. 1995- the internet service was firstly provided in India.
2. 1996- First B-B (India Mart) Directory was launched in India
3. 1999- First e-commerce company – Fabmart K. Vaitheeswaran
4. 2005- First e booking for air traveling was launched.
5. 2005-06- eBay acquired Baazee.com and entered the fledgling India market
6. 2006- First OTA (Online Travel Agent) started by Indigo and Spice Jet
7. 2007- Flipkart by Sachin and Binny Bansal
8. 2010- Bulk or group purchase was started
9. 2012- India Postle Services started IT changes for delivery.
10. 2012- International Brand Amazon
11. 2013 -Myntra offers one hour delivery promise in Delhi
12. 2023- more than 19000 companies operated from different websites

Forces that create new Indian rural market.

1. **Change in income level-** The per capita income of rural India is 40925 in 2011-12 which increase around 160,230 which leads to create new demand

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2. **Change in purchasing power** – Increase in income level leads to change in purchasing power. People need more goods for fulfil their desire of luxurious goods
3. **TV, News Paper, Films, etc. impact** – increase in income levels leads to purchasing electronic gazettes in the house. The personalized home theatre i.e. TV create easy penetration of advertisement and new trends in different sense. People ware always curious about urban lifestyles. Due to these films and serials urban lifestyle ware easy to copy in rural area. Hence there is increase in purchasing new and trendy goods and services through e-commerce

1. **Increase in Infrastructural Development**: the road connectivity, new market created by government and private sectors, lead to filling in the gap between both markets, it is easy to transport the goods and services through these channels.
2. **New city creation**: the increasing number of populations leads to develop large villages to small cities which was supported by small start-ups. These startups ware connected to the consumer through internet and e commerce websites leds to rural consumer base development.
3. **New techno-age generation**: the generation born in era of technology leads to create demand which is advanced in nature. Their need is absolutely trendy in nature. Due to these the sale of goods through e-commerce increases in rural area.
4. **Increase in Low price mobile phones: -** The main gazette in e commerce is mobile phone. The electronic revolution leads to low price mobiles in market. The purchasing of new mobile leads to classify personal and family market secretly currently In 2022, 35-40% of the 122 million smartphones sold in the country were bought in in rural India.
5. **Internet penetration: -** In Current situation India the second large country with internet penetration after China. And also goes through 5G internet revolution. In 2022 there is 700 million active internet users from that 425 million internet users from rural area which is significantly higher. The more no of internet users lead to easy fishing of advertisement-based consumer.
6. **Increase in rural banking**: - According to RBI there are 30% branches are located in rural area where around 60% population lives. There percentage is low in some decade. The availability of banking facility makes easy to consumer to purchase goods with help of financial services provide by these banks
7. **Private finance players**: in rural area along with public sector the private sector bank, NBFS, small finance companies, authorised money lender, also plays vital role in create consumer base in rural area.
8. **Easy Access of Websites and Apps: -** In new phase of technology the technocracy web page and easy app operating system leads to more use of these facility. The more use of application leads to

create easy desire to purchase new goods. The factor of regional language also led to develop new consumer base which have language problems.

9. **Schemes and policies**: Currently more than 70% of transaction from rural area made by cash on delivery system which create confident in consumer to purchase the unknown goods. Also, creative shopping festivals also affect the buying behaviour of rural consumer
10. **Government Initiatives**: - Currently Government of India focused on digital literacy. Through these large nos of schemes ware launched through digital platform. Due to these there is increase in no of internet, bank and mobile users in rural area. These are ready to purchase buyers for e-commerce companies.

Challenges faced by e-commerce in rural Indian Market

Along with these availabilities the e commerce companies face several problems while serving rural areas. Some of theme are follows

1. **Mindset of people:** Thow the rate if increasing sale in rural Areas are seen the order placed by rural people are from trusted peoples only who know the process of e-commerce. But the people who dose not know the practices of e commerce companies are not in the position to take or place orders to the same.
2. **Lack of connectivity:** Most of the villages connected through roads and other transport facilities which are nearby small cities. The villages away from main cities are anable to cover due to low connectivity
3. **Low purchasing power:** e-commerce also faces problems of low purchasing power of rural area. Due to low purchase power the people are in the position to buy only low-price goods which in not feasible in nature.
4. **Exchange of goods: -** as per consumer policy the consumer has right to exchange or return the purchased goods. Dur to there the transaction cost was increased and the money ware wasted in the process.
5. **Price Sensitive Consumer: -** Most of the time the rural consumer is in the position to purchase good from that provider which offer him low prices. Small changes in prices leads to huge fall in demand of certain goods**.**
6. **Lack of Digital Literacy: -** though there in increase in use of internet the most of the people use it for social media. But when it comes to purchase there is certain type of phobia of Froud. These fear leads to lowering purchase decision.
7. **Ater sales services:** - While purchasing high price goods rural consumer prefer local shops for further services. And also, e-commerce companies faced problems to provide skill full labour at cheap price for the same.

Some Policies which can help to overcome these threats

1. Develop chain system delivery model.
2. Create rural warehouses in collaborative base.
3. Use accurate data of consumer for fetching the demand.
4. Take help of rural marketing agencies which are already working in rural areas.
5. Use Self Help groups, NGO's Co-operative societies as a middleman or logistic agent in rural area.
6. Provide more financial services to consumer which boost the purchase rate

Conclusion:

There is tremendous scope to e-commerce operations to public, private players for create new consumer base in rural area. The help of artificial intelligence and new big data help to trap the untouched rural area. The increasing banking facility was core at the purchasing power of people. Making more tie-ups with financial service providers the consumer base can get wider. There is also need to focus on cyber security, Data security, legal structure which leads to create a greater number of consumers.

References:

1. Aggarwal A. Untapped potential of e-commerce in Rural India [online]. 2016 [cited 2019 Mar Available from: URL: http://www.iamwire.com/2016/08/potential-of-ecommerce-inrural-india/140447

2. Anooja A. Digital India with E-Commerce Revolution in Rural India: Transform India Digitally and Economically**,** Engineering International. 2015; 3(2)

Clarke A & Pont AD. Unravelling the Indian Consumer.[online]. 4th ed. Deloitte. 2019.

4. Pahwa A. Rural e-commerce: The untapped potential. Ernst & Young. 2018.

5. Sharma A & Gupta A. Winning the Payments War Requires Continuous Innovation. Forrester. 2018.

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Trends Of Industrialization Of Western Maharashtra: Acase Study Of Sangli District

Dr. Govardhan S Ubale [1] Dr. Siddharth S Ghodera [2] Dr Subhash D Kamble [3] Dr. Sunil G Bhosle [4]

[1,2,4]Vivekanand College, Kolhapur (Autonomous)

Shikshannaharshi Bapuji Salunkhe Mahavidyalay, Karad [3]

Introduction:

Industrialization refers to the process of fostering the growth of the manufacturing industry to achieve economic development and raise the standard of living by leveraging a region's natural resources and transforming them into productive wealth (Chaudhari, 1966). It entails a systematic and organized approach where basic resources are processed and transformed to manufacture new products. Industrialization involves a series of interconnected activities, including mechanization, establishment of new industries, market expansion, and resource exploitation in previously untapped regions. These processes contribute to the accumulation and universalization of capital.

While industrialization is synonymous with industry, it is essential to recognize that it represents a broader process that holds significant economic importance within a region (Shirokov, 1973). The direction of industrialization in a particular region is influenced by its resource base and social and cultural attitudes, public policies, customs, and traditions (Chauhan, P.R. & S.K. Sing, 2009). Historically, industrialization has evolved through three distinct stages. The first stage centres around the transformation of primary products, followed by the manufacturing of new products through the processing of primary materials in the second stage. The third stage involves the mechanized production of capital-intensive goods that are not consumed directly but instead facilitate further production. This systematic and qualitative progression drives industrialization within a region. Consequently, industrialization becomes intricately linked with the overall system of social and economic activities in that region. Examining industrialization within a specific regional context helps in understanding the process of regional development. Industrialization serves as a fundamental driver of economic development and is often contingent upon the availability of mineral and power resources in a region. It is important to note that even regions primarily dependent on agricultural and pastoral economies can achieve industrial development by capitalizing on agricultural and animal products, provided they have access to the necessary technological, financial, and infrastructural resources (Khusro, 1983). Industrialization is a multifaceted process that entails the growth of the manufacturing industry to stimulate economic development and improve living standards. It encompasses various stages, resource considerations, and sociocultural factors, ultimately playing a vital role in shaping the economic landscape of a region.

Keynote: - Trends, Industrialization Sangli district

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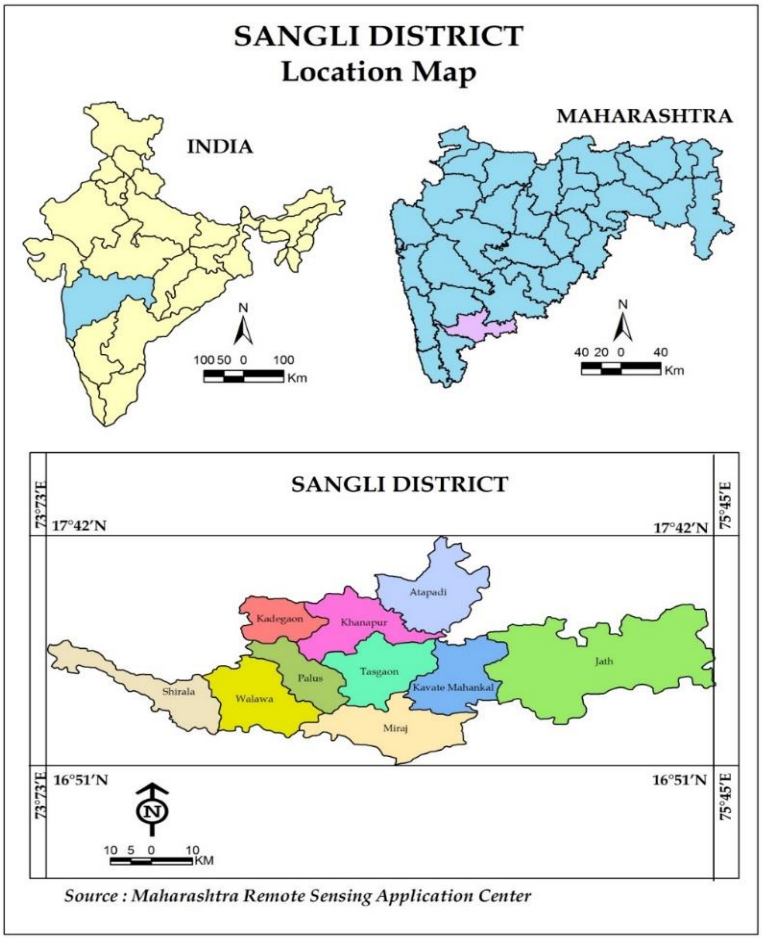
Study Area:

The Sangli District is one of the most Politically dominated district of Maharashtra state, It is lies between the 16°45' N and 17°33' N latitude and of 73°41 'East and 75°41 'East longitude. The geographical area of the district is 8572 Sq km as per 2011 census. The district is bounded by Satara district on the North western side, Southern is boarded by Belgaum and Bijapur district of Karnataka State, At the Centers and East Kolhapur district and the Ratnagiri district touches western part of Sangli district. According to 2011 census the population was 2581835 and the literacy rate was 76.6 %. The district is divided in to Five Administrative sub division mainly Khanapur, Walwa, Miraj, Tasgaon, Palus. The Shirala and Walwa Taluka was included in Walwa Sub. Division The Miraj Subdivision includes Atpadi and Khanapur and Palus Subdivision Include Kadegaon and Palus.

In the Sangli district, Sangli-Miraj-Kupwad, Ashta, Uran Islampur, Jat, Tasgaon, Vita, Palus, Kavathe Mahankal, Kadegaon, Khanapur, Shirala are the urban centers and emerging new industries in this urban area of the districts.



Source : Maharashtra Remote Sensing Application Center

Objectives

1. To Study the Trends of Industrialization in Sangli district.

2. To Study the Growth of Industries is Sangli district.

Data Base And Methodology

The present research work is based on secondary data the secondary data related to the trend of industrialization is obtained through District census handbook, Socio-economic abstract of Sangli district various published research papers as well as various government agencies, Map making based of obtained statistical data in GIS tool (Geographical Information System).

Industrialization In Sangli District :

As per the history of industrial development in the study region, industrialization started in 1910 with Kirloskar Brothers factory and after the independence of India, Indian government five year plans and co-operative movements helps in the growth of industries in the Sangli district. Here for the analysis of the trends in industrialization secondary data is used and last five decades are considered to calculate temporal development.

Trends In Industrialization In Sangli District

(1971 - 2011)

Year	Industry	Changes
1971	148	--
1981	269	121
1991	492	223
2001	566	74
2011	786	217

Source: - Socio economic abstract of Sangli district 1981 to 2011

Table shows trends in industrialization in Sangli district during 1971 to 2011. As per the table in 1971 total 148 industries was present in the district which increased by 121 industries in 1981 and total 269 industries was operating. In 1991, 492 industries were in functioning and this was nearly dabbled than previous decade i.e. 1981. There are total 566 industries are observed in 2001 and the lowest change is observed in the study period that is only 74 new industries are newly established during 1991 to 2001. In the last decade of the study period total 786 industries are located and during 2001 to 2011, 217 new industries are established in the study region. Overall in the Sangli district there was continuous development in the industrialization is observed. In the study period highest new industrial establishment is observed during 1981 to 1991 whereas during 1991 to 2001 lowest new industrial establishment is observed.

Growth Of Industries:

Industrial growth is the most fundamental process with which all other socio- economic factors are directly and indirectly associated. Industrial growth determines population density as well as distributional pattern and composition of population. Urbanization process is closely related to the industrial growth. Therefore geographical study of growth in industries of the region has fundamental for understanding its vitality as well as for planning at the local and regional level.

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Growth Of Industries In Sangli District

(1971 - 2011)

Year	Industries	Growth Rate
1961-1971	148	----
1971-1981	269	81.75
1981-1991	492	82.89
1991-2001	566	15.04
2001-2011	783	38.33

Table shows the decadal growth of industries in Sangli district. In 1971 there are 148 industries are located in the Sangli district which was increased in 1981 and total 269 industries are in the study region with 81.75 per cent growth rate. As compare to earlier decade in 1991 the growth rate of industries is 82.89 per cent with 492 industries. In 2001 industries in the Sangli district was increased but the growth rate is decreased, in 2001 only 15.04 per cent industrial growth is observed. In 2001 new industrial establishments is very minimum as well as some old industries are closed due to changes in the co- operative rules and regulations. In the last decade of the study period total 783 industrial units are operational and the growth rate was 38.33 per cent which is more than double of 2001 and this is good sign of economic development in the Sangli district.

Overall in the Sangli district there was continuous decadal positive growth rate is observed in industrialization but after 1991 growth rate is decreases as compare to earlier decade's growth rate. The highest growth rate of industrialization was observed during 1981-1991 and the lowest growth rate was found during 1991 – 2001. After Independences due to co – operative movements high industrial growth is observed in the study region but after 1991 private industrial units are established in very less number therefore the growth was low as compare to growth in previous decades of study period in Sangli district.

Tehsil Wise Distribution Of Industries In

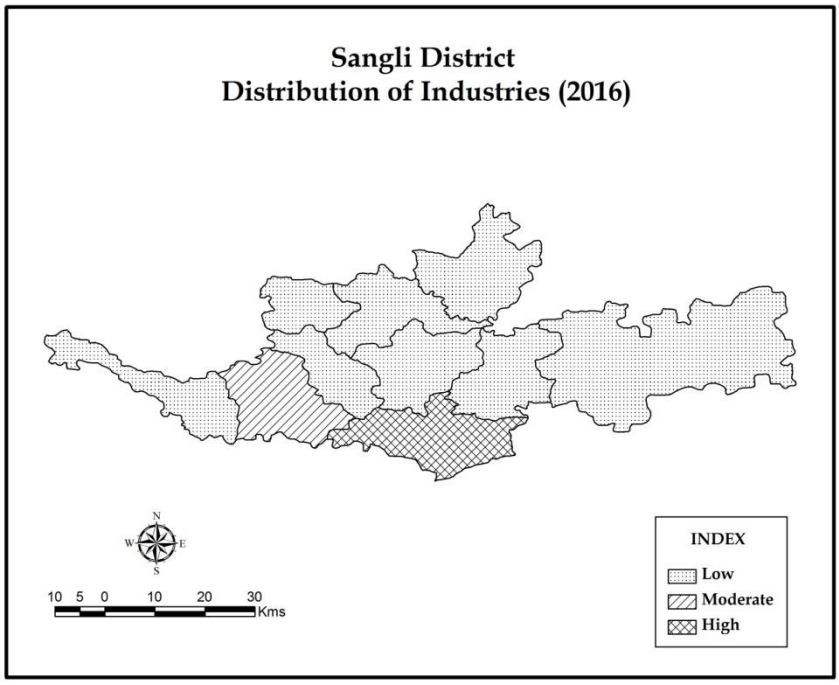
Sangli District (2016)

Sr. No.	Tehsils	Industries
1	Miraj	512
2	Walwa	158
3	Khanapur	23
4	Tasgaon	72
5	Shirala	19
6	Palus	68
7	Kadegaon	24
8	Atpadi	23
9	Kavathemahankal	17
10	Jat	18
	District	**934**

The Sangli district is administratively divided into 10 tehsils. In this 10 tehsils four tehsils has urban area where mainly industries are established and developed but in the study region due to increases in agro based industries rural areas has some medium to small scale industries as well as

majority sugar factories are located in the rural areas in this way all 10 tehsils has industries but there is big difference in distribution of industries is observed.

Miraj tehsil has highest number of industries with 512 industrial units in the Sangli district which is more than half of total industries in the study region. Because it has location of two industrial areas and large urban area. The Miraj tahsil is mainly famous for the textile industry. Walwa Tahsil has 158 industrial unit and rank second in the study region. Agro based industries are mainly developed in the walwa tahsil due to fertile plain region with highest area under sugarcane cultivation. Tasgaon and Palus tahisls has 72 and 68 industrial unit with third and fourth rank respectively. The dairy and Metallic Production industries are mainly developed in these tahsils. Kadegaon, Khanapur and Atpadi tahsils has new developed industrial areas which have more than 20 industries. Kadegaon and Khanpur tahsil mainly has textile units whereas Atpadi tahsil has agro based industries. Industries in Shirala tahsil is primarily forest based because it has highest area under forest in the study region. Kavathemahankal and Jat tahsil has 17 and 18 manufacturing industries basically sugar and allied industries are established in these tahsils.



Conclusion :

The history of industrialization of the district dates back to 1910, when the Kirloskar Brothers factory was established at Kirloskarwadi. This proved a landmark and a turning point in the history of the industrialization of the district. In total only 15 industries in the Sangli district in the year 1915, which included ginning and pressing, oil and engineering industries but now there are 934 industries are located in the study region. Oil industry, Cotton Textile, Chemical Industry, Engineering Work,

Sugar Industry, Printing and Publication, Bidi-making and Tobacco Processing, Gold -Silver Industry and Cotton weaving industries are observed in the Sangli district.

In the Sangli district, there was a continuous development of industrialization. In the study, time observed highest new industrial establishment was from 1981 to 1991 whereas from 1991 to 2001 lowest new industrial establishment.

In the Sangli district observed the proportion of industries is increase during the period of 1961 to 2001 but growth rate are dicreas during period. Highest growth rate observed from 1981 to 1991 was 82.59 percent and the lowest growth rate was observed 1991 to 2001.

In Sangli district have total 10 tehsils namely Miraj, Walwa, Khanapur,Tasgaon, Shirala, Palus, Kadegaon, Atpadi, and Kavatemahakal. In the Sangli district observed total 934 industries in 2016, highest industry was located in Miraj tehsil because there is a railway junction in Miraj tehsil, the raw materials needed for industrial business are available there in large quantities, so industrial progress can be seen high in Miraj tehsil. As well as Miraj tehsil is an urbanized center in Sangli district and most of the working population is located in Miraj tehsil, therefore highest industries are located there. And lowest industries are located in Jat tehsil because Jat tehsil in Sangli district is a drought area, where the proportion of the rainfall is very low, therefore Jat tehsil is known as a drought-prone tehsil and also there is a lack of facilities required for industry, so the development of industries there is very less.

Reference:

1. Chaudhari, M.R. (1971). The Industrial Landscape of West Bengal: An Economic Geographic Appraisal. *Oxford and IBH Publishing Co*.
2. Government of Maharashtra. (1961-2011). *Socio-Economic Review and District Statistical Abstract of Sangli District*.
3. Bose, A. (1973). Studies in India's Urbanization. *Bombay: Tata Mc Graw Hill Publishing.*
4. Chauhan, P. R., & Singh, S. K. (2009). Industrialization and Areal Development in Chhatisgarh, India. *The Deccan Geographer, 48(2), Pp.93-94*.
5. Gupta, R.C. (1969). Changing Trends in the Spatial Distribution of Industry. The *Deccan Geographer, 7(2)*.
6. Stam, L. D. (1961). Urbanization in Developing Countries. In Alam & others (Eds.)
7. Singh, R. B. (1975). Characteristics of Urbanization in India. *Uttar Bharat Bhugol Patrika*, 11, Pp.83-98.

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A Study On Cost Benefit Analysis Of Tur (Red Gram) With Reference To Dry Land In Solapur District

Dr. Yogesh B. Mane[1] Mr. Sunny. S. Kale[2]

Department of Commerce

Vivekanand College, Kolhapur (Autonomous)

Abstract:-

The present study was carried out in all the tehsils in Solapur district to study cost of cultivation, prices and profitability of Tur (Red Gram) production. The study was based on the primary data of 50 Tur (Red Gram) cultivators for the year 2020-21. The average per acre cost of cultivation of Tur (Red Gram) was estimated to Rs. 18889 and per quintal cost was estimated to Rs. 5373. Amongst the different items of cost, human labour cost and machine labour cost was the major components of variable cost. Rental value of owned land is the major component of cost in case of fixed costs. The average production of Tur (Red Gram) was 3.52 quintal per acre. The minimum support price for Tur (Red Gram) crop was Rs. 5800. The gross returns obtained from Tur (Red Gram) crop were Rs. 19906 and Net Return was Rs. 1017 it means that Tur (Red Gram) growers have earned the profit. The benefit-cost ratio of Kharif Tur (Red Gram) in sample area was 1.05. It means that farmers have invested 1 rupee in Tur (Red Gram) production but they earn 0.5 paise net profit per rupees. This profit is not a significant profit.

Keywords: Cost, Prices, Profitability, Gross Return, Net Return, Cost Benefit Ratio, Area, Production, Productivity**.**

1. Introduction:

Pigeon pea (Arhar) commonly known as red gram or Tur is a very old crop of this country. After gram, Arhar is the second most important pulse crop in the country. It is mainly eaten in the form of split pulse as ‘dal’. Seeds of Arhar are also rich in iron, iodine, essential amino acids like lysine, threonine, cysteine and arginine etc. Tur (Red Gram) is the most important Pulse crop in India. It is a drought tolerant crop which is cultivated in low rainfall. It was originated in Africa and India. This crop is raised in Kharif season. Uttar Pradesh, Madhya Pradesh, Maharashtra, Bihar, Andhra Pradesh, Punjab, Haryana, West Bengal, Assam, Orissa, Rajasthan, Himachal Pradesh, Gujarat, Jammu and Kashmir, Karnataka, Tamil Nadu, Kerala these are the major Tur (Red Gram) cultivating states in India. Tur (Red Gram) is used as human food in various forms. Tur is also used as a cattle feed (Dried Leaves in the form of Bhusa). Tur (Red Gram) crops are Kharif crops grown in the months of June and July and harvested between December and January. Duration of Tur (Red Gram) crop was 170 to 180 days. Total Estimated area under Tur (Red Gram) crop was 4714.55 thousand hectors, estimated production was 4092.56 thousand tonnes and productivity was 868 kg per hector.

In Maharashtra total area under Tur (Red Gram) crop was 1281.42 thousand hectares, production was 1173.97 thousand tonnes and productivity was 916 kg per hector. In Solapur district total area under Tur (Red Gram) crop was 515.32 hundred hectors, production was 294.32 hundred tonnes and productivity was 571.13 kg. per hector. Solapur district is also one of the major Tur (Red Gram) producing districts in Maharashtra. In all the tehsils of Solapur district Tur was cultivated. The present investigation was attempted to study cost of cultivation of Tur production, prices of Tur Production, profitability of Tur production and cost benefit ratio of Tur production in the study area.

2. Objectives Of The Study:

The main objective of study is to analyse the costs and prices of Tur (Red Gram) with reference to dry land in Solapur district and specific objectives of the present study are as follows-

1. To analyse the cost of Tur (Red Gram) Production in the area under study.
2. To study the prices for Tur (Red Gram) Production in area under study.
3. To study the profitability of Tur (Red Gram) Production in the area under study.
4. To estimate the benefit cost ratio of Tur (Red Gram) production in study area.

3. Hypothesis:

1. Tur (Red Gram) crop is not profitable.

4. Research Methodology:

For the study undertaken researcher has used the multistage sampling. For the selection of sample farmers researcher has used the purposive sampling method. For selection of farmers researcher has selected non-irrigated land farmers purposefully and quota sampling method is used to select the Tur (Red Gram) crop farmer. Therefore, the researcher has used the purposive quota sampling method because there is no exact data of non-irrigated farmers of selected crops in Solapur district. The study was conducted in Solapur district as whole. From Solapur district all 11 tahsils i.e Pandharpur, Mangalweda, Malshiras, Madha, Karmala, Akkalkot, Barshi, Mohol, Sangola, Solapur North & Solapur South having maximum area under Tur (Red Gram) cultivation were selected. The study was based on primary data for the year 2020-21. Thus for present study 50 Kharif Tur (Red Gram) growers were selected as per the quota sampling method. These 50 respondents were selected from each tehsil. Data collection was made by preparing separate questionnaire/ interview schedule for Tur (Red Gram) producer.

5. Result And Discussion:

1. Estimated Cost of Cultivation & Total Cost of Tur (Red Gram) in Solapur District

Table 4.15 Estimated Cost of Cultivation and Total Cost of Tur (Red Gram) in Solapur District (₹ Per Acre)

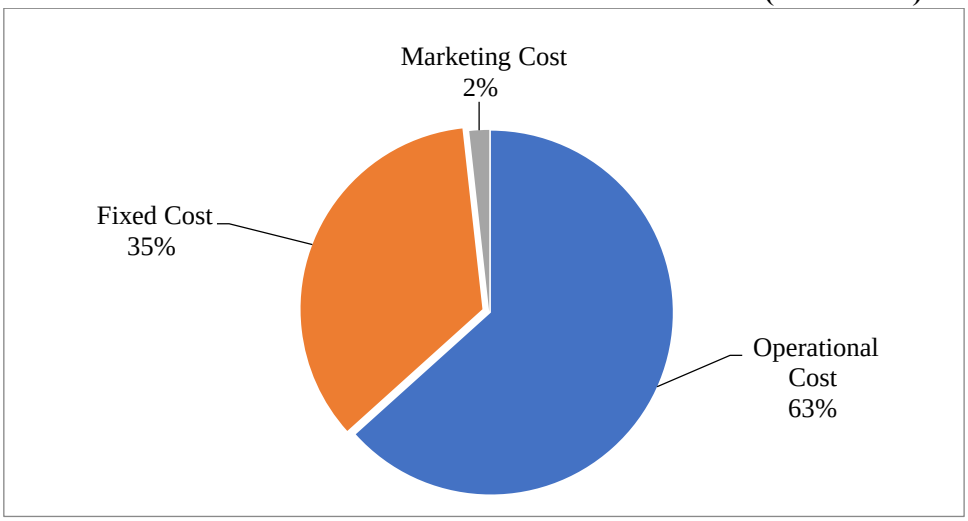
Sr. No	Elements of cost	ATC	%	Min.	Max.	SD
1	Human Labour- Hired	2713	14.36	0	10000	2154

2	Human Labour- Family	3029	16.04	0	12000	2631
3	Bullock Labour - Hired	452	2.39	0	6667	1161
4	Bullock Labour - Owned	8	0.04	0	933	132
5	Machine Labour - Hired	1922	10.18	0	5000	1244
6	Machine Labour - Owned	0	0.00	0	0	0
7	Seeds	575	3.04	80	1800	370
8	Fertilizer	869	4.60	0	3000	646
9	Manure	471	2.49	0	8000	1530
10	Insecticides	1020	5.40	0	6000	1028
11	Irrigation (Water + Electricity Charges)	144	0.76	0	350	93
12	Crop Insurance	110	0.58	0	650	180
13	Interest on Working Capital	648	3.43	264	1379	257
14	Miscellaneous	2	0.01	0	40	7
I)	**Operational Cost (1 to 14)**	**11963**	**63.33**	**6287**	**28079**	**5006**
15	Rental Value of Owned Land	5556	29.41	2800	14000	1821
16	Rent Paid on Leased land	0	0.00	0	0	0
17	Land Revenue, Cesses & Taxes	27	0.14	0	260	51
18	Depreciation of Farm Builds & Implements	287	1.52	0	840	188
19	Interest on Fixed Capital	725	3.84	187	2800	652
II)	**Fixed Cost (15 to 19)**	**6594**	**34.91**	**3083**	**16393**	**2172**
III)	**Total Cost of Cultivation (I + II)**	**18557**	**98.24**	**11116**	**34765**	**5758**
20	Packaging cost	91	0.48	4	1200	173
21	Transportation Cost	191	1.01	10	1200	215
22	Sales Expenses in Market Committee	50	0.27	4	167	42
IV)	**Selling And Distribution Cost (20 to 22)**	**332**	**1.76**	**14**	**2460**	**394**
	Total Cost / Cost of Sales (III + IV)	**18889**	**100.00**	**11140**	**34799**	**5912**

(Source: Field Survey)

Figure 4.13

Estimated Cost of Cultivation and Total Cost of Tur (Red Gram)



Variable Cost/ Operational Cost of Tur (Red Gram)-

In Tur production human labour cost is the major variable cost. Hired Human labour cost incurred was ₹ 2713 (12.75%) per acre, and family labour cost incurred was ₹ 3029 (14.24%) per acre. Family labour cost is more as compared to hired human labour cost. Hired Bullock labour cost incurred was ₹ 452(2.12%) per acre and there is no owned bullock labour cost because the farmers have not owned the bullock labour. Hired machine labour cost incurred was ₹ 1952 (9.04%) per acre and there is no owned machine labour cost because the farmers have not owned the machine labour. Seeds cost incurred was ₹ 575 (2.70%) per acre for Tur production. Fertilizer cost incurred was ₹ 869 (4.08%) per acre. In case of Tur production manure cost incurred was ₹ 471 (2.21%) per acre. Insecticides cost incurred was ₹ 1020 (4.80%) per acre. Irrigation cost incurred was ₹ 144 (0.68%) per acre which includes water and electricity charges. In Tur production crop insurance cost incurred was ₹ 110 (0.52%) per acre. Interest on Working capital cost incurred was ₹ 648 (3.05%) per acre and miscellaneous cost incurred was ₹ 2 (0.01%) per acre in the sample study area. The average total operational or variable cost incurred was ₹ 11963 (56.24%), minimum cost incurred was ₹ 6287, maximum cost incurred was ₹ 28079 per acre and standard deviation was 5006 in the selected sample study area. So, from the variable cost analysis it was observed that human labour cost and machine labour cost is the major components of operational or variable cost. Cost of miscellaneous, crop insurance and irrigation are very less in case of Tur production.

Fixed Cost of Tur (Red Gram)-

In the case of Tur production rental value of owned land is the major component of fixed cost. Rental value of owned land cost incurred was ₹ 5556 (29.41%) per acre in sample study area. There is no cost of rent paid on leased land because in sample area no any farmer was taken land on lease. Land revenue, cesses and taxes cost incurred was ₹ 27 (0.14%) per acre. Depreciation of farm builds and implements cost incurred was ₹ 287 (1.52%) per acre. Interest on fixed capital cost incurred was ₹ 725 (3.84%) per acre. Average total fixed cost of Tur cultivation incurred was ₹ 6594 (34.91%), minimum cost was ₹ 3083, maximum cost was ₹ 16393 per acre and standard deviation was 2172. So, from the analysis of fixed cost it was observed that rental value of owned land is the major component of cost in case of fixed costs. It was also observed that there is no cost of rent paid on leased in land because all the selected farmers have their own land. Land revenue, cesses and taxes cost is very less in fixed costs.

Total Cost of Cultivation of Tur (Red Gram)-

The average total cost of cultivation of Tur was ₹ 18557 (98.24%), minimum cost was ₹ 11116, maximum cost was ₹ 34765 per acre and standard deviation was 5758. Out of total cost of cultivation operational cost was ₹ 11963 (63.33%) and fixed cost was ₹ 6594 (34.91%).

Selling and Distribution Cost of Tur (Red Gram)-

In the case of Tur production the packaging cost was incurred ₹ 91 (0.48%) per acre in drought prone area of Solapur district. Majority of the Tur farmers sale their production at local markets (block and district market) the transportation cost from farm to local market was ₹ 191 (1.01%) per acre. The average sales expenses in market committee (portage, weight & other cost) incurred was ₹ 50 (0.27%) per acre. The average total selling and distribution cost of Tur was ₹ 332 (1.76%), minimum cost was ₹ 14, maximum cost was 2460 per acre and standard deviation was 394 in the study area of Solapur district.

Total Cost /Cost of sales of Tur (Red Gram)-

In Tur farming, per acre average total cost or cost of sales incurred was (total cost of cultivation + total marketing cost) ₹ 18889, minimum cost was ₹ 11140 and maximum cost was ₹ 34799 per acre and standard deviation was 5912 in the study area. The share of variable cost in total cost or cost sales was ₹ 11963 (63.33%), fixed cost was ₹ 6594 (34.91%) and selling and distribution cost was ₹ 332 (1.76%). From this table it was observed that per acre cost of Tur production was ₹ 18889.

2. Estimated Cost of Production and Total Cost of Tur (Red Gram) in Solapur District:

Table4.35

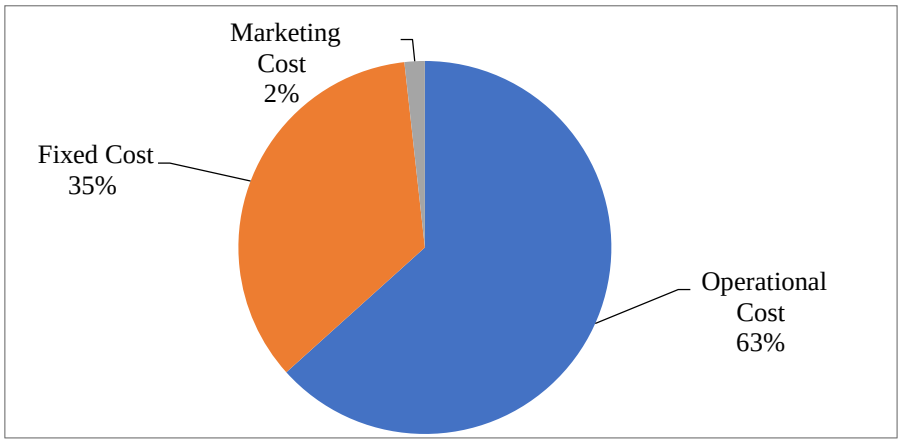
Estimated Cost of Production and Total Cost of Tur (Red Gram) in Solapur District (₹ Per Quintal)

Sr. No	Elements of cost	ATC	%	Min.	Max.	SD
1	Human Labour- Hired	772	14.36	0	6000	1390
2	Human Labour- Family	862	16.04	0	13000	2001
3	Bullock Labour - Hired	129	2.39	0	3750	560
4	Bullock Labour - Owned	2	0.04	0	933	132
5	Machine Labour - Hired	547	10.18	0	5000	922
6	Machine Labour - Owned	0	0.00	0	0	0
7	Seeds	163	3.04	33	1667	290
8	Fertilizer	247	4.60	0	2500	387
9	Manure	134	2.49	0	1333	294
10	Insecticides	290	5.40	0	5000	712
11	Irrigation (Water + Electricity Charges)	41	0.76	0	600	105
12	Crop Insurance	31	0.58	0	1400	205
13	Interest on Working Capital	184	3.43	53	2070	310
14	Miscellaneous	0	0.01	0	16	3
I)	**Operational Cost (1 to 14)**	**3403**	**63.33**	**1177**	**36570**	**5575**
15	Rental Value of Owned Land	1580	29.41	267	14000	2445
16	Rent Paid on Leased land	0	0.00	0	0	0
17	Land Revenue, Cesses & Taxes	8	0.14	0	120	27
18	Depreciation of Farm Builds & Implements	82	1.52	0	567	136
19	Interest on Fixed Capital	206	3.84	46	2800	576
II)	**Fixed Cost (15 to 19)**	**1876**	**34.91**	**288**	**16110**	**3061**
III)	**Total Cost of Cultivation (I + II)**	**5278**	**98.24**	**1516**	**52680**	**8355**

20	Packaging cost	26	0.48	3	80	16
21	Transportation Cost	54	1.01	7	150	28
22	Sales Expenses in Market Committee	14	0.27	3	100	18
IV)	**Selling and Distribution Cost (20 to 22)**	**94**	**1.76**	**17**	**330**	**54**
	Total Cost / Cost of Sales (III + IV)	**5373**	**100.00**	**1633**	**52680**	**8090**

(Source: Field Survey)

Figure 4.41
Estimated Cost of Production and Total Cost of Tur (Red Gram)



Variable Cost/ Operational Cost of Tur (Red Gram)-

In Tur production human labour cost is the major variable cost. Hired Human labour cost incurred was ₹ 772 (14.36%) per quintal, and family labour cost incurred was ₹ 862 (16.04%) per quintal. Family labour cost was more as compared to hired human labour cost. Hired Bullock labour cost incurred was ₹ 129 (2.39%) per quintal and owned bullock labour cost is incurred ₹ 2 (0.04%). Hired machine labour cost incurred was ₹ 547 (10.18%) per quintal and there is no owned machine labour cost incurred due to farmers have not owned machines. Seeds cost incurred was ₹ 163 (3.04%) per quintal for Tur production. Fertilizer cost incurred was ₹ 247 (4.60%) per quintal. In case of Tur production manure cost incurred was ₹ 134 (2.49%) per quintal. Insecticide's cost incurred was ₹ 290 (5.40%) per quintal. Irrigation cost incurred was ₹ 41 (0.76%) per quintal which includes water and electricity charges. In Tur production crop insurance cost incurred was ₹ 31 (0.58%) per quintal. Interest on Working capital cost incurred was ₹ 184 (3.43%) per quintal and miscellaneous cost incurred was ₹0 (0.01%) per quintal in the sample study area. The average total operational or variable cost incurred was ₹ 3403 (63.33%), minimum cost incurred was 1177, maximum cost incurred was 36570 per quintal in the selected sample study area and standard deviation of operational cost was 5575. So, from the variable cost analysis it was observed that human labour cost (30.40%) and machine labour cost (10.18%) was the major components of operational or variable cost. Cost of miscellaneous (0.01%), bullock labour owned (0.04) and crop insurance (0.58%) was very less in case of Tur production.

Fixed Cost of Tur (Red Gram) -

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In the case of Tur production rental value of owned land is the major component of fixed cost. Rental value of owned land cost incurred was ₹ 1580 (29.41%) per quintal in sample study area. There is no cost of rent paid on leased land because in sample area no any farmer was taken land on lease. Land revenue, cesses and taxes cost incurred was ₹ 8 (0.14%) per quintal. Depreciation of farm builds and implements cost incurred was ₹ 82 (1.52%) per quintal. Interest on fixed capital cost incurred was ₹ 206 (3.84%) per quintal. The average total fixed cost of Tur cultivation incurred was ₹ 1876 (34.91%), minimum cost was ₹ 288, maximum cost was ₹ 16110 per quintal and standard deviation of fixed cost was 3061. So, from the analysis of fixed cost, it was observed that rental value of owned land (29.41%) is the major component of cost in case of fixed costs. It was also observed that there was no cost of rent paid on leased in land because all the selected farmers have their own land. Land revenue, cesses and taxes cost (0.14%) was very less in fixed costs.

Total Cost of Cultivation of Tur (Red Gram) -

The average total cost of cultivation of Tur per quintal was ₹ 5278 which was 98.24% of total cost or cost of sales. Minimum cost was ₹ 1516 and maximum cost was ₹ 52680 per quintal. The standard deviation of total cost of cultivation was 8355. Out of total cost of cultivation operational cost was ₹ 3403 (63.33%) and fixed cost was ₹ 1876 (34.91%).

Selling and Distribution Cost of Tur (Red Gram) -

This table shows the selling and distribution cost of per quintal Tur production. The packaging cost was incurred ₹ 26 (0.48%) per quintal in draught area of Solapur district. Majority of the Tur farmers sale their production at local markets (block and district market) the transportation cost from farm to local market was ₹ 54 (1.01%) per quintal. The average sales expenses in market committee (portage, weigh & other cost) incurred was ₹ 14 (0.27%) per quintal. The average total selling and distribution cost of Tur was ₹ 94 (1.76%), minimum cost was ₹ 17 and maximum cost was ₹ 330 per quintal in study area of Solapur district. Standard deviation of selling and distribution cost was 54.

Total Cost /Cost of sales of Tur (Red Gram)-

In Tur farming, the average total cost or cost of sales was (total cost of cultivation + total selling and distribution cost) ₹ 5373, minimum cost was 1633 maximum cost was 52680 per quintal in the study area. The standard deviation of total cost was 8090. The share of variable cost in total cost or cost sales was ₹ 3403 (63.33%), fixed cost was ₹ 1876 (34.91%) and marketing cost was ₹ 94 (1.76 %). From this table it was observed that per quintal cost of Tur production was ₹ 5373.

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3. Gross Returns, Net Return and Benefit-Cost Ratio of Tur (Red Gram):Table 4.57

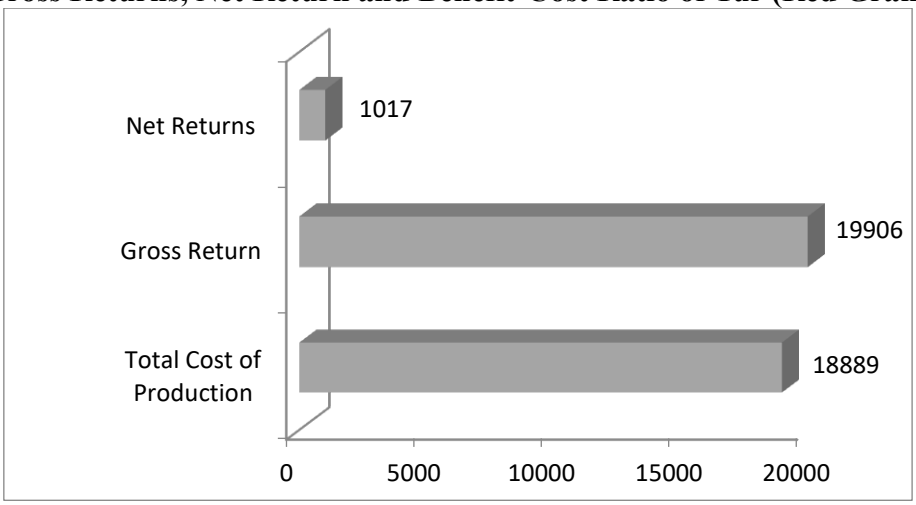
Gross Returns, Net Return and Benefit-Cost Ratio of Tur (Red Gram) (₹ Per Acre)

Sr. No	Factor	Details	Returns
1	Gross Return	A) Own Consumption (in quintal)	0.03
		Price (in Rs.)	5100
		Gross Return (output* price)	153
		B) Production Sold (in quintal)	3.49
		Price (in Rs.)	5660
		Gross Return (output* price)	19753
		C) Total Production A+B (in quintal)	3.52
		Gross Return (output* price) A+B	19906
2	Net Return	Total Cost of Production	18889
		Gross Return	19906
		Net Returns (gross return- total cost)	1017
3	Benefit-Cost Ratio	Gross Return / Total Cost	1.05

(Source: Field Survey)

Figure 4.52

Gross Returns, Net Return and Benefit-Cost Ratio of Tur (Red Gram)



In case of Tur farming, productivity of non- irrigated Tur is 3.52 quintal per acre and farmers get averagely ₹5660 price per quintal at local market. Out of total production own consumption of Tur is 0.03 quintal per acre and production sold is 3.49 quintal per acre. Gross return of Tur is ₹ 19906 per acre out of which ₹ 19753 (99.23%) is from sell of Tur production and ₹ 153 (0.77%) is from own consumption of Tur by farmers. During the filed survey it was observed that farmer keep some Tur production for own consumption but in very less quantity. Net return of Tur production is ₹ 1017. The benefit-cost ratio of non-irrigated Tur in sample area is 1.05. It means that farmers have invested rupee 1 in Tur production and they gain 0.05 paise net profit per rupee.

6. Hypothesis Testing:

Researcher has formulated the hypotheses on the profitability of Tur (Red Gram) in area under study. This hypothesis is-

Tur (Red Gram) Crop is not profitable.

To study the hypothesis Tur (Red Gram) Crop is not profitable, Researcher was used the one sample t-test to test the hypothesis and taken test value = 0.

Table 4

Profitability of Tur (Red Gram) Crop

	Test value = 0						
Variable	**N**	**Mean**	**SD**	**SE Mean**	**95% Lower Bound**	**T**	**P**
Tur (Red Gram)	50	6508	52545	7431	-5951	0.88	0.193

The above testing of hypothesis revels that p value of Tur (Red Gram) crops is greater than the level of significance i.e. 0.05 hence it is concluded that the null hypothesis i.e. Tur (Red Gram) Crop is not profitable is accepted and the study reject the alternative hypothesis i.e. Tur (Red Gram) Crop is profitable. It concludes that Tur (Red Gram) is not profitable in the area under study.

7. Conclusion:

In Tur (Red Gram) cultivation, per acre average total cost or cost of sales was ₹ 18889. The share of variable cost in total cost or cost sales was ₹ 11963 (63.33%), fixed cost was ₹ 6594 (34.91%) and selling and distribution cost was ₹ **332** (1.76 %). In Tur (Red Gram) farming, per quintal average total cost or cost of sales was ₹ 5373. The share of variable cost in total cost or cost sales was 3403 (63.33%), fixed cost was ₹ 1876 (34.91%) and selling and distribution cost was ₹ 94 (1.76 %). Productivity of Kharif Tur is 3.52 quintal per acre and farmers get averagely ₹ 5660 price per quintal at local market. Gross return of Tur is ₹ 19906 per acre out of which ₹ 19753 (99.23%) is from sell of Tur production and ₹ 153 (0.77%) is from own consumption of Tur by farmers. Net return of Tur production is ₹ 1017. It means that Tur growers have a profit of ₹ 1017. The benefit-cost ratio of non-irrigated Tur in sample area is 1.05. It means that farmers have invested rupee 1 in Tur (Red Gram) production but they earn only 0.05 paise net profit per rupee. The minimum support price for Tur (Red Gram) crop was Rs. 5800 it was not sufficient to cover the cost of production. So it was suggested to government to increase the MSP of Tur (Red Gram) crop and it was also suggested to take all the costs into consideration while declaring MSP. It was suggested to farmers to increase the productivity of Tur (Red Gram) crops in area under study by using the high yield variety programme means varieties of improved seeds, enhanced application of the fertilizers and extended use of pesticides etc. because productivity of Tur (Red Gram) crop was low in the area under study.

8. References:

1. Commission on agricultural costs and prices, price policy for kharif crops the marketing session 2020-21.
2. Sen and Bhatia (2004) State of the Indian Farmers - Cost of Cultivation and Farm Income, Volume 14, PP.92-93.)

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

3. Normal Estimates of Area, Production and Yield of Selected Principal Crops, Government of India Ministry of Agriculture and Farmer Welfare, Directorate of Economics and Statistics New Delhi Report April 2022.
4. Cacp.dacnet.nic.in
5. http://krishi.maharashtra.gov.in/Site/Upload/Pdf/LUS_2019-20.pdf)

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Hierarchical Distribution of Rural Settlement in Kolhapur District: A Geospatial Analysis

Dr Sunil Bhosale
Assit. Prof., Department of Geography, Vivekanand College (Autonomous), Kolhapur
Dr Govardhan Ubale
Head, Department of Geography, Vivekanand College (Autonomous), Kolhapur
Dr. Sidharth Ghoderao
Assit. Prof., Department of Geography, Vivekanand College (Autonomous), Kolhapur

Abstract:

The Indian settlement system is typically a village system. The village community has been essentially an agro-craft community the economic organization based on the local soil, animal and plant world and their simple utilization at direct subsistence level. Here an attempt has been made to understand the settlement system and its evolution to the present context. The most conspicuous physiographic feature of Kolhapur district, which have not only influenced the availability of various natural resources within the region the region but also influenced the economic and demographic patterns as seen today. Here an attempt has been made to study the spatial distribution of settlement on the basis of population. According to the 2011 census there are 1195 inhabited villages' in the Kolhapur District, having a population of 2645992. The rural settlements of the region have been categorized according population size in seven groups from less than 200 persons to more than 10,000 persons. Present study is mainly based on secondary data which is collected from the District Census Handbook of Kolhapur District 2001 to 2011. Statistical methods and GIS technique have been applied to measure settlement pattern in study area.

Key Words: Settlement system, Population size class, inhabited villages.

Introduction:

Rural landscape in India is dominated by the Villages and the Primary activities carried out by the inhabitants of those villages. Over 5.9 lakh villages are spread all over the country (Khullar, 2007, P.p 415). According to Blache, "India is per excellence, a country of villages". Agriculture is the most important of all the primary activities carried out by villagers. Thus villages are par excellence characteristic of agricultural landscape of the rural India. Settlement of the countryside is the mainstay of the human society. Rural settlement is the only element in human geography where we may really search and try to locate the genesis of settlement geography. In this way rural settlements are the topographic expression of the grouping and arrangement of two fundamental elements of human geography, houses and highways.

There are two sets of variables which effect settlement types in rural areas. We may call them agglomerating and deagglomerating factor. These parameters are both physical and cultural and lead

to compact and dispersed settlements according to the relative influence of centripetal and centrifugal forces. History of settlement is as old as history of man himself. Since the appearance of man on the surface of the earth, he started looking for a place to settle for his safety and where he had to do minimum efforts to gain his food. In that stage man was dominated by nature, with the course of time he started interacting with nature and as a result the modern man has come up with highly complex settlement system.

Objectives:

1. To study hierarchical classification of rural settlement based on Population Size class in Kolhapur district.
2. To study impact of physiographic structure on hierarchical distribution of rural settlement in Kolhapur District.

Data Base And Methodology:

Spatial distribution of rural settlement is basically based on population size class. According to the 2011 census there is inhabited villages (Grampanchayat) 1195 in Kolhapur District, having a population of 2645992. The rural settlements of the region have been categorized according population size in seven groups from less than 200 persons to more than 10,000 persons. Present study is mainly based on secondary data which is collected from 2011 District Census Handbook of Kolhapur District. To study impact of physiographic structure on hierarchical distribution of rural settlement on the basis of Cartosat 30 met resolution data. Statistical methods and GIS technique have been applied to measure settlement pattern and distribution in study area.

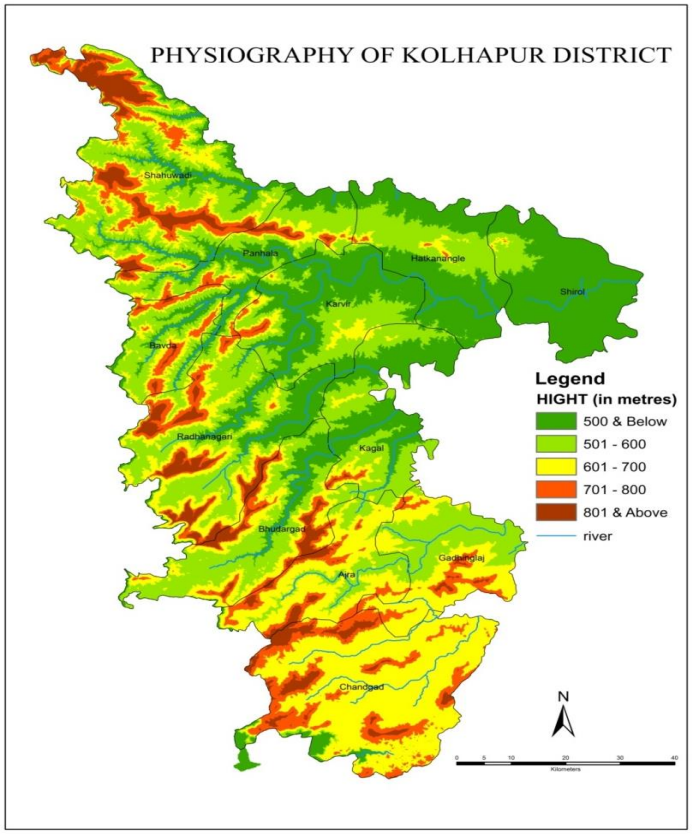
Study Area:

Kolhapur district is situated in the extreme southern part of Maharashtra State. It lies between 15° 43' and 17° 17' north latitudes and 73° 40' and 74° 42' east longitudes. It is surrounded by Sangli district to the north, Karnataka State to the east and south and Ratnagiri and Sindhudurg districts to the west. The Sahyadri ranges to the west and Varna River to the north form the natural boundaries. The district has an area of 7,685.00 sq.kms. and a population of 3876001 (3.45) persons as per Census 2011. While the area of the district accounts for 2.5 percent of the total area of the State, the districts population constitutes 3.45 percent of the total population of the State. The headquarters of the district is at Kolhapur. Kolhapur was the capital of the former Kolhapur State, a premier State of the Deccan and was also the seat of the Residency for Deccan States. It derives its importance from its past political associations and its present position as a great commercial, religious, cultural and educational centre. It is well connected both by road as well as by rail.

Physiography:

The Physiography of the Kolhapur district can be best appreciated in the background of its geology and relief. The district, on the whole, is a part of the Deccan table-land with an average

height of 548 meters above mean sea level, with the Sahyadrian scarp forming the most prominent feature along its western administrative boundary.

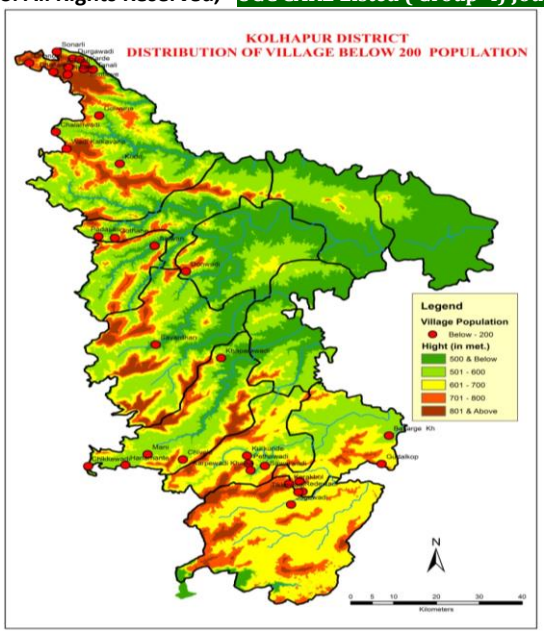


The gently uneven and mature looking crest-line of the Sahyadries, the Kolhapur portion of the plateau is marked by several hill ranges which emerge from the main range and develop an eastward or north-eastward trend. Some of them extend up to 40 to 45 kms while others terminate after a short stretch. But all these ranges have that characteristic 'Lava' topography consisting of flat tops and steep escarpments on flanks which carry several terraces or ' steps'. The ranges rise to about 300 meter to 450 meters above the valley floors.

Size Class Distribution Of Villages

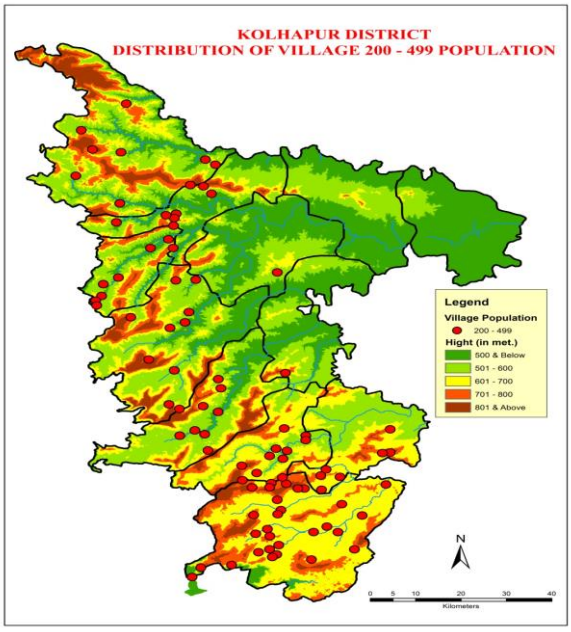
Size Class Less than 200:

Among the 1195 in 2011 census inhabited 16 villages (1.3) are small sized with a population below 200. There are 16 villages with less than 200 inhabitants each constituting 1.3 percent of the total inhabited villages with 0.1 percent (1812 persons) of the rural population of the district. The 12 tehsil of the district the percentage of villages with less than 200 population size is the highest in Ajra (4.12 percent) in 2011. Lowest in Karvir tehsil (0.8 percent) in 2011. Within 4 tehsil of this district such as Hatkanangale, Shirol, Kagal and Chandgad do not have any villages with population range less than 200 in 2011 census.



Size Class 200 – 499:

In this size class there are 124 villages (10.3 percent) in 2011 census. In this 124 villages with population size 200-499 accounting for 10.3 percent of the total inhabited villages with 1.8 percent (46835 persons) of the rural population of the district. The percentage of villages with population size 200-499 is highest in Bavda tahasil (28.9 percent) and lowest in Kagal tahasil (1.1 percent) in 2011. Within 2 tehsil of this district such as Hatkanangale and Shirol do not have any villages with population range 200 to 499 in 2011.



Size Class 500 – 999: According to census 2011 there are 294 villages (24.60 percent) are in the size class 500-999. In size class of 500 – 999 population there are 294 villages accounting 24.60

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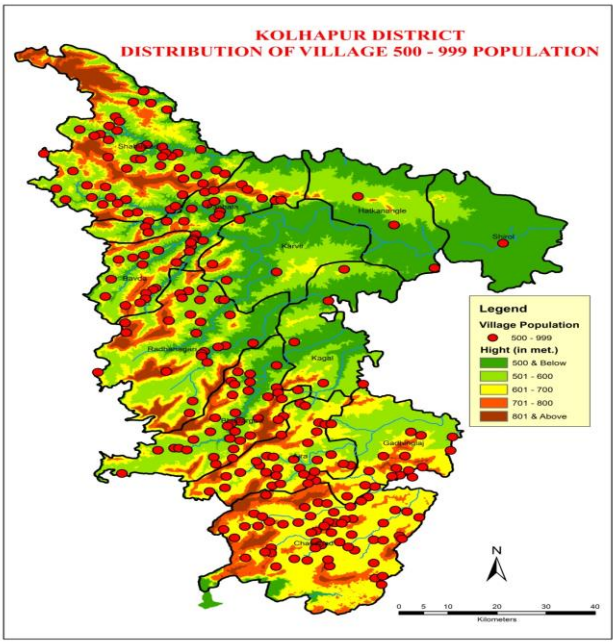
percent of the total inhabited villages with 8.3 percent (219049 persons) of the rural population of the district. The percentage of villages with population size 500-999 is highest in Bhudargad (39.5 percent) and lowest in Shirol (1.9 percent)



Size Class 1000 – 1999:

In size class of 1000 to 1999 there are 363 villages (30.4 percent) 2011. These size class villages with population size 1,000-1,999 accounting 30.4 percent of the total inhabited villages with 19.8 percent (523532 persons) of the rural population of the district. The percentage of villages with population size 1,000-1,999 is highest in Shahuwadi tehsil (43.6 percent) and lowest in Shirol tahsil (5.6 percent).

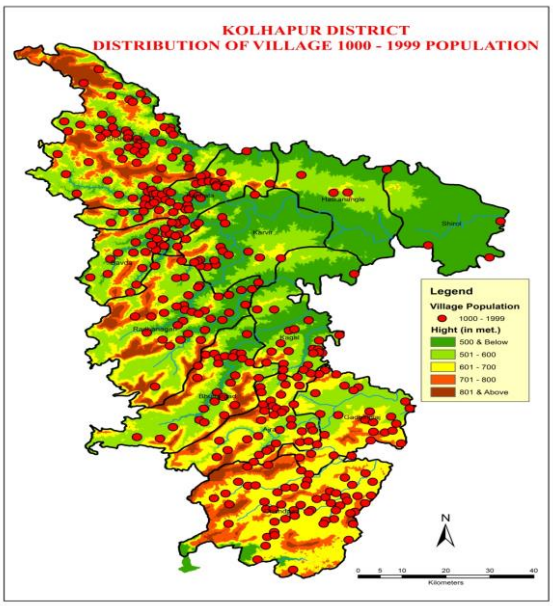


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Table No: 1 Distribution of Rural Settlement According to population Size Class

Sr.No	District		Class (Rural Settlement in Per Cent)							
			I	II	III	IV	V	VI	VIII	Total
1	Shahuwadi	No. of Settlement	2	9	45	58	18	1	0	133
		% of Settlement	1.50	6.77	33.83	43.61	13.53	0.75	0.00	100
2	Panhala	No. of Settlement	2	13	29	50	27	7	1	129
		% of Settlement	1.55	10.08	22.48	38.76	20.93	5.43	0.78	100
3	Hatkanangale	No. of Settlement	0	0	3	6	18	18	13	58
		% of Settlement	0.00	0.00	5.17	10.34	31.03	31.03	22.41	100
4	Shirol	No. of Settlement	0	0	1	3	26	18	6	54
		% of Settlement	0.00	0.00	1.85	5.56	48.15	33.33	11.11	100
5	Karveer	No. of Settlement	1	4	13	25	57	18	3	121
		% of Settlement	0.83	3.31	10.74	20.66	47.11	14.88	2.48	100
6	Gaganbawada	No. of Settlement	1	13	16	14	1	0	0	45
		% of Settlement	2.22	28.89	35.56	31.11	2.22	0.00	0.00	100
7	Radhanagari	No. of Settlement	1	12	30	36	30	5	0	114
		% of Settlement	0.88	10.53	26.32	31.58	26.32	4.39	0.00	100
8	Kagal	No. of Settlement	0	1	5	26	44	7	1	84
		% of Settlement	0.00	1.19	5.95	30.95	52.38	8.33	1.19	100
9	Bhudargad	No. of Settlement	4	14	45	34	15	1	1	114
		% of Settlement	3.51	12.28	39.47	29.82	13.16	0.88	0.88	100
10	Ajra	No. of Settlement	4	22	31	32	7	1	0	97
		% of Settlement	4.12	22.68	31.96	32.99	7.22	1.03	0.00	100
11	Gadhinglaj	No. of Settlement	1	5	21	28	27	7	1	90
		% of Settlement	1.11	5.56	23.33	31.11	30.00	7.78	1.11	100
12	Chandgad	No. of Settlement	0	31	55	51	18	0	1	156
		% of Settlement	0.00	19.87	35.26	32.69	11.54	0.00	0.64	100
Kolhapur District		No. of Settlement	16	124	294	363	288	83	27	1195
		% of Settlement	1.34	10.38	24.60	30.38	24.10	6.9	2.26	100

Source: Kolhapur District Census Handbook 2011.

Table No: 2 Distribution of Rural Settlement According to population Size Class

Sr.No	District		Class (Population in Per Cent)							
			I	II	III	IV	V	VI	VIII	Total
1	Shahuwadi	Population	280	3168	32168	87836	49701	7169	0	180322
		Population in %	0.16	1.76	17.84	48.71	27.56	3.98	0.00	100
2	Panhala	Population	337	4897	22123	71959	80829	42457	29001	251603
		Population in %	0.13	1.95	8.79	28.60	32.13	16.87	11.53	100
3	Hatkanangale	Population	0	0	2840	9042	59631	130241	205474	407228
		Population in %	0.00	0.00	0.70	2.22	14.64	31.98	50.46	100
4	Shirol	Population	0	0	694	4176	91003	126129	98131	320133
		Population in %	0.00	0.00	0.22	1.30	28.43	39.40	30.65	100
5	Karveer	Population	166	1720	8360	35949	181091	115184	39534	382004
		Population in %	0.04	0.45	2.19	9.41	47.41	30.15	10.35	100
6	Gaganbawada	Population	197	4830	11124	17573	2048	0	0	35772
		Population in %	0.55	13.50	31.10	49.13	5.73	0.00	0.00	100
7	Radhanagari	Population	195	4568	22477	51569	86692	34212	0	199713
		Population in %	0.10	2.29	11.25	25.82	43.41	17.13	0.00	100
8	Kagal	Population	0	465	3930	41723	131337	41435	11182	230072
		Population in %	0.00	0.20	1.71	18.13	57.09	18.01	4.86	100
9	Bhudargad	Population	261	5315	33303	47905	44108	5175	14301	150368
		Population in %	0.17	3.53	22.15	31.86	29.33	3.44	9.51	100
10	Ajra	Population	220	8741	24041	44430	17748	0	7828	103008
		Population in %	0.21	8.49	23.34	43.13	17.23	0.00	7.60	100
11	Gadhinglaj	Population	156	2025	15798	40156	82281	46947	11186	198549
		Population in %	0.08	1.02	7.96	20.22	41.44	23.65	5.63	100
12	Chandgad	Population	0	11106	42191	71214	52504	0	10205	187220
		Population in %	0.00	5.93	22.54	38.04	28.04	0.00	5.45	100
Kolhapur District		Population	1812	46835	219049	523532	878973	548949	426842	2645995
		Population in %	0.1	1.77	8.28	19.8	33.22	20.75	16.13	100

Source: Kolhapur District Census Handbook 2011.

Size Class 2000 – 4999:

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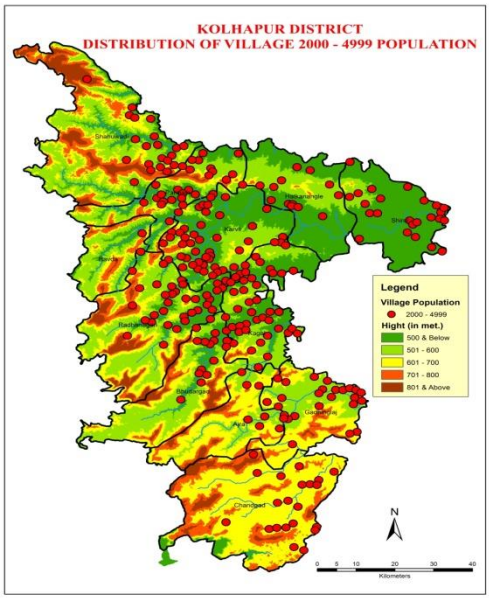
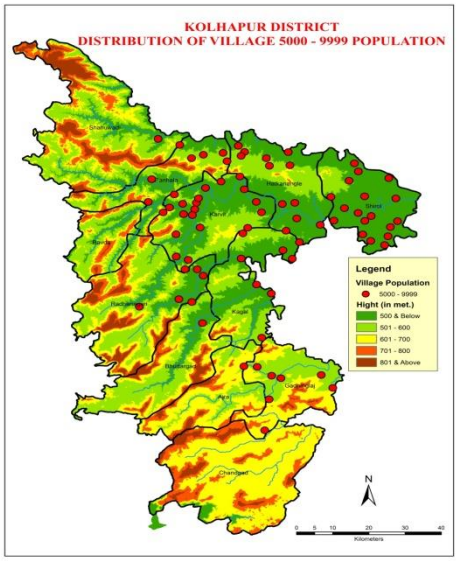


In this size class 288 villages (24.1 percent) are found in 2011 census. In the size class of 2,000 - 4999 288 villages with population size 2,000-4,999 accounting 24.1 percent of the total inhabited villages with 32.2 percent (878973 persons) of the rural population of the district. The percentage of villages with population size 2,000-4,999 is highest in Kagal (52.4 percent) in and lowest in Bavda tehsil (2.2 percent) in 2011.

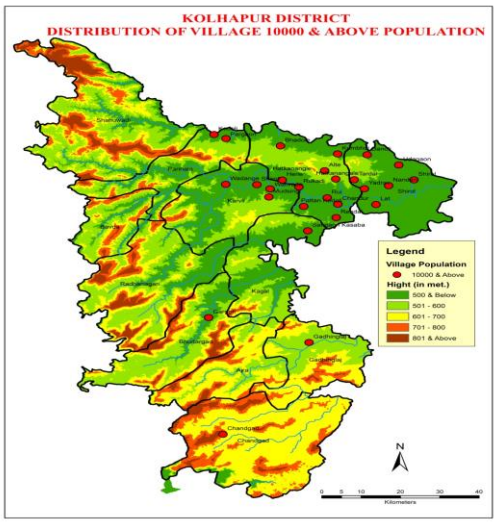
Size Class 5000 - 9999:



In 2011 census there are 83 villages (6.9 percent) in size class 5,000-9,999. These 83 villages with population size 5000 - 9999 accounting 6.9 percent of the total inhabited villages with 20.7 percent (548949 persons) of the rural population of the district. The percentage of villages with population size 5,000- 9,999 is highest in Shirol tehsil (33.3 percent) and lowest in Shahuwadi tehsil (0.7 percent) in 2011. Within 2 tehsil of this district such as Gaganbavada and Ajra do not have any villages with population range 5000 to 9999.

Size Class 10,000 & Above:

The size classes of 10000 and above there are 27 villages (2.3 percent) in 2011. There are 27 villages with population size 10,000 and above constituting 2.3 percent of the total inhabited villages with 16.3 percent (426842 persons) of the rural population of the district. The percentage of villages with population size 10,000 and above is highest in Hatkanangle tehsil (22.4 percent) and lowest in Chandgad tehsil (0.6 percent) in 2011. Shahuwadi, Bavda, Radhanagari, Kagal and Ajra tehsil have no villages in this range 10,000 and above in 2011.



Conclusion:

Western part of Kolhapur district is remote and hilly area. The Sahyadri Hills are spread in a north-south direction along the western boundary of the district. These hills are densely forested. In 2011 census total ¼ (25 per cent) of Settlements (less than 500 population) found in Gaganbavada 31.11, Ajra 26.80 per cent. These small settlements are called as Wady and Dhangarwady. In Kolhapur district there are 1195 rural settlement and these settlement are occupies 26, 45, 992 population.

The small size settlements (less than 1000 populations) are mainly located in foot hill (Above 700 met.) area of Shahuwadi, Bavda, Bhudargad, Ajra and Chandgad tehsil in the western part of Kolhapur district. There are 36.32 percent (434) settlement occupies 10.12 percent (2,67,696) of population.

The medium size (1000 - 5000) settlement are found Panhala, Radhanagari, Gadhingalaj, Kagal and western part of Karvir tehasil in clustered format. These 53 percent (651) of settlement occupies 54.48 percent (14,02,505) of population and located near river bank.

The eastern part of Kolhapur district is covered by plain area (Below 500 met.) of Panchaganga, Krushna and his sub tributaries. The large size 9.20 (110) percent settlement occupies 36.88 (9,75,791) percent population. Sites (Absolute location of Settlement) and Situations (Relative location of Settlement) are mostly affected on rural settlement. In study area Hatkanangale 48.3 and 53.4 and Shirol 44.4 per cent (Above 5000 Population) of Settlement in 2011 are located on Panchaganga and his sub tributaries of river bank. Agricultural situation is a most dominant factor of that settlement.

References:

1. Mukherji A.B, (1970): “Spacing of Rural Settlement in Rajasthan” a spatial analysis. Geographical outlook Vol. I, No.1.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

2. Ibid. (1974): "Spacing of Villages in Upper Ganga Yamuna Doab" Abstract. Geographical review of India, Vol. I 36, No. 2, p.p. 155 - 164.
3. Vyas.P.R. (1991): "Social Amenities and Regional Development", Rawat Publication, Jaipur, p.p. 45 - 64.
4. Khullar (2007): "India A Comprehensive Geography", Kalyani Publication, Ludhiana, p.p. 414 – 419.
5. Singh. R.Y (1994): Geography of Settlements, Rawat Publications, Jaipur.

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Study of Infertility Cases in Kolhapur

Sheetal M. Jaunjal, Rabia Kakitkar and Tekchand C. Gaupale

Department of Zoology, Vivekanand College, Kolhapur (Autonomous)

C.S. 2130, E ward, Tarabai Park, Kolhapur-416003.

Email ID: bakaresheetal@gmail.com

Abstract :

Infertility is the major global health issues and couples are unable to get it. Infertility affects approximately 8-10 %. It is a multidimensional problem with social, economic and cultural implication. Infertility may be associated with women or men and several factors affect fertility. Therefore, this study aims to investigate the infertility cases in Kolhapur city. The study showed that most women of the age group 26–30 years were affected. Women's infertility problems were double as compared to male infertility cases. This study highlighted that 27.4% of the cases were due to fallopian tube dysfunction, 20% due to menstrual disturbance, 9.1% due to problems of the uterus, 2.7% due to sexual disorders and another 2.7% because of age. This study states the major cause of infertility.

Introduction:

Infertility in couples is a health or medical condition caused by the psychological, physical and mental condition of the patient. Infertility is defined as not being able to get pregnant (conceive) after one year. In the world, in fertility is increasing and there are 60 million cases (Adamson et al., 2011; Stephen & Chandra, 1995). In couples, infertility is a health problem, social and emotional problem, which leads to divorce (Bhatti et al., 1999; Zeng et al., 2000). In primary infertility, couples have never been able to conceive. In secondary infertility, couples have difficulty conceiving after already having conceived. There is need for identification and calculation of primary infertility in the population (Dovom et al., 2014). Volgsten et al., (2008) reported the primary infertility in developed and developing countries as 6.6-26.4% and 5-25.7% respectively. In addition, 21.9 % of primary infertility were reported in the investigations (Safarinejad et al., 2008). According to WHO (World Health Organization), infertility in couples is due to reproductive system disorders where pregnancy does not occur with continuous intercourse for 12 months (Masearenhas, et al., 2012).

According to published data from WHO, the infertility frequency in people is around 17.5% and the ratio of 1 in 6 worldwide (WHO. 2023 link). Infertility is not always a women's problem. Infertility in men can be caused by different factors and is typically evaluated sperm count, motility and shape etc. Obstruction of different ducts, failure to deposit sperm in the vagina, errors in the seminal fluid, endocrine factors and smoking etc.

Material and Methods :

In the present study, the infertility cases were in Kolhapur. The data is collected from the IVF centers and maternity hospitals in Kolhapur. This information is the record of the hospitals and IVF centers by health workers. The information about infertility cases was recorded as per the information available from the patients.

Results and Discussion:

Infertility seems to be a multidimensional health issue which occurs not only due to health problems related to the fallopian tubes, the ovaries, and the endometrium, but it may also be a result of the choices imposed by the modern lifestyle, like the higher average age of people who get married, stress, non-conducive legal framework for assisted reproduction, etc. In the present study, 100 sources showed that a high proportion of women aged 20–40 years took part in a program of assisted reproduction, possibly because this is the reproductive age period among them. The distribution of age wise infertility in women from the 100 cases:- 21-25 age:- 18 cases, 26-30 age:- 46 cases, 31-35 age:- 26 cases, 36-40 age:- 9 cases, 41-45 age:- 1 cases (Table 1). As compared to female, the infertility in male is less. According to the study, the female has 40% more cases than males.

by a semen analysis. When a semen analysis is performed. The causes of women's infertility are fallopian tube abstraction, disorders of the menstrual cycle, uterus, age and ovarian failure. Male infertility associated problems are azoospermia, disruption of testicular functions, hormonal disorders, genetic disorders, malignant pituitary tumors, overweight or obesity, exposure to radiation, defective spermatogenesis, number of

Table 1. Analysis of Patients

Sr. No.	Age	Married For (In Years)	Infertility	Male Factors	Female Factors
	28	3 Y	1st		Uterus
1.	28	6Y	1st		Fallopian tube
2.	33	9Y	2nd		Fallopian tube
3.	29	5Y	2nd		
4.	26	10Y	2nd		Ovary
5.	27	8Y	2nd	HIV + VE	
6.	43	22Y	2nd		Ovary
7.	31	9Y	1st		
8.	20	9Y	1st		Ovary
9.	34	1Y	1st		
10.	28	13Y	1st		Ovary+Uterus
11.	29	4Y	1st		Tube
12.	25	4Y	1st		Ovary
13.	26	7Y	1st	Azoospermia	uterus
14.	31	5Y	2nd		
15.	30	8Y	2nd		uterus
16.	24	4Y	1st		
17.	26	4Y	2nd		
18.	35	8Y	1st		Ovary
19.	20	2Y	1st		
20.	37	15Y	2nd		Ovary

21.	33	11Y	2nd		uterus-Tube
22.	25	2Y	1st		Ovary
23.	31	10Y	2nd	Fertigate-M	
24.	37	12Y	1st	Varicocelectomy	Ovary
25.	28		2nd		
26.	23		1st		uterus-Tube
27.	28	2.5Y	1st		Ovary+Uterus
28.	39	10Y	2nd		Ovary
29.	21	3Y	1st		Ovary
30.	30	15Y	2nd		
31.	32		1st		
32.	30	4Y	1st		
33.	35		1st		Ovary
34.	28		2nd		Ovary
35.	24	4Y	2nd		
36.	36	14Y	1st		Ovary
37.	26	2.5Y	2nd		Ovary
38.	30	15Y	1st		Ovary
39.	31	4Y	4th		Ovary
40.	38	10Y	2nd		Ovary
41.	25	3Y	1st		Ovary
42.	28	9Y	1st		Ovary
43.	30	4Y	1st		Ovary
44.	32	5Y	1st		
45.	31		2nd		
46.	28	12Y	2nd		
47.	26	7Y	1st		
48.	30	9Y	2nd		uterus
49.	25	7Y	2nd		
50.	32	11Y	3rd		
51.	27	10Y	2nd		
52.	32		2nd		
53.	32	2.5Y	2nd		Ovary polyp
54.	28	5Y	1st		Ovary
55.	29	3Y	1st		
56.	26	5Y	1st		Ovary
57.	39	17Y	3rd		Ovary
58.	32	10Y	2nd	Azoospermia	Ovary
59.	33		1st		Ovary
60.	40	24Y	1st	Azoospermia	Ovary
61.	22		2nd		Ovary
62.	28	10Y	1st		Ovary
63.	30		2nd		Ovary
64.	27	3Y	1st		Tube
65.	21	2Y	1st		
66.	28	3Y	1st		
67.	30		2nd	HIV +VE	
68.	39	2Y	2nd		Ovary
69.	35	16Y	1st		Ovary
70.	27	5Y	1st		uterus
71.	21		1st		Left+ Ovary
72.	27	7.5Y	1st		
73.	29	3Y	2nd		
74.	21	2Y	1st		

75.	35	11Y	1st		Ovary +Tube
76.	36	10Y	1st		
77.	36	10Y	1st	Sever Oligospermia	Ovary tube
78.	25	10Y	1st		
79.	31	6Y	1st		Ovary
80.	21	1Y	1st		
81.	29	12Y	2nd		
82.	29	2Y	1st		
83.	34	17Y	1st		
84.	26	3Y	1st		
85.	21	3Y	1st		
86.	24	7Y	1st		
87.	29		2nd		
88.	25	4Y	2nd		
89.	22	2Y	1st		
90.	31	9Y	2nd		uterus
91.	27	3Y	1st		
92.	29	7Y	1st		
93.	28	7Y	1st		uterine tube
94.	28	8Y	2nd		
95.	29	12Y	1st		uterine tube
96.	30		3rd		
97.	29	4Y	1st		
98.	21	1Y	2nd		
99.	26		1st		

It is widely accepted that during the last twenty years, the average age of having children has increased and this is a key factor for infertility (Safarinejad, 2008). As the age of giving birth is increased, the reproductive capacity is decreased, the ovary becomes less efficient, the frequency of sexual intercourse is decreased and the possibility of chromosomal abnormalities and miscarriage is increased. The results also showed that the majority of women who took part in the study were employees in the public or the private sector. One possible interpretation of the finding is that women who work are in daily contact with other people, exchange ideas, are well-informed and receive various stimuli in the working environment, which makes them face assisted reproduction in a more positive way. As for the causes of female infertility, these relate mostly to the hypothalamus, the pituitary gland, the ovaries, the fallopian tubes, the body of the uterus, the cervix of the uterus and the vagina. The participants' responses were that problems related to the tubes are the primary cause of female infertility and other unknown cause. The main cause of infertility related to the fallopian tubes is any condition affecting the normal function and anatomy of the fallopian tubes and preventing the meeting of sperm with the ovum and the consequent conception. The development of ectopic intrauterine tissue occurs mainly in women aged 30-40 years old and occurs more often in advanced countries. This specific condition is more common among women that have given birth many times before and those that give birth at an older age. Finally, the use of contraception methods can also contribute to infertility because they can cause inflammation and destruction of the fallopian tubes

(Wasti et al., 2017). The present showed that 10.4% did not know the cause of infertility. The failure to identify a clear cause of the infertility after a full screening of both partners is defined as infertility of «unknown cause. In the present study, 20% of the infertility was due to menstrual disorders, which often occur as a result of metabolic diseases. It is known that the function of the thyroid gland is directly affected by the relationship of hypothalamic-pituitary gland-ovarian hormones. The increased function of the thyroid is likely to cause disorders in the menstrual cycle, and an increase or decrease in women's sexual activity. The second common cause (9.1%) of infertility was problems in the uterus. The main problems that are related to the body of the uterus and cause infertility are malformations, abnormal positions of the uterus, inflammation, intrauterine symphysis, atrophy of the endometrium, and malignant neoplasm. Other common problems are inflammation of the ovaries, endometriosis, polycystic ovarian syndrome and neoplasms. Also, infertility may be associated with impairment of the luteal phase where, after ovulation, the fertilized egg is not possible to be implanted in the uterus. Primary infertility in the population is more prevalent and consistent than secondary (Ganguly & Unisa, 2010, Allok et. Al., 2016; Safarinejad, 2018).

Conclusion:

Infertility is a health problem that requires appropriate treatment strategy. Modern medical science has developed advanced therapies to assist reproduction over the last 20 years. The main causes of female infertility are the problems related with health. The treatment for infertility was IUI, Laparoscopy and IVF was advice to the people. The infertility in population that about 1500 new cases a year. The female infertility factors are about 40%, male infertility factors around 20%, and combined factors are about 40%. In addition, there is lack of knowledge among couples and deficiency of data about infertility.

References :

1. Adamson P.C., Krupp K., Freeman A.H., Klausner JD., Reingold A.L., Madhivanan P., Prevalence & correlates of primary infertility among young women in Mysore, India. *Indian J Med Res.* 2011; 134:440-446.
2. Allow A.K., Sadek S.M., Maryam B., distribution of infertility factors among infertile couples in Yemen. J. Clin. Dev. Biol. 2016;.1:3.
3. Bhatti L.I., Fikree F.F., Khan A., The quest of infertile women in squatter settlements of Karachi, Pakistan: a qualitative study. Soc Sci Med. 1999; 49:637-649.
4. Dovom M. R., Fahimeh R. T., Mehrandokht A., Golshan A., Somayeh H., Mahsa N., A population-based study on infertility and its influencing factors in four selected provinces in Iran (2008-2010). Iran J Reprod Med. 2014,12 (8): 561-566.
5. Farhi J, Ben-Haroush A., Distribution of causes of infertility in patients attending primary fertility clinics in Israel. Isr Med Assoc J 2011;13: 51-4.

6. Ganguly S, Unisa S., Trends of infertility and childlessness in India: Findings from NFHS data. Facts Views Vis. Obgyn., 2010;2:131-138.
7. Masearenhas M., Flaxma S., Boerma T, Vanderpoel S.H., Gretchen A., National, Regional, and Global Trends in Infertility Prevalence Since 1990: A systematic analysis of 277 health surveys (2012). https://doi.org/10.1371/journalpmed1001356.
8. Masoumi S.Z., Parsa P., Darvish N., Mokhtari S., Yavangi M., Roshanaei G., An epidemiologic survey on the causes of infertility in patients referred to infertility center in Fatemieh hospital in Hamadan. Iran. J. Reprod. Med., 2015; 13: 513-516.
9. Safarinejad M.R., Infertility among couples in a population-based study in Iran: prevalence and associated risk factors. Int, J, Androl., 2008; 31:303–314.
10. Stephen E.H., Chandra A., Updated projections of infertility in the United States: 1995-2025. Fertil. Steril., 1998; 70: 30-34.
11. Volgsten H., Skoog S. A., Ekselius L., Lundkvist O., Sundstrom P. I., Prevalence of psychiatric disorders in infertile women and men undergoing in vitro fertilization treatment. *Hum. Reprod.*, 2008; 23:2056-2063.
12. Wasti, S. P., Simmons R., Limbu N., Chipanta S., Haile L., Velcoff J., Shattuck. 2017. "Side-Effects and Social Norms Influencing Family Planning Use in Nepal." *Kathmandu Uni.Medical Jou.2017;* 15(3): 9.
13. WHO-https://www.who.int/news/item/04-04-2023-1-in-6-people-globally-affected-by-infertility.
14. Zeng Y, Wu D., Regional analysis of divorce in China since1980. *Demography*. 2000; 37: 215-219.

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Diversity of Ant species in Radhanagari Tehsil, District Kolhapur, Maharashtra, India.

Anupama Pawar[1], G. K. Sontakke[1] and Bharati Wali [2]

[1]Vivekanand College Kolhapur (Autonomous)

[2]Department of Zoology, Shri Yashwantrao Patil Science College, Solankur, 416212

Email:anupamapawar27@gmail.com

Abstract:

Eleven species of ants of family Formicidae in which 3 subfamilies; 7 species of Formicinae, 3 species of Myrimicinae,1 species of + Sphecomyrminae, and 9 genera were detected during January to April 2022. In Radhanagari Tehsil, various observations were studied and recorded. According to the observations it is understood that the ants are important for agricultural fertile soil and the related crops, as compared to ants in non-agricultural areas. It is mainly to study various characteristics of species and changes around surrounding environments. It is important to understand that there is diversity in our ecosystem. It was also observed that spraying insecticides and pesticides on Agricultural land can cause harm to the ant species. The result also shows that there is a need to examine and spread information about preserving some ant species which are rare. The spraying of chemicals to gain high yield harms the ant species.

The ant species play vital role in soil fertility. It is a very mainly factor in maintaining the balance in the ecosystem. Formic acid is found in most ants and stingless bees. The first person to describe the isolation of this substance (by the distillation of large numbers of ants) was the English naturalist John Ray, in 1671. Ants secrete the formic acid for attack and defense purposes. Formic acid was first synthesized from hydrocyanic acid by the French chemist Joseph Gay-Lussac, in 1855. According to theoretical details, ants are a premium source of formic acid. In which some molecules contain iron (Fe) (Rumpold and Schluter,2013). So, it can be very useful in future discoveries related to the invention of new tablets containing (Fe) element as the number of patients with anemia is increasing, it can be used for the production of drugs and medicines related to iron tablets for future generation of human species.

Key Words: Ant, Soil ecology, Diversity, fertile soil ecological balance.

Introduction:

Earth is blessed with amazing variety of living organisms consisting of both micro and macro-organisms such as bacteria, fungi, plants and animals. The variability among all these organisms from all sources such as terrestrial and aquatic ecosystems help to maintain the genetic variations among them. Ants are recognized as ecologically important invertebrates in many ecosystems (Hölldobler and Wilson 1990). They positively affect physical and chemical soil properties, plant and animal

distribution, and forest health. Some species (e.g., carpenter ants [Camponotus spp.]) achieve direct pest status because they may cause serious structural damage in buildings. Other species invade homes, and cause indirect damage to plants by harboring some aphids and scale insects. Ants serve as important food for many vertebrates, including woodpeckers (Torgersen and Bull 1995).

As all the living organisms play vital role in one or the other ways in nature, ants also play an important role in soil formation and fertility. The study of these interesting and diverse group of insects is known as ‘‘Myrmecology’’. All ants are eusocial and they are considered as useful organisms for monitoring the soil fertility as they are abundant of ubiquitous in both intact and disturbed areas (Andersen, 1990; Pearson, 1994; Andersen, 1997; Folgarait, 1998; Hoffman, 2000).

Material and Method:

1. Study site:

I have selected the rural region of Solankur of Radhanagari Tehsil as the survey area for a research study. I have observed various agricultural and nonagricultural areas surrounding the village area. The agricultural area included crops like sugarcane, rice, various vegetables etc.

2. Survey Time:

A daily survey was carried out every week between 7 to 10 am and 4 to 6 pm in the study sites from August to February. Observations were made randomly based on habitat, structure availability of ant species and various other factors.

3. Collection:

Ants were collected from different areas using various methods suitable for respective habitats. Morning and evening collections provide the best results. Ant colonies will be deeper in the soil during the winter season, although a few foragers are at the surface. In present study collection of ants by digging to a depth of 1-3 meters. In the spring season, the colonies moved nearer the soil surface. The method used for the collection of ants is “Pit Fall Trap Method”. (Bedding, R.A. and Akhurst, R. 1975). The observed species were collected, photographed and preserved for further studies.

4. Killing and Preservation:

Ethyl acetate-coated blotting papers were used to kill the ants by placing them in the glass bottle to avoid direct contact with chemicals.

Preservation and identification of specimens Samples mixed with debris were separated from debris and washed with alcohol before preserving them. Immediately after collection, all the specimens were sorted out based on similar groups. The specimens were sealed and kept in separate vials of 70% alcohol with appropriate labels for further identification. The collected ants were identified up to genus and for a few, species-level identification was done with the help of keys given by Ali (1992); Bingham (1903); Bolton, B. (1994); Rastogi et. al., (1997); Tiwari (1999); Varghese (2002 & 2003).

5. Identification:

Several types of keys were used for taxonomic studies, to identify the collected ant specimens.

1. The collected specimens were identified based on the morphological characteristics such as, the number of segments in the antenna, the position of the antenna, type of eyes, number of lymph nodes, spines present in the petiole region, presence or absence of sting, body coloration, size, and hair etc.

2. The collected specimens were photographed and identified by using effective available keys and field guides from the net or books of ants (http://antkey.org/en; http://www.ipm.ucdavis.edu/TOOLS/ANTKEY/; Bolton, 1994).

Result:

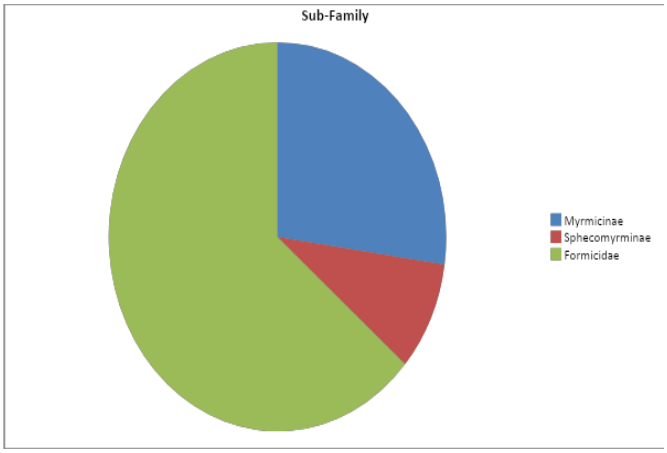
In the rural area near Radhanagari, some ant species from the family Formicidae were identified. A total number of 11 species were observed and found in which 3 subfamilies i.e. 7 species of Formicinae, 3 species of Myrimicinae, and 1 species of + Sphecomyrminae were detected during my study and observation. Therefore, according to the observations made it is understood that the ants are very important to agricultural fertile soil and the related crops as compared to ants in nonagricultural areas.

It is a very mainly factor in maintaining the balance in the ecosystem. According to theoretical details, ants are a premium source of formic acid. In which some molecules contain iron (Fe). So, it can be very useful in future discoveries related to the invention of new tablets containing (Fe) element as the number of patients with anemia is increasing, it can be used for the production of drugs and medicines related to iron tablets for future generations of human species.

Observation Table: Table No.1 Diversity of ant's species from Radhanagari Tehsil.

Sr.No.	Name	Family	Sub-Family	Genus	species
1	Wasmaniaauropunctata	Formicidae	Myrmicinae	Wasmannia	W.auropunectata
2	Crematogasterrongenfori	Formicidae	Myrmicinae	Crematogaster	C. rogenhoferi
3	Pheidoledentate	Formicidae	Myrmicinae	Pheidole	P.dentata
4	Sphecomyrmafreyi	Formicidae	Sphecomyrminae	Sphcomyrma	S. freyi
5	Nylanderiafluva	Formicidae	Formicidae	Nylanderia	N.fluva
6	Lasius americanus	Formicidae	Formicidae	Lasius	L. americanus
7	Ocephyllasmaragdina	Formicidae	Formicidae	Oyecophylla	O.smaragdina
8	Paratrechinalongcornis	Formicidae	Formicidae	Paratrechina	P. longcornis
9	Componotuspennsylvanicus	Formicidae	Formicidae	Camponotus	C. pennsylvanicus
10	Componotusnovaeboraceni	Formicidae	Formicidae	Camponotus	C. novaeboracenis

	s				
11	Componotus japonicus	Formicidae	Formicidae	Camponotus	C. japonicus



Simpsons Diversity Index:

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

N= Total number of organisms

n= Population of each individual species

D= Diversity index

Sr.No.	Species (subfamily)	Number of organism (n)	n-1	n (n-1)
1	Myrmicinae	3	3-1=2	3×2=6
2	Sphecomyrminae	1	1-1=0	1×0=0
3	Formicidae	7	7-1=6	7×6=42
	Total	**11**	**48**	

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

$$D = \frac{11(11-1)}{48}$$

$$D = \frac{11(10)}{48}$$

$$D = \frac{110}{48}$$

D= 2.29

Conclusion:

It is important to study various characteristics of species and changes according to surrounding environments. Present study elaborates diversity in our ecosystem. According to the survey, it is understood that ant species are found in various fertile and non-fertile areas. It was also observed that spraying of insecticides and pesticides on Agricultural land can cause harm to the ant species. The result also shows that there is a need to examine and spread information about preserving some ant species which are rare. The spraying of chemicals to gain high yield harms the ant species. Therefore, it is more difficult to cognitively detect species that play a very important role in the ecosystem.

The ant species play an important role in soil fertility. It is a mainly factor to maintain the balance in the ecosystem. Some species of ants are extremely important forest defoliators, and as a primary food source for Woodpeckers (Torgesen and Bull 1995) helps to balance biodiversity and the food chain.

References:

1. Akbar S.A., Bharti H. (2017), A new species of the ant genus *Carebara* westwood (Hymenoptera: Formicidae) from India. *J. Entomol. Res. Soc.*19:35–43. [Google Scholar]
2. Ali, T.M. (1991), “Ant fauna of Karnataka.” IUSSI Newsletter 5:1-8.
3. Ali, T.M. (1992), “Ant fauna of Karnataka.” IUSSI Newsletter 6: 1-7.
4. Andersen, A.N. (1990), the use of ant communities to evaluate change in Australian terrestrial ecosystems: a review and a recipe. Proc. Ecol. Soc. Aust. 16, 347-357.
5. Andersen A.N. (1997), Ants as indicators of restoration success following mining: a functional group approach. In Conservation outside Nature Reserves (P. Hale and D. Lamb, eds), Centre for Conservation Biology, University of Queensland, Queensland, Australia. pp. 319- 325.
6. Anjos D.V., Andersen A.N., Carvalho R.L., Sousa R.M., Del-Claro K. (2020), Switching roles from antagonist to mutualist: A harvester ant as a key seed disperser of a myrmecochorous plant. *Ecol. Entomol.* 45:1063–1070. doi: 10.1111/een.12885. [CrossRef] [Google Scholar]
7. Baroni Urbani, C. and M. L. de Andrade. 2003. The ant genus Proceratium in the extant and fossil record (Hymenoptera: Formicidae). Museo Regionale di ScienzeNaturali, Monografie 36: 1-480.
8. Bharti H., Wachkoo A.A., Kumar R. (2017), First inventory of ants (Hymenoptera: Formicidae) in northwestern Shivalik, India. *Halteres.* 8:33–68. doi: 10.5281/zenodo.582706. [CrossRef] [Google Scholar]
9. Bingham, C.T. (1903), “Fauna of British India”. ǁ Vol. II. Taylor Francis, London. Pp: 106.
10. Bolton, B. (1994), Identification Guide to the ant genera of the world. Harvard University Press. ISBN-10: 0674442806; ISBN-13: 978-067444280.

11. Bolton, B. (1994), "Identification guide to the ant genera of the world." Harvard University Press, Cambridge, Massachusetts, USA.
12. Chen Z., Lattke J.E., Shi F., Zhou S. (2017), Three new species of the genus *Gnamptogenys* (Hymenoptera, Formicidae) from southern China with a key to the known Chinese species. *J. Hymenop. Res.* 54:93–112. doi: 10.3897/jhr.54.10816. [CrossRef] [Google Scholar]
13. Cuezzo, F. 2000. Revisión del género Forelius (Hymenoptera: Formicidae: Dolichoderinae). Sociobiology 35: 197-277.
14. Dash, S. T. 2004. Species Diversity and Biogeography of Ants (Hymenoptera: Formicidae) in Louisiana, with Notes on their Ecology. M.S. Thesis, Louisiana State University, 290 pp.
15. Folgarait, P J. (1998), Ant biodiversity and its relationship to ecosystem functioning: a review. Biodiversity and Conservation 7, 1221-1244.
16. Fontanilla A.M., Nakamura A., Xu Z., Cao M., Kitching R.L., Tang Y., Burwell C.J. (2019), Taxonomic and functional ant diversity along tropical, subtropical, and subalpine elevational transects in Southwest China. *Insects.* 10:128. doi: 10.3390/insects10050128. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
17. Hoffman B D. (2000), Changes in ant species composition and community organization along grazing gradients in semi-arid rangelands of the Northern Territory. Rangel. J. 22(2), 171-189.
18. Johnson, W. B. (1803). *History of the process and present state of animal chemist*
19. Kansas, J. L.; Achuff, P. L.; Raine, R. M. (1989), A food habits model for grizzly bear habitat evaluation in Banff, Jasper, Kootenay and Yoho national parks.
20. Liu C., Dudley K.L., Xu Z.H., EconomoE.P.(2018), Mountain metacommunities: Climate and spatial connectivity shape ant diversity in a complex landscape. *Ecography.* 41:101–11 doi: 10.1111/ecog.03067. [CrossRef] [Google Scholar]
21. MacGown, J. A. and J. G. Hill. 2006. The Eastern ant cricket, Myrmecophiluspergandei Bruner (Orthoptera: Myrmecophilidae), reported from Mississippi, U.S.A. Journal of the Mississippi Academy of Sciences. 51: 180-182. [pdf]
22. Marathe A., Priyadarsanan D.R., Krishnaswamy J., Shanker K. (2020), Spatial and climatic variables independently drive elevational gradients in ant species richness in the Eastern Himalaya. *PLoS ONE.* 15: e0227628. doi: 10.1371/journal.pone.0227628. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
23. Ohyama L., King J.R., Jenkins D.G. (2020), Are tiny subterranean ants' top predators affecting aboveground ant communities? *Ecology.* 101: e03084. doi: 10.1002/ecy.3084. [PubMed] [CrossRef] [Google Scholar]

24. Pearson D. (1994), Selecting indicator taxa for the quantitative assessment of biodiversity. Phil. Trans. R. Soc. Lond. B. 345: 75–79.
25. Raine, R. M.; Kansas, J. L. (1990), Black bear seasonal food habits and distribution by elevation in Banff National Park, Alberta. International Conference Bear Research and Management 8: 297-304.
26. Rastogi, N., Nair, P., Kolatkar, M., William, H., and Gadagkar, R. (1997), "Ant fauna of The Indian Institute of Science Campus – Survey and some preliminary observations. "J.IndianInst.Sci 77: 133-140.
27. Rossi N., FeldhaarH. (2020), *Encyclopedia of Social Insects*. Springer; Cham, Switzerland: Carpenter ants; pp. 973–978. [Google Scholar]
28. Rumpold BA & Schluter OK (2013a) Nutritional composition and safety aspects of edible insects. Molecular Nutrition and food Research 57:802-23.
29. Subedi I.P., Budha P.B., Bharti H., Alonso L. (2020), An updated checklist of Nepalese ants (Hymenoptera, Formicidae) *ZooKeys*. 1006:99–136. doi: 10.3897/zookeys.1006.58808. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
30. Subedi I.P., Budha P.B. (2020), Diversity and distribution patterns of ants along elevational gradients. *Nepal. J. Zool*. 4:44–49. doi: 10.3126/njz.v4i1.30672. [CrossRef] [Google Scholar]
31. Subedi I.P., Budha P.B., Bharti H., Alonso L., Yamane S. (2021), First Record of the Ant Subgenus *Orthonotomyrmex* of the Genus *Camponotus* from Nepal (Hymenoptera, Formicidae) *Zoodiversity*. 55:279–284.doi: 10.15407/zoo2021.04.279. [CrossRef] [Google Scholar]
32. Tiwari, R.N. (1999)," Taxonomic studies on Ants of a Southern India (Insecta: Hymenoptera: Formicidae)." Memories. 18: 1-962.
33. Thurman J.H., Northfield T.D., Snyder W.E. (2019), Weaver ants provide ecosystem services to tropical tree crops. *Front. Ecol. Evol*. 7:120. doi: 10.3389/fevo.2019.00120. [CrossRef] [Google Scholar]
34. Trager, J. C. 1991. A revision of the fire ants, Solenopsis geminata group (Hymenoptera: Formicidae: Myrmicinae). Journal of the New York Entomological Society 99: 142-198
35. Varghese,T. (2002), "Record of Strumigenysemmae(Emery) (Formicidae: Myrmicinae) from Bangalore, Karnataka and a key to Indian species of Agriculture, Mysore state."
36. Varghese, T., (2003), "Ants of the Indian Institute of science campus‖." Technical report no 93, Centre for Ecological Sciences, Bangalore.
37. Wachkoo A.A., Akbar S.A., Jan U., Shah G.M. (2020). *Biodiversity of the Himalaya: Jammu and Kashmir State*. Springer Nature; Basingstoke, UK: Taxonomic inventory of ants (Hymenoptera: Formicidae) in Jammu and Kashmir state; pp. 733–747. [CrossRef] [Google Scholar]

38. Wray, *J (1670).* "Extract of a Letter, Written by Mr John Wray to the Publisher January 13. 1670. Concerning Some Un-Common Observations and Experiments Made with an Acid Juyce to be Found in Ants". *Philosophical Transactions of the Royal Society of London. 5 (57–68): 2063–2066.* Bibcode:1670RSPT....5.2063W. doi:10.1098/rstl.1670.0052
39. Wetterer J.K. (2017), Geographic distribution of the weaver ant *Oecophyllasmaragdina*. *Asian Myrmecol.* 9: e009004. [Google Scholar]
40. Williams J.L., Lapolla J.S. (2018), Two new *Prenolepis* species (Hymenoptera: Formicidae) from Indomalaya and Australasia, with a redescription of *P. dugasi* from Vietnam. *Zootaxa.* 4441:171–180. doi: 10.11646/zootaxa.4441.1.10. [PubMed] [CrossRef] [Google Scholar]

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Is there a connection between a species dispersal and its seed size? : A case study in genus *Habenaria* (Orchidaceae)

B.T. Dangat[1] and R. V. Gurav[2]

[1]Department of Botany, Vivekanand College, Kolhapur (Autonomous)

[2]Department of Botany, Shivaji University, Kolhapur

Email: schndangat@gmail.com

Abstract:

The family Orchidaceae is well recognized for its very small, dust-like seeds, which have round to oval endosperm encased in a thin, translucent fusiform testa. These traits demonstrate the sophisticated nature of families and their patterns of development. Since many of the features utilized in seed morphometry have a taxonomic significance, microscopic investigation is used in the current work to examine seeds from the genus *Habenaria*, family Orchidaceae. Quantitative and qualitative data pertaining to the general morphology of the seed is discussed. This includes data about the seed's surface characteristics, such as size, shape, visibility of the embryo, and variation between the seed's length/width ratio at its maximum and minimum. The findings indicate that higher seed volume is the outcome of both bigger length and breadth, according to data on seed volume. Compared to the testa, the embryo's volume is significantly less. Because of this, seeds contain a lot of internal air passages that give them a balloon-like shape. This characteristic helps seeds disperse by air and water currents over great distances. While seeds with modest sizes stay endemic to a particular locality, seeds with maximal length and width disseminate to larger geographical locations. Seed buoyancy is increased by increasing the ratio of seed to embryo air percentage. The current study establishes a favorable link between seed buoyancy and distribution pattern. Because of its longer and flyer-type seeds, *Habenaria digitata* and *H. gibsonii* are extensively dispersed, but *H. grandifloriformis* is still confined to a particular location because of its relatively small seeds.

Keywords: *Habenaria*, scanning electron microscope, seed morphometry, Western Ghats.

Introduction:

The tiny, dusty seeds of the orchid family, orchidaceae, have round, oval, or ellipsoidal endosperm that is encased in a thin, translucent fusiform testa. The elegant nature of the family and its developmental patterns are reflected in this character. The length and breadth of these seeds vary significantly, which is noteworthy from a taxonomic standpoint at the genus and species levels (Arditti & Ghani, 2000). Numerous researchers (Clifford & Smith, 1969; Vij et al., 1992; Rasmussen, 1995; Swamy et al., 2004 and Verma et al., 2013) have shown a clear relationship between orchid seed size and plant habit: epiphytic orchids often have smaller seeds than terrestrial orchids. The information on the numerical and physical properties of orchid seeds provided by Arditti & Ghani

(2000), however, indicates that this is not a norm. After examining the size of numerous orchid seeds, Molvray & Kores (1995) reached their conclusion that, on average, seed size varies from 0.5 to 0.8 mm depending on the species taken into consideration. According to studies performed by Arditti et al. (1979) and Vij et al. (1992), seeds of advanced Epidendroid orchids (Epidendroideae) vary greatly in shape, with fusiform seeds often showing the least variance among primitive orchids (Cypripedioideae). All other seed forms may have evolved from fusiform seeds, which are found in all of the subfamilies, as a primordial trait (Arditti et al., 1979; 1980; Healey et al., 1980; Rasmussen 1995; Verma et al., 2013). They proposed that a more accurate indicator of orchid seed size should be the volume, not the length or breadth. Additionally, it has been suggested by Arditti et al. (1980) and Augustine et al. (2001) that the length/width ratio might reveal information on the relative degree of truncation of orchid seeds. Linguistically speaking, truncated seeds are those whose L/W value is less than 6.0, whereas elongated seeds are those whose L/W value is greater than 6.0. Using light and scanning electron microscopes, Arditti et al. (1980) and Barthlott and Ziegler (1981) examined a variety of seed characteristics and provided a thorough explanation of the structure and varieties of seeds. The majority of the currently examined species have quadrilateral testa cells. Prior research by Clifford & Smith (1969), Vij et al. (2006), and Verma et al. (2013) revealed that fusiform quadrilateral testa cells are often found in epiphytes and are regularly seen in ground-growing taxa. According to Kurzweil (1993), the seed coat of orchids might consist of variously shaped and decorated cells, which are typically elongated and concave, with straight or slightly undulating anticlinal walls. A correlation between seed size and volume was postulated by Arditti et al. (1979). They contend that there is a direct proportionality between seed size and volume. Higher "seed volume/embryo volume" ratio seeds are predicted to be more buoyant and to belong to more widely spread species than lower ratio seeds. Studies on seed morphometry, according to Augustine et al. (2001), offer incredibly helpful information in resolving various taxonomy, phylogeny, and phytogeographic issues. The majority of the previous researchers concentrated on and talked about the importance of the air space that exists in orchid seeds, which makes the seeds incredibly light and buoyant. Even Augustine et al. (2001) proposed that whereas seeds with less air space exhibit a more constrained and confined distribution, extremely light and buoyant seeds with a higher proportion of air space may get scattered over a broad variety of geographical locations. According to Arditti & Ghani (2000), an increase in the testa's cell length is the cause of the rise in the proportion of air space.

With the exception of a few instances of research on the use of seed morphometry, the genus *Habenaria* is either completely disregarded or inadequately investigated for seed characteristics and seed morphometry as a taxonomical tool. Therefore, an effort is made in this work to thoroughly examine the different characteristics of seeds and how they relate to the distribution pattern of species within this underappreciated genus.

Material and Methods:

From 2014 to 2021, mature seeds from eighteen different species of *Habenaria* were gathered from both the Departmental Botanical Garden's germplasm bank and the spontaneously dehiscing capsules found in the wild. Light microscopic investigations and photography studies of 18 species were carried out under an Olympus DM2000 compound microscope. Using light microscopes, investigators examined both qualitative and quantitative data regarding the general morphology of the seed, including seed surface characteristics like size, shape, color, visibility of the embryo, testa structure, curvature, and ridges, ornamentation of the periclinal and anticlinal walls, and variation in the length/width ratio of the seed. The observation table contains the observations that were made. Since the different morphometric characteristics vary greatly within a single species, substantial means have been obtained by observing a large number of seeds. Since the cross section of orchid embryos is elliptical, the formula $4/3\ \pi ab^2$, where a = ½ for length and b = ½ for width, was used to compute the embryos' volume. The terms used here to refer to the morphology of seeds and other finer characteristics in SEM are those recommended by Arditti et al. (1980).

Results and Discussion:

Seed shape **(Table 1 and Plate I)**

Three basic seed shapes are revealed by microscopic studies: (1) spathulate in *Habenaria brachyphylla*, *H. grandifloriformis*, *H. roxburghii*, *H. suaveolens*, and *H. rariflora* (Plate I. a, i, and p-r); (2) fusiform in *Habenaria* commelinifolia, *H. crinifera*, *H. heyneana*, *H. longicorniculata*, *H. longicornu*, *H. marginata*, and *H. plantaginea* (Plate I. b, c, j-m, and o); and (3) filiform in *Habenaria* digitata, *H. foetida*, *H. furcifera*, *H. gibsonii*, and *H. ovalifolia* (Plate I. d, f-h and n). All species have centrally placed, oval to elliptical embryos that are visible.

Seed size (Table 1)

The length of the seeds varies between *Habenaria grandifloriformis* (0.29 ± 0.14 mm) and *H. digitata* (1.69 ± 0.35 mm). *H. commelinifolia* has a width of 0.08 ± 0.02 mm, whereas *H. diphylla* has a width of 0.33 ± 0.02 mm. The species under study may be divided into three different categories according to the length of the seeds: tiny (up to 0.7 mm), intermediate (0.7 to 0.9 mm), and big (0.9 mm to 2.0 mm). Category 1 includes *Habenaria brachyphylla*, *H. diphylla*, *H. grandifloriformis*, and *H. roxburghii* (Plate I. a, e, i, and q), which are species with dorsiventrally flat leaves on the ground. *H. commelinifolia*, *H. crinifera*, *H. heyneana*, *H. longicorniculata*, *H. longicornu*, *H. marginata*, *H. rariflora*, and *H. suaveolens* (Plate I, b, c, e, k-n, p, and r) are included in group (2) *H. digitata*, *H. foetida*, *H. furcifera*, *H. gibsonii*, and *H. ovalifolia* were identified in category (3) (Plate I. d, f-h and n). The bulk of the species investigated in the current study belonged in the intermediate group. The findings align with the findings reported by Molvray and Kores (1995). Therefore, differences in the size and form of seeds in *Habenaria* can serve as an extra taxonomic marker for species identification.

Ratio of seed length to width (L/W) (Table 1):

H. commelinifolia, *H. digitata*, *H. foetida*, *H. furcifera*, *H. gibsonii*, *H. ovalifolia*, and *H. rariflora* were found to have elongate seeds in the current study, in accordance with Arditti et al. (1980) and Augustine et al. (2001). In contrast, *H. brachyphylla*, *H. crinifera*, *H. diphylla*, *H. grandifloriformis*, *H. heyneana*, *H. longicorniculata*, *H. longicornu*, *H. marginata*, *H. plantaginea*, *H. roxburghii*, and *H. suaveolens* displayed truncate seeds. *H. gibsonii* had the highest L/W ratio (17.67 ± 3.84), while *H. diphylla* had the lowest ratio (1.75 ± 0.69). The degree of seed truncation is a unique taxonomic characteristic that may be utilized to distinguish across *Habenaria* species.

Seed Volume (Table 1)

The volume and size of the seed have a link, according to Arditti et al. (1979). They contend that there is a direct proportionality between volume and size. Working with the species *Bulbophyllum*, Augustine et al. (2001) discovered that longer testa is not the cause of larger seed volume; rather, it is the wider testa. Identical findings were seen in the current study. The species *H. diphylla* has the highest seed volume (16.97 ± 2.14 mm3 × 10-3) because of its wider seeds (0.31 ± 0.12 mm), whereas the species *H. crinifera* has the lowest seed volume (0.08 ± 0.03 mm) of all the species examined.

Quantative characters of embryo: (Table 2)

In every species under study, variations have been noted in the length, width, and length/width (L/W) ratio of the embryo. differences in breadth are 0.06 ± 0.01 mm to 0.19 ± 0.10 mm, while differences in length range from 0.17 ± 0.09 mm to 0.34 ± 0.17 mm. *H. roxburghii* has the longest embryo (0.34 ± 0.17 mm), while *H. grandifloriformis* has the shortest (0.17 ± 0.09 mm); *H. roxburghii* has the widest embryo (0.19 ± 0.10 mm), while *H. crinifera* has the smallest (0.06 ± 0.01 mm). In *H. diphylla*, the L/W ratio is 1.09 ± 0.09, whereas in *H. crinifera*, it is 5 ± 2.98. Most of the species have an L/W ratio of one to two. According to Healey et al. (1980), the embryo's volume varies from species to genus in orchids, although the embryo's size tends to be consistent within a genus. When working on the genus *Bulbophyllum*, Augustine et al. (2001) provided strong support for this approach. According to Arditti et al. (1980), there may be significant differences in the quantities of seeds and embryos as well as the percentage of air space across several populations within the same species. The current study validates the research conducted by Augustine et al. (2001) and Healey et al. (1980). In *Habenaria*, embryo size is generally consistent within a species, although embryo volume varies widely. According to Augustine et al. (2001), there can often be a significant amount of variance in the volume of the orchid seed and embryo. In most orchid seeds, the embryo only takes up a relatively tiny percentage of the seed; but, in certain *Bulbophyllum* species, the embryo is enormous and takes up a significant portion of the seed. Similar findings were noted in a few *Habenaria* species.

The embryos of *Habenaria grandifloriformis*, *H. rariflora*, and *H. suaveolens* occupy a significant percentage of the seed, contributing to the seeds' rising weight.

Seed volume to embryo volume ratio (Table 2)

According to Augustine et al. (2001), there can often be a significant amount of variance in the volume of the orchid seed and embryo. In most orchid seeds, the embryo only takes up a relatively tiny percentage of the seed; but, in certain *Bulbophyllum* species, the embryo is enormous and takes up a significant portion of the seed. Similar findings were noted in a few *Habenaria* species. The embryos of *H. grandifloriformis*, *H.*, *H. rariflora*, and *H. suaveolens* occupy a significant percentage of the seed, contributing to the seeds' rising weight.

Seed volume to embryo volume ratio (Table 2)

The embryo volume (mm3 × 10-3) varies from 0.4 ± 0.09 in *H. gibsonii* to 16.29 ± 4.36 in *H. diphylla*, while the seed volume (mm3 × 10-3) varies from 0.86 ± 0.12 (*H. crinifera*) to 16.97 ± 2.14 (*H. diphylla*). An increase in embryo volume causes a decrease in air space and a rise in seed weight; conversely, a drop in embryo volume and an increase in seed volume increase the percentage of air space, which causes a decrease in seed weight. *H. gibsonii* and *H. furcifera* were discovered to have the greatest ratios of seed volume to embryo volume (6.63 and 6.57, respectively) in the current investigation, which contributed to their widespread dispersion across India. *H. brachyphylla* and *H. roxburghii*, on the other hand, have the lowest S/E volume ratios (1.2 ± 1.02 and 1.24 ± 0.65, respectively), while having a restricted distribution.

Air space (Table 2):

The relevance of air space in orchid seeds—which contributes to their extreme lightness and buoyancy—has been covered by Arditti et al. (1980), Arditti & Ghani (2000), and Augustine et al. (2001). Arditti and Ghani (2000) proposed that a rise in the testicular cell length is the cause of the proportion of air space increasing. In this study, the highest proportion of air space in seeds was found in *H. gibsonii* (84.91 ± 11.34%), followed by *H. furcifera* (84.77 ± 9.45%), while the lowest percentage of air space was found in *H. grandifloriformis* (0.86 ± 0.46%).

Conclusion:

It has been established via the current morphometric investigations on *Habenaria* seeds that the different traits investigated have diagnostic significance and can be utilized for both the Phytogeographical studies of species and the taxonomical separation between diverse species. According to the L/W ratio, seven species have truncated seeds, whereas the remaining species have elongated seeds. The long-distance dispersal of the species is facilitated by longer seed lengths, a higher ratio of seed to embryo volumes, and a higher percentage of air space. Higher seed volume is the outcome of both bigger length and breadth, according to data on seed volume. Compared to the testa, the embryo's volume is significantly less. Because of this, seeds contain a lot of internal air

passages that give them a balloon-like shape. This characteristic helps seeds disperse by air and water currents over great distances. While seeds with modest sizes stay endemic to a particular locality, seeds with maximal length and width disseminate to larger geographical locations. Seed buoyancy is increased by increasing the ratio of seed to embryo air percentage. The current study establishes a favorable link between seed buoyancy and distribution pattern. Because of its longer and flyer-type seeds, *Habenaria digitata* and *H. gibsonii* are extensively dispersed, but *H. grandifloriformis* is still confined to a particular location because of its relatively small seeds.

Literature Cited:

1. Arditti, J. & A.K.A.Ghani, 2000. Numerical and physical properties of orchid seeds and their biological implications. *New Phytologist* 145(3): 367-421.
2. Arditti, J., J.D.Michaud & P.L.Healey, 1979. Morphometry of orchid seeds. I. *Paphiopedilum* and native California and related species of *Cypripedium*. *American Journal of Botany* 66: 1128-1137.
3. Arditti, J., J.D.Michaud & P.L.Healey, 1980. Morphometry of orchid seeds.
4. II. Native California and related species of *Calypso*, *Cephalanthera, Corallorhiza* and *Epipactis*. *American Journal of Botany* 67: 347-365.
5. Augustine, J., Yogendrakumar & J.Sharma, 2001. *Orchids of India–II. Biodiversity and status of Bulbophyllum* Thou. Daya publishing house, Trinagar, New Delhi, 99 pp.
6. Barthlott, W. & B.Ziegler, 1981. Mikromorphologie der Samenschalen als systematisches Merkmal bei Orchideen. *Berichteder Deutschen Botanischen Gesellschaft* 94(1): 267-273.
7. Clifford, H.T. & W.K.Smith, 1969. Seed morphology and classification of Orchidaceae. *Phytomorphology* 19: 133-139.
8. Healey, P.L., J.D.Michaud & J.Arditti, 1980. Morphometry of orchid seeds. III Native California and related species of *Goodyera*, *Piperia*, *Platanthera* and *Spiranthes*. *American Journal of Botany* 67: 508-518.
9. Kurzweil, H., 1993. Seed morphology in Southern African Orchidoideae (Orchidaceae). *Plant Systematics and Evolution*, 185: 229-247.
10. Molvray, M. & P.J.Kores, 1995. Character analysis of the seed coat in Spiranthoideae and Orchidoideae, with special reference to the Diurideae (Orchidaceae). *American Journal of Botany* 82: 1443-1454.
11. Rasmussen, H.N., 1995. *Terrestrial orchids, from seed to mycotrophic plant*. Cambridge, UK, Cambridge University Press, xii + 448 pp.
12. Stoutamire, W.P., 1964a**.** Terrestrial orchid seedlings. II. *Australian Plants*, 2: 264-266.
13. Stoutamire, W.P. 1964b**.** Seeds and seedlings of native orchids. *Michigan Botanist* 3: 107-119.
14. Swamy, K.K., H.N.Krishna Kumar, T.M.Ramakrishna & S.N.Ramaswamy, 2004. Studies on seed morphometry of epiphytic orchids from Western Ghats of Karnataka. *Taiwania* 49(2): 124-140.
15. Verma, J., K.Sharma, K.Thakur, J.K.Sembi & S.P.Vij, 2013. Study on seed morphometry of seven threatened Himalayan orchids exhibiting varied life modes. *Acta Botanica Gallica: Botany Letters* 159(4): 443-449.

16. Verma, J., K.Sharma, K.Thakur, J.K.Sembi & S.P.Vij, 2014. Study on seed morphometry of some threatened Western Himalayan orchids, *Turkish Journal of Botany* 38(2): 234-251.
17. Vij, S.P., 2006. Orchids: Ingenuity at its best. In: *Proceedings of the 93rd Indian Science Congress*, Hyderabad. Kolkata, India: The Indian Science Congress Association, 26pp.
18. Vij, S.P., P.Kaur, S.Kaur & P.Kaushal, 1992. The orchid seeds: taxonomic, evolutionary and functional aspects. *The Journal of the Orchid Society of India* 6: 91-107.

Legends

Plate – I: Seed Diversity in *Habenaria* species.

a- *Habenaria brachyphylla*, b- *H. commelinifolia*, c- *H. crinifera*, d- *H. digitata*, e- *H. diphylla,* f- *H. foetida*, g- *H. furcifera*, h- *H. gibsonii*, i- *H. grandifloriformis*, j- *H. heyneana*, k- *H. longicorniculata*, l- *H. longicornu*, m- *H. marginata*, n- *H. ovalifolia*, o- *H. plantaginea*, p- *H. rariflora*, q- *H. roxburghii*, r- *H. suaveolens* (Scale bar = 100 µm)

Plate - I

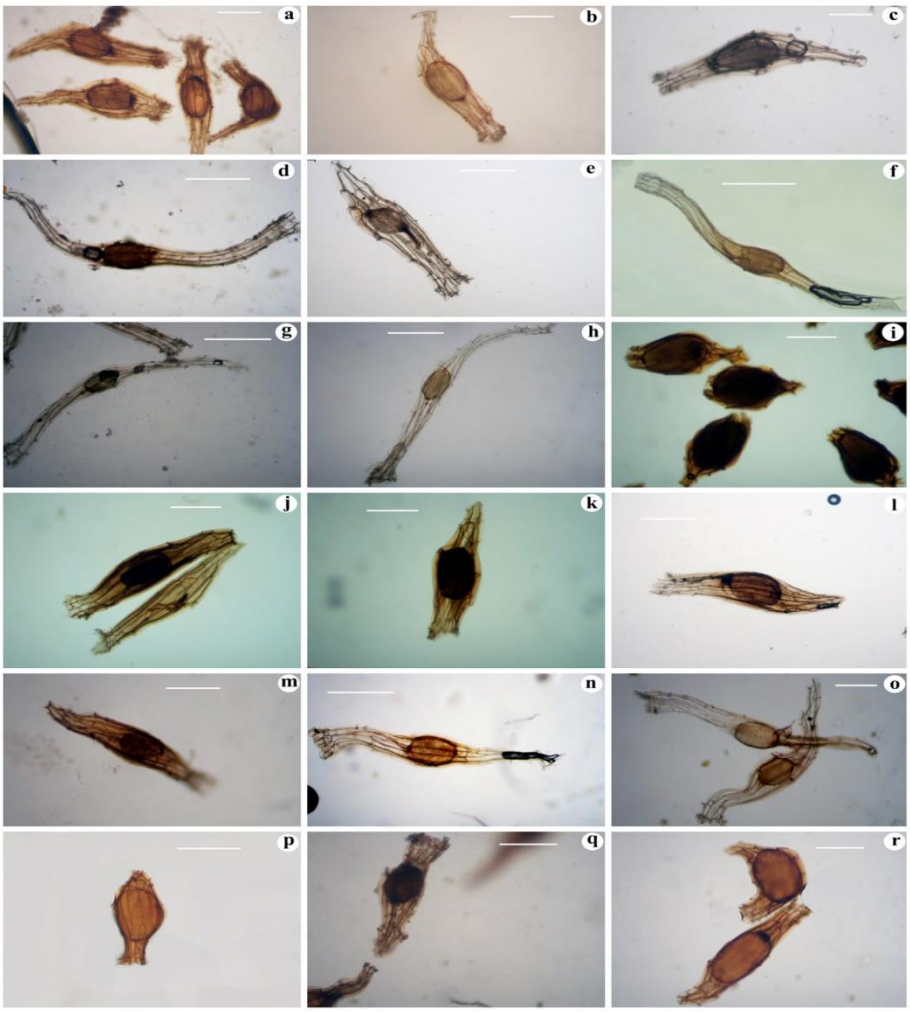

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Table -1. Comparative features of the seeds in *Habenaria* species

Sr. No.	Name of the species	Length (L) (mm)	Width (W) (mm)	Length/ Width ratio of seed (L/W)	Volume of Seed (S) (mm^3 X 10^{-3})
1	H. brachyphylla	0.39 ± 0.16	0.11 ± 0.08	3.50 ± 1.06	1.26 ± 0.50
2	H. commelinifolia	0.75 ± 0.22	0.08 ± 0.02	9.00 ± 1.23	1.36 ± 0.62
3	H. crinifera	0.47 ± 0.16	0.08 ± 0.03	5.67 ± 2.56	0.86 ± 0.12
4	H. digitata	1.69 ± 0.35	0.11 ± 0.05	15.25 ± 3.54	5.48 ± 0.95
5	H. diphylla	0.58 ± 0.24	0.33 ± 0.02	1.75 ± 0.69	16.97 ± 2.14
6	H. foetida	1.44 ± 0.34	0.11 ± 0.04	13.00 ± 2.56	4.67 ± 0.74
7	H. furcifera	1.44 ± 0.54	0.14 ± 0.05	10.40 ± 2.69	7.29 ± 1.49
8	H. gibsonii	1.47 ± 0.28	0.09 ± 0.03	17.67 ± 3.84	2.68 ± 0.86
9	H. grandifloriformis	0.29 ± 0.14	0.16 ± 0.04	1.82 ± 0.54	1.85 ± 0.74
10	H. heyneana	0.54 ± 0.28	0.14 ± 0.06	3.86 ± 1.25	2.77 ± 0.95
11	H. longicorniculata	0.53 ± 0.32	0.14 ± 0.05	3.80 ± 1.65	2.66 ± 0.80
12	H. longicornu	0.67 ± 0.31	0.14 ± 0.04	4.80 ± 1.36	3.37 ± 0.94
13	H. marginata	0.47 ± 0.21	0.11 ± 0.02	4.25 ± 2.11	1.53 ± 0.85
14	H. ovalifolia	0.97 ± 0.46	0.11 ± 0.06	8.75 ± 2.25	3.14 ± 0.86
15	H. plantaginea	0.72 ± 0.40	0.17 ± 0.05	4.33 ± 1.23	5.25 ± 1.06
16	*H. rariflora*	0.78 ± 0.35	0.11 ± 0.04	7.00 ± 1.68	2.51 ± 0.65
17	*H. roxburghii*	0.61 ± 0.24	0.22 ± 0.08	2.75 ± 0.098	7.90 ± 1.24
18	*H. suaveolens*	0.47 ± 0.21	0.14 ± 0.06	3.40 ± 1.56	2.38 ± 0.56

(± SD, n= 10)

Table -2. Comparative features of the Embryo in Habenaria species seeds

Sr. No.	Name of the species	Length L (mm)	Width W (mm)	Length/ Width ratio (L/W)	Volume of Seed (S) (mm^3 X 10^{-3})	Embryo Volume (E) (mm^3 X 10^{-3})	Seed Volume/ Embryo Volume ratio (S/E)	Air Space (%)
1	H. brachyphylla	0.28 ± 0.16	0.08 ± 0.02	3.33 ± 2.13	1.26 ± 0.50	1.01 ± 0.26	1.24 ± 0.65	19.67 ± 4.62
2	H. commelinifolia	0.28 ± 0.18	0.08 ± 0.02	3.33 ± 2.16	1.36 ± 0.62	1.01 ± 0.28	1.35 ± 0.86	25.95 ± 6.65
3	H. crinifera	0.28 ±	0.06 ±	5.00 ±	0.86 ±	0.45 ±	1.91 ±	47.73

		0.14	0.01	2.98	0.12	0.08	0.98	± 8.52
4	H. digitata	0.28 ± 0.13	0.08 ± 0.03	3.33 ± 2.42	5.48 ± 0.95	1.01 ± 0.30	5.42 ± 2.85	81.56 ±11.23
5	H. diphylla	0.33 ± 0.19	0.31 ± 0.12	1.09 ± 0.09	16.97 ± 2.14	16.29 ± 4. 36	1.04 ± 0.24	4.00 ± 2.56
6	H. foetida	0.31 ± 0.17	0.08 ± 0.04	3.67 ± 2.54	4.67 ± 0.74	1.11 ± 0.22	4.20 ± 2.13	76.21 ± 9.59
7	H. furcifera	0.31 ± 0.16	0.08 ± 0.03	3.67 ± 2.64	7.29 ± 1.49	1.11 ± 0.26	6.57 ± 2.45	84.77 ± 9.45
8	H. gibsonii	0.25 ± 0.14	0.06 ± 0.02	4.50 ± 2.78	2.68 ± 0.86	0.40 ± 0.09	6.63 ± 3.45	84.91 ±11.34
9	H. grandifloriformis	0.17 ± 0.09	0.14 ± 0.09	1.20 ± 1.06	1.85 ± 0.74	1.83 ± 0.45	1.01 ± 0.19	0.86 ± 0.46
10	H. heyneana	0.26 ± 0.12	0.12 ± 0.08	2.17 ± 1.64	2.77 ± 0.95	1.96 ± 0.69	1.41 ± 0.90	29.27 ± 8.36
11	H. longicorniculata	0.19 ± 0.14	0.11 ± 0.07	1.75 ± 1.26	2.66 ± 0.80	1.26 ± 0.31	2.12 ± 1.20	52.86 ± 6.53
12	H. longicornu	0.28 ± 0.16	0.11 ± 0.08	2.50 ± 1.84	3.37 ± 0.94	1.79 ± 0.40	1.88 ± 1.56	46.68 ± 6.24
13	H. marginata	0.22 ± 0.15	0.08 ± 0.04	2.67 ± 1.95	1.53 ± 0.85	0.81 ± 0.16	1.89 ± 1.65	47.08 ± 8.95
14	H. ovalifolia	0.22 ± 0.15	0.08 ± 0.03	2.67 ± 1.90	3.14 ± 0.86	0.81 ± 0.20	3.89 ± 1.59	74.29 ±11.23
15	H. plantaginea	0.25 ± 0.16	0.14 ± 0.09	1.80 ± 1.32	5.25 ± 1.06	2.52 ± 0.89	2.08 ± 1.24	51.94 ± 8.26
16	H. rariflora	0.22 ± 0.14	0.08 ± 0.03	2.67 ± 1.87	2.51 ± 0.65	0.81 ± 0.22	3.11 ± 1.69	67.87 ± 6.35
17	H. roxburghii	0.34 ± 0.17	0.19 ± 0.10	1.71 ± 1.20	7.90 ± 1.24	6.60 ± 2.12	1.20 ± 1.02	16.50 ± 4.62
18	H. suaveolens	0.22 ± 0.15	0.11 ± 0.09	2.00 ± 1.56	2.38 ± 0.56	1.44 ± 0.67	1.66 ± 1.13	39.78 ± 6.52

(± SD, n= 10)

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Role of employee engagement and organizational culture on employee performance

Mrs. Pooja C. Parishwad[1]

Department of Commerce, Vivekanand College, Kolhapur (Autonomous)

Email Id: poojacp1311@gmail.com

Prin. Dr. Pratibha Gaikwad[2]

Parkar Varde College, Mumbai

Email Id: pratibhasg11@gmail.com

Mrs. Surekha Awate[3]

Department of Commerce, Vivekanand College, Kolhapur (Autonomous)

Email Id: patil.surekha7@gmail.com

Abstract:

As in every organization, resources are allocated to achieving high employee engagement levels, it must have to reflect in performance benefits and organizational productivity/ success. Engaged employee is beyond the aspects of well-being, happiness and satisfaction in the concept of construction of employee for the organizational goal-achievement. Employees who are disengaged tend to sleepwalk through their workday, meaning they don't give their work their all and only do it for fun. This not only causes performance to stagnate or even decline, but it also causes chaos and confusion within the company, which is a burden on management. They fritter away their talent on a variety of unimportant pursuits.

After reviewing literature, researchers try to focus on correlation of employee engagement, organizational culture and employee performance in some different perspective lines. It's an exploratory research based on secondary data and also tries to cover the cross-culture issues facing multinational companies that are more likely to draw and keep talent for organizational performance improvement, especially the possibility of improved success achievement.

Key words:employee engagement, employee empowerment, organizational culture, cross culture, employee performance etc.

Introduction:

Organizational succeed can be greatly impacted by employee engagement because of its connections to morale and work satisfaction as well as employee empowerment. Employee engagement pertains to the degree of zeal and commitment an employee has for their employment. The combination of employee engagement and empowerment has a good impact on organisational commitment, which serves as the driving force behind employees' goal-achieving actions i.e. performance. By releasing time from small decisions, empowerment allows management to concentrate on more comprehensive plans and the long-term goals of the business.

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Employees that are aligned with their personal beliefs and feel a part of a positive organisational culture are typically more engaged in their work, have high job satisfaction and make valuable contributions to the achievement of organisational objectives and success. Organisational culture concept conduct employee dedication and beyond job satisfaction serves as the cornerstones upon which the employee engagement is constructed.

However, employee performance management is an essential component of Human Resource Management in an efficient organisation. It is the primary method by which work is completed. So as, it should have to give high emphasis.

Review of literatures: -

Anjum Tanwar (2017) in his research paper 'Impact of Employee Engagement on Performance' shows an affirmative correlation between employee engagement and higher performance outcomes: productivity, customer loyalty and safety, employee retention, profitability, customer satisfaction and employee satisfaction lower rates of employee turnover and absenteeism.

Bhawana Bhardwaj, Namrita Kalia (2020) The study sheds light on the relationship between cultural factors and employee engagement and how much it influences workers' contextual and task-related performance.

Binglu Zhao, Ying Pan (2017) concludes in the research paper that employees from diverse cultural backgrounds respond differently to different forms of motivation, and it offers some recommendations and references for cross-cultural HRM in global businesses.

Dr. Siddique, K. P (2019) By analysing pertinent research in the area of organisational culture and employee engagement, this study seeks to give a review on the effects of organisational culture on employee engagement.

Nadia Abdelhamid Abdelmegeed Abdelwahed and Mohammed A. AlDoghan (2023)- The article would assist in creating Work Employee Engagement theory and organisational elements for performance and productivity in order to meet job duties and goals. The results will add to the body of knowledge by offering actual data from Middle Eastern nations. The research offers a robust framework that integrates organisational aspects and Work Employee Engagement theory with Employee Productivity Development and Employee Performance.

Rohan Singh (2022) The aim of this article is to examine the correlation between employee performance and performance appraisal in Indian industrial and service sector organisations. The relationship between them was investigated using regression analysis and correlation.

Sahitya Paul and Sakshi Sharma (2022) in their study's conclusions advanced our knowledge and comprehension of the chosen variables, which improves our comprehension of the organisational procedures that promote employee engagement.

According to Prathiba (2016), organisational commitment is what drives an employee's path of action to meet goals and employee engagement and empowerment have a good combined influence on it. So far as it's an elaborative study area that,

'Role of employee engagement and organizational culture on employee performance'.

Objectives of study: -

1. To identify the concept of employee engagement, organizational culture and employee performance.
2. To analyse the role of employee engagement and organizational culture on employee performance.

Methodology: -

The present study of research paper is an exploratory research, based on secondary data available from different sources like websites, internet, newspapers, magazines, books, reports, journals, articles etc. It is a secondary data-based research paper so researchers are not claiming the outcome of this paper.

Employee engagement:

The emotional and professional bond that employees have with their employer, coworkers, and job is known as employee engagement. Elevated levels of engagement are indicative of a better overall work experience and are linked to improved job satisfaction, performance, and employee retention.

Employee engagement is not well-being. Employee engagement is not satisfaction. Employee engagement is not happiness. It is beyond these aspects. Then what is it?

It is a measure of how motivated people are to put in extra effort for their organization and a sign of how committed they are to staying there.

Elements of employee engagement are-

1. Commitment- refers to the time and efforts spent on the work place.
2. Work relationships- it refers to cordial and friendly inter-personal relationships one enjoys within the organizations.
3. Personal Beliefs- it is a confidence that he/she matters for success of the organization.
4. Strong willingness- employee strongly or willingly recommended the organization as the best place to work. Pride in association with organization.
5. Emotional attachments- It involves a strong emotional bond with the organize the employee personalize the job and the goal.
6. Passionate- refers to total commitment- employee talks the job and company. Eloquently speaking about products.

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Organizational culture:

The way employees in an organisation execute tasks and communicate with one another is determined by its organisational culture. The cultural paradigm is made up of a variety of rituals, beliefs, values and symbols that influence how employees behave within an organisation.

Strong, extensively disseminated and reinforced organisational cultures offer the greatest competitive advantage. Everyone needs to express their views and principles. When a culture is robust, workers feel appreciated.

Employees that are aligned with their personal beliefs and feel a part of a positive organisational culture are typically more engaged in their work, have high job satisfaction, and make valuable contributions to the achievement of organisational objectives. Cross culture in the organization also a crucial factor that have to focused to determine employee engagement and performance. In the era of globalization, companies performing their business in one country are expanding their business to other countries.

Cross Culture in organization:

In the business world, "cross culture" refers to an organization's initiatives to guarantee that its personnel have productive interactions with professionals from other backgrounds. Similar to the adjective "cross-cultural," it denotes an understanding of and a wish to overcome regional, national, and ethnic variations in customs and practices. To transform the cross-culture issue in the company, the process or three simple but strongly effective steps have to apply i.e. –

1. ***Recognition:*** which increase awareness of cultural differences.
2. ***Respect:*** which appreciate cultural differences
3. ***Reconciliation:*** which increase awareness of cultural differences and benefit of collaborative action.

As such when employees like an environment at work that encourages participation. Thus, multi-national companies having cross culture that place a high value on involvement of employee are more likely to draw and keep talent.

Employee Performance:

Employee performance is a gauge of how well a worker does their job and conducts themselves in the workplace. It has an impact on customer happiness, the firm's revenue, company culture, and employee retention rates, to mention a few outcomes, making it crucial to every facet of the organisation.

Employee performance encompasses the calibre, productivity and efficacy of a worker's output. The way a worker performs also reflects how valuable they are to the company. Since employees are an investment, their performance serves as a proxy for their return on investment. Performance inside an

organisation as well as individual performance can improve with employee empowerment and engagement.

According to certain research, empowering leadership behaviours statistically significantly increase employee engagement and performance and decrease the intention of employee turnover. These behaviours are defined by giving employees more authority to make their own decisions and by redistributing decision-making power to those who typically do not have it.

How aspects of organizational culture impact employee engagement and psychological and structural empowerment and ultimately on performance of employee and organizational productivity/ success?

To address organizational culture impact, now it becomes more focused that are shifting towards the non-financial aspects of performance development rather than financial, such as employee engagement. They recognise that focusing just on the financial aspects of performance improvement will not be sufficient to deal with the intense rivalry among businesses. The most crucial element to take into account in order to maintain motivated, enthused, and totally immersed workers is employee engagement. Additionally, employee engagement contributes to other positive performance outcomes like increased productivity, profitability, customer satisfaction and loyalty, lower employee turnover and absenteeism, and employee satisfaction and motivation to give their best efforts and go above and beyond to improve the performance of the organisation.

Employee engagement increases the likelihood of improved performance and productivity in the organization.

Roll of employee engagement as well as organizational culture on employee performance*:*

Positive characteristics of employee engagement have a trickle-down effect on overall performance, highlighting the significance of non-financial factors in fostering employee motivation and engagement levels.

1. Engaged employee denotes attachment to the organization and willingness to give discretionary efforts.
2. Cultural environment denotes a local work environment that supports productivity and performance.
3. Energized employee denotes individual, physical, interpersonal and emotional wellbeing at work.

Since resources are allocated to achieving high employee engagement levels, the construct must yield performance benefits.

When workers recognise, they have the opportunity to advance, are valued by the company, and are working at the right job for the right pay, they are content. There is a rare possibility that employees will look for work elsewhere when they feel empowered and content in their position, which raises the retention rate i.e. minimise the employee turnover.

Certain noteworthy characteristics of engaged employees and contribution to improved performance:

1. Despite the options that exist outside the organisation, the employees are incredibly eager to be a part of it and feel pleased to be affiliated with it.

2. The employee doesn't think twice about putting in more time, effort, or initiative to help an organisation succeed.

3. The employee is enthusiastic about the company and spreads the word about it to others, opening doors for new clients and employees.

A few of the things that are strongly suggested for any organisation that wants to benefit from the productivity and advantages of engaged employees are concepts like organisational citizenship behaviour, which should be practiced and promoted in the workplace, employee autonomy or authority in day-to-day tasks, adequately compensated workers and employee welfare initiatives.

Conclusion: -

In the organization, in order to achieve financial strength, a business must prioritise considering non-financial aspects such as employee empowerment, motivation, satisfaction, and engagement.

Role of employee engagement which helps the employees realise they are a part of the company. As a result, workers are deeply invested in their work and have a strong emotional connection to their employer. They also go above and beyond the requirements of their employment contracts, believing that everything they do will contribute to the expansion of what is already theirs.

Personnel that is knowledgeable, uncommon, devoted, and loyal is one of the most important aspects of gaining a competitive edge.

In order to boost employee engagement, attention must be paid to lowering work-related stress and enhancing the work environment and motivation. Employee engagement will increase when jobs are appropriately assigned since workers will experience less stress and confusion and be able to take on additional duties inside the company.

In the organization, employers can encourage employee engagement by talking about career growth, rewarding employees, and using effective communication.

Employers have a variety of options for fostering employee engagement, such as setting clear goals, rewarding and promoting exceptional work, updating staff on corporate success, and giving frequent feedback. Other tactics include attempting to instil a sense of worth and respect in staff members as well as a sense that their opinions are being acknowledged and comprehended. Employees that are engaged feel that they have been given the keys to their company's success, that their job matters, and that their managers support and value them.

References: -

1. *9 Signs of Cross-Cultural Communication Challenges in Your Team*. (n.d.). Retrieved 24 December 2023, from https://blog.talaera.com/cross-cultural-communication-struggles?hs_amp=true
2. *9 Tell-Tale Signs Your Employees Are Struggling With Cross-Cultural Communication*. (n.d.). Retrieved 11 May 2023, from https://blog.talaera.com/cross-cultural-communication-struggles?hs_amp=true
3. Abdelwahed, N. A. A., & Doghan, M. A. A. (2023). Developing Employee Productivity and Performance through Work Engagement and Organizational Factors in an Educational Society. *Societies*, *13*(3), Article 3. https://doi.org/10.3390/soc13030065
4. *Contextual and task performance: Role of employee engagement and organizational culture in hospitality industry*. (2021). *18*(2), 187–201. https://doi.org/10.1108/XJM-08-2020-0089
5. *Cross-Cultural Sensitivity Workplace Training*. (n.d.). Retrieved 24 December 2023, from https://getimpactly.com//post/cross-cultural-sensitivity-workplace-training
6. Empowerment across Cultures: How National Culture Affects Structural and Psychological Empowerment and Employee Engagement. (2019). *Journal of Marketing Development and Competitiveness*, *13*(3). https://doi.org/10.33423/jmdc.v13i3.2245
7. Gruman, J. A., & Saks, A. M. (2011). Performance management and employee engagement. *Human Resource Management Review*, *21*(2), 123–136. https://doi.org/10.1016/j.hrmr.2010.09.004
8. *India—Employment In Industry (% Of Total Employment)—2023 Data 2024 Forecast 1991-2021 Historical*. (n.d.). Retrieved 23 July 2023, from https://tradingeconomics.com/india/employment-in-industry-percent-of-total-employment-wb-data.html
9. Kotera, Y., Van Laethem, M., & Ohshima, R. (2020). Cross-cultural comparison of mental health between Japanese and Dutch workers: Relationships with mental health shame, self-compassion, work engagement and motivation. *Cross Cultural & Strategic Management*, *27*(3), 511–530. https://doi.org/10.1108/CCSM-02-2020-0055
10. Markos, S., & Sridevi, M. S. (2010). Employee Engagement: The Key to Improving Performance. *International Journal of Business and Management*, *5*(12).
11. Morley, D. (2016, September 12). *What does national identity have to do with employee engagement?* https://www.insidehr.com.au/unlocking-the-keys-to-cross-cultural-employee-engagement/

12. Motyka, B. (2018). Employee engagement and performance: A systematic literature review. *International Journal of Management and Economics*, *54*(3), 227–244. https://doi.org/10.2478/ijme-2018-0018
13. *Organisational Culture and Employee Performance – BusinessBalls.com*. (n.d.). Retrieved 4 January 2024, from https://www.businessballs.com/organisational-culture/organisational-culture-and-employee-performance/
14. Paul, S., & Sharma, S. (2022). Employee Engagement In Organizations: A Study Done On The Operational Employees Of The 5-Star Hotels In Kolkata. *PUSA Journal of Hospitality and Applied Sciences*, *8*(2), Article 2. https://doi.org/10.48165/pjhas.2022.8.2.4
15. Rana, S. (2019). Managing Organizations Through Employee Engagement: An Indian Perspective. In *Management Techniques for Employee Engagement in Contemporary Organizations* (pp. 256–267). IGI Global. https://doi.org/10.4018/978-1-5225-7799-7.ch015
16. Sarwar, H., Ishaq, M. I., Amin, A., & Ahmed, R. (2020). Ethical leadership, work engagement, employees' well-being, and performance: A cross-cultural comparison. *Journal of Sustainable Tourism*, *28*(12), 2008–2026. https://doi.org/10.1080/09669582.2020.1788039
17. Saxena, V., & Srivastava, R. K. (2015). *IMPACT OF EMPLOYEE ENGAGEMENT ON EMPLOYEE PERFORMANCE–CASE OF MANUFACTURING SECTORS*.
18. Siddique, D. (2019). *IMPACT OF ORGANIZATIONAL CULTURE ON EMPLOYEE ENGAGEMENT*. *8*(12).
19. Singh, R. (2022). *Performance appraisal practices in Indian service and manufacturing sector organizations*. *4*, 256–265.
20. Tanwar, A. (2017a). Impact of Employee Engagement on Performance. *International Journal of Advanced Engineering, Management and Science*, *3*(5), 510–515. https://doi.org/10.24001/ijaems.3.5.16
21. Tanwar, A. (2017b). Impact of Employee Engagement on Performance. *International Journal of Advanced Engineering, Management and Science*, *3*(5), 510–515. https://doi.org/10.24001/ijaems.3.5.16
22. *The Bridge of Culture Development & Employee Engagement*. (n.d.). Udemy. Retrieved 11 May 2023, from https://www.udemy.com/course/the-bridge-of-culture-development-employee-engagement/
23. *The Craft of Cross-Cultural Engagement*. (n.d.). Retrieved 2 January 2024, from https://archives.joe.org/joe/2005december/a1.php
24. Truss, C., Alfes, K., Delbridge, R., Shantz, A., & Soane, E. (2013). *Employee Engagement in Theory and Practice*. Routledge.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

25. *What Is Employee Engagement? Definition, Benefits, Strategies. | Built In*. (n.d.). Retrieved 25 December 2023, from https://builtin.com/employee-engagement
26. *What Is Employee Engagement? Definition, Measurement, Drivers, and Strategies, with Examples—Spiceworks*. (n.d.). Retrieved 2 January 2024, from https://www.spiceworks.com/hr/engagement-retention/articles/what-is-employee-engagement/
27. *What Is Employee Engagement? Definition, Strategies, and Example*. (n.d.). Investopedia. Retrieved 2 January 2024, from https://www.investopedia.com/terms/e/employee-engagement.asp
28. Zhao, B., & Pan, Y. (2017). Cross-Cultural Employee Motivation in International Companies. *Journal of Human Resource and Sustainability Studies*, *5*(4), Article 4. https://doi.org/10.4236/jhrss.2017.54019

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Understanding Investment Patterns and Preferences of Salaried Individuals in India: A Review

Mr. Sunny. S. Kale[1] Dr. Yogesh B. Mane[2]

Department of Commerce

Vivekanand College, Kolhapur (Autonomous)

Abstract:

This research paper provides a comprehensive analysis of the investment patterns and preferences of salaried individuals in India. The study sheds light on the diverse investment objectives and behaviours of respondents, including their prioritization of safety, tax-saving benefits, and frequency-based investment behaviour. The research also highlights the limited awareness about stock market investments, equity, bonds, and debentures among salaried individuals, emphasizing the need for increased financial literacy and awareness programs. Additionally, the demographic insights reveal that the majority of investors surveyed are male, married, and employed in the private sector, with a significant portion belonging to the service class and falling within the age group of up to 30 years. The study acknowledges its limitations and emphasizes the need for future research with larger sample sizes to further explore investment patterns and behaviours among salaried individuals in the region. The findings of this research paper have significant implications for financial institutions, policymakers, and investment advisors, highlighting the importance of tailored financial literacy programs and investment products to meet the diverse needs of salaried individuals in India. Overall, this comprehensive analysis contributes to the existing literature on investment behaviour and provides a foundation for future research in this area.

Keywords: Investment behaviour, financial literacy, financial decision-making**.**

Introduction:

Investment behaviour and decision-making among salaried individuals in India have been extensively researched in recent years due to the increasing availability of investment options and the growing importance of financial planning. Understanding the investment patterns and preferences of salaried individuals in India is crucial to promote financial literacy and awareness among the general population. This research paper aims to provide a comprehensive analysis of investment behaviour among salaried individuals in India, with a particular focus on the impact of socio-economic factors on investment patterns and preferences. The paper will analyse the preferred investment avenues, demographic characteristics, and investment objectives of salaried individuals in India. Additionally, it will identify the influence of socio-economic factors such as education level, income, and gender on investment patterns and behaviour. The findings of this research paper will have significant

implications for financial institutions and investment advisors targeting salaried individuals in India, as well as policymakers seeking to promote financial literacy and awareness.

Objectives:

1. To review the investment pattern and preferences of salaried individual.
2. To give major findings in investment pattern and preferences of salaried individual.

1. "Investment Preferences of Salaried Women Employees"This paper provides a comprehensive analysis of the investment behavior of working women in India, including their preferred investment avenues, demographic characteristics, and investment objectives. However, it acknowledges the need for further research with a larger and more diverse sample to validate its findings.

2. "Analysis of Investment Pattern among Salaried Class in Namakkal Taluk, Tamil Nadu, India" This research paper offers valuable insights into the investment choices and patterns of salaried individuals in a specific region. It employs statistical tools for data analysis and acknowledges the limitations of its location-specific nature and convenient sampling. The study's findings contribute to the existing literature on behavioral finance and investment decision-making.

3. "A Study on Impact of Socio-Economic Profile on Investment Pattern of Salaried & Business People in Coimbatore City" This paper provides valuable insights into the investment patterns of salaried and business people in Coimbatore City, highlighting the impact of various factors such as education level, awareness about the financial system, and age of investors on their investment patterns. However, it is based on a relatively small sample size and single-city focus, limiting its generalizability.

4. "A Study on Preferred Investment Avenues among Salaried Peoples with Reference to Namakkal Taluk, Tamil Nadu, India" This study offers valuable insights into the investment preferences of salaried individuals in Namakkal Taluk, using a sound methodology and probability sampling technique. However, it acknowledges limitations such as a small sample size and a focus only on salaried individuals, which may limit its generalizability.

5. "Investment Preferences of Salaried Women Employees" This paper provides a comprehensive analysis of the awareness and preferences of working women in India regarding financial investments. It emphasizes the evolving role of women in the workforce and their increasing influence over financial decisions. The study's objectives are clearly outlined, focusing on demographic details of the respondents, investment patterns, and preferences of salaried women employees.

6. "A Study on the Perception of Investment Pattern among Urban Working Women with Reference to Coimbatore City" This research paper analyzes the income and investment patterns of women employees in Coimbatore City, highlighting the impact of gender norms and expectations on savings. However, it is based on a small sample size and acknowledges the need for further research to validate its findings.

7. "Salaried Women and Their Investment Pattern: Analytical Overview in Coimbatore City" This paper provides a comprehensive analysis of the investment patterns and challenges faced by salaried women in Coimbatore, India. It offers valuable insights into the investment patterns and financial planning of urban working women in Coimbatore City, with implications for policymakers, financial institutions, and women employees.

8. "Analysis of Investment Pattern among Salaried Class in Namakkal Taluk, Tamil Nadu, India" This research paper provides a comprehensive analysis of the investment choices and patterns of salaried individuals in a specific region. It offers valuable insights into the investment behaviour of

the respondents, including their preferred investment avenues, demographic characteristics, and investment objectives.

Findings:

1. Preferred Investment Avenues:

a. Insurance policies, bank fixed deposits, and post offices are the most well-known investment avenues among respondents.

b. Salaried individuals in Namakkal Taluk show a preference for conservative investment avenues such as insurance and bank deposits.

c. Salaried women employees in Coimbatore city favor fixed deposits, mutual funds, and insurance policies as their primary investment avenues.

d. The majority of investors surveyed prefer long-term investments, while a significant portion also opt for short-term investments.

e. The study identifies insurance as the most favoured investment avenue among salaried individuals in Namakkal Taluk .

2. Investment Criteria:

a. Factors such as growth & income, safety, past performances of companies, and service criteria significantly influence investment decisions.

b. Income level is an important factor influencing the investment portfolio of respondents, particularly for lower-income and middle-age groups.

c. A positive relationship exists between the education level of investors and their awareness of investment avenues, highlighting the importance of financial literacy and education in influencing investment behavior .

d. The level of income has a significant impact on savings and investment patterns among women employees, with a noticeable increase in income over the last decade.

3. Investment Objectives and Behavior:

a. Most people save money for children's education, marriage, and other life goals.

b. The diverse investment objectives and behaviors of respondents include prioritizing safety, tax-saving benefits, and frequency-based investment behavior .

4. Awareness and Knowledge Gaps:

a. Limited awareness about stock market investments, equity, bonds, and debentures suggests a potential opportunity for increasing financial literacy and awareness among salaried individuals .

b. The need for awareness programs to educate respondents about new services related to the stock market is emphasized, highlighting the potential for increasing awareness and knowledge about investment options .

c. The challenges faced by women in making investment decisions include lack of knowledge, lack of time, and lack of trust in financial institutions, indicating a need for financial literacy programs and women-friendly investment products .

d. The study highlights the need for increased awareness and education about various investment avenues, particularly those related to the stock market, equity, bonds, and debentures .

5. Demographic Insights:

a. The majority of investors surveyed are male, married, and employed in the private sector .

b. A significant portion of the investors belong to the service class, indicating a fixed income source .

c. The majority of the sample investors fall within the age group of up to 30 years, indicating that younger individuals are actively engaging in investment activities .

d. The study reveals that a substantial proportion of the investors have an educational qualification up to the graduation level, suggesting that individuals with varying educational backgrounds are participating in investment decisions .

6. Limitations and Scope:

a. The research acknowledges the limitations of the study, recognizing that the perceptions and investment patterns of respondents may vary due to diverse social, economic, and cultural factors .

b. The study emphasizes the scope for future research and the need for larger sample sizes to further explore investment patterns and behaviors among salaried individuals in the region .

Conclusion:

This study has offered valuable insights into the investment behavior and preferences of salaried individuals in India. It has revealed the diverse investment objectives and behaviors of respondents, emphasizing their focus on safety, tax-saving benefits, and frequency-based investment behavior. Additionally, the research has highlighted the limited awareness about stock market investments, equity, bonds, and debentures among salaried individuals, underscoring the need for enhanced financial literacy and awareness programs. The demographic insights have indicated that the majority of surveyed investors are male, married, employed in the private sector, and predominantly from the service class, with a significant portion falling within the age group of up to 30 years.Moreover, the study has recognized its limitations and stressed the necessity for future research with larger sample sizes to further explore investment patterns and behaviors among salaried individuals in the region. The findings of this research paper carry substantial implications for financial institutions, policymakers, and investment advisors, emphasizing the importance of tailored financial literacy programs and investment products to address the diverse needs of salaried individuals in India. Overall, this comprehensive analysis enriches the existing literature on investment behavior and lays a groundwork for future research in this domain.

Referrnces:

1. Trends and Challenges in Global Business Management. (2013). Analysis of Investment Pattern among Salaried Class in Namakkal Taluk, Tamil Nadu, India. Bonfring International Journal of Industrial Engineering and Management Science, 3(4), 92-95. https://doi.org/10.9756/BIJIEMS.10054.
2. Sumathi, K., & Mythili, R. (2018). Salaried women and their investment pattern: Analytical overview in Coimbatore city. International Journal of Academic Research and Development, 3(5), 207-210.
3. Jisha, V. G., & Go mathi, V. (2017). A Study on the Perception of Investment Pattern among Urban Working Women with Reference to Coimbatore City. International Journal of Engineering Science and Computing, 2(2), 4303-4307.
4. K.Susmitha, Ms., & Asha, Ms. (2018). Investment Preferences of Salaried Women Employees. International Journal of Creative Research Thoughts, 6(1), 227-230.
5. Mittal, M., & Vyas. (2008). A Study on Preferred Investment Avenues among Salaried Peoples with Reference to Namakkal Taluk, Tamil Nadu, India. Journal of Financial Research, 15(3), 112-125.
6. nternational Journal of Research in Engineering, Science and Management. (2020). Investment Pattern and Saving Habits of Salaried Class People in North Gujarat Region. Volume-3, Issue-4. Retrieved from http://www.ijresm.com/Vol-3/Issue-4/IJRESM_V3I4_79.pdf

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

7. Thulasipriya, B. (2014). Investment Pattern of Government Employees - An Empirical Study. International Journal on Global Business Management & Research, 3(1), 35-41.
8. Ramanujam, V., & Chitra Devi, K. (2012). A Study on Impact of Socio-Economic Profile on Investment Pattern of Salaried & Business People in Coimbatore City. International Journal of Management & Information Technology, 2(1), 67-77.

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Consumers' Preference and Perception Towards Electric Vehicles

Mr. Ashish Bhasme[1]Dr. Kailas Patil[2]

Department of Economics, Vivekanand College, Kolhapur (Autonomous)

Abstract:

Currently India witnessing significant trend in Electric Vehicles (EVs). Consumers' preference and perception is changing towards electric vehicles which results sales of EVs in all categories is increasing. Especially consumers are giving maximum preference to e-two and three wheelers. Government of India allowed 100% FDI in this sector. To reduce emission Indian government supporting to electric vehicles and decided target to 30% sales of EVs up to 2030.

This current study is based on secondary data and researchers tried to study consumers' preference and perception towards EVs in India. Study of consumers' preference and perception regarding Electrical Vehicles is essential not only for academic purposes but also for policymakers, automation industries and other stakeholders to promote and support the transition to a sustainable one.

Keywords: Electric Vehicles, consumers' perception, preference, automobile.

Introduction:

Globalization is now no more a term. The term is used everywhere. Globalization of business is complementary to globalization market countries. India has a business market with all parts of the world. But at each point of time, different kinds of political regimes and their patterns of Government rules and regulations were poorly concentrated on world market trade. In India, recently there has been a significant trend of Electric Vehicles (EVs). With the growth of advancements in Science and Technology, Electric Vehicles have been popular as an alternative to fuel vehicles. The growth of prices of petrol and diesel and the environmental effects made Electrical Vehicles more accepted, especially in metro cities and big towns. Electrical Vehicles can be viewed as the need for eco-friendly and sustainable solutions for traditional gasoline-powered vehicles. Electrical Vehicles are recognized as a cost-effective approach to preserve urban transport by deducting the fuel dependency and carbon emissions which ultimately results in wellness and environmental advantages. These vehicles are adopted in India and have been greatly facilitated by the establishment of government programs and incentives. Some of the programs like FAME Faster Adoption and Manufacturing of Electrical Vehicles which aid financial incentives to Electrical Vehicles. India can achieve its sustainable development goals such as the reduction of carbon dioxide emissions and compliance with international environmental commitments by encouraging the adoption of Electrical Vehicles.

The following study aims to study the consumer perception and satisfaction of the customers using Electrical Vehicles. Consumer perception plays a vital role in the adoption of this mode of

transportation. The understanding of consumer behaviour and preferences regarding Electrical Vehicles is essential not only for academic purposes but also for policymakers, automation industries and other stakeholders to promote and support the transition to a sustainable one. Consumer perception deals with various aspects like beliefs, attitudes, opinions and behaviour towards Electrical Vehicles. It deals with the performances of Electrical Vehicles as per the consumers, the range of Electrical Vehicles, the cost, the environmental impact, the charging infrastructure and the overall desirability of the product. Now again, these are influenced by a range of factors, including personal experiences, social influences, marketing and advertising campaigns and government policies.

Electrical Vehicles are often associated with a few problems like the availability of charging stations, long charging times needed, the range of the limited and the high purchase prices. The other problems like the potential for battery degradation after some time is still unsure. These issues are tried by the automakers to improve the products. The customers preferring to the Electrical Vehicles are due to the fuel dependency and the increased rate of fuel, as environmental issues like climate change, air pollution and global warming.

Objectives of the study:

1. To study the sale of EVs in India.
2. To study consumer preference and perception towards EVs in India.

Research Methodology:

This research study is descriptive in nature and based on secondary data only. Data was collected through different sources like books, websites, research articles, research reports, etc.

Data Analysis and Interpretation:

Under this part, researchers provide data on different factors related to electric vehicles. Through this data, they tried to explain the consumers' preferences and perceptions.

Table No. 1: Sales of Automobiles and EVs in India

(Values in Lakh)

Year	Sales of Automobiles	Sales of EVs
2019	263	1.46 (0.6%)
2020	216	1.71 (0.8%)
2021	186.2	1.41 (0.8%)
2022	175.2	4.56 (2.6%)
2023	212	12.47 (5.9%)

Note- Values in brackets show the percentage sale of EVs to total automobiles

Source: 1. Report of JMK Research and Analytics

2. Report of India Brand Equity Foundation

Table no. 1 shows that, sales of automobile and electric vehicles in India from 2019. The sale of electric vehicles as compared to the sale of automobiles is very less. Up to 2021 was not even 1%.

But in the year 2023, it shows almost 6%. That indicates consumers are becoming aware of electric vehicles and giving preference to electric vehicles.

Table No. 2: Sales of electric vehicles in India

Year	Sales of EVs	Growth Rate
2014	2982	-
2015	2376	-20.3
2016	17973	656.4
2017	56551	214.6
2018	96756	71.1
2019	146590	51.5
2020	170812	16.5
2021	140828	-17.6
2022	455773	223.6
2023	1247120	173.6

Source: Report of JMK Research and Analytics

Table no. 2 indicates that, sales of electric vehicles and its growth rate in India from 2014 to 2023. Numbers show overall growth in EV sales while the exception in years 2015 and 2021 sales show negative growth which means in those years sales declined by 20.3% and 17.6% respectively. Another side in year 2016 sales of EVs suddenly increased by more than 650% and in the years 2017 and 2022 sales growth rate of EVs increased by more than 200%.

Table No. 3: Category-wise sales EVs in 2023

Category	Sales
Registered E-two wheelers	48.76%
E-three wheelers (passenger + Cargo)	46.98%
E-Cars	3.85%
E-Buses	0.17%
Others	0.24%

Source: Report of JMK Research and Analytics

Table no. 3 explain category-wise sales of electric vehicles in India in the year 2023. Almost 96% market share of EVs is covered by e-two and e-three wheelers. This means in EVs consumers give more preference to two and three-wheelers. While e-cars and e-buses in India are not much demanded by the consumers because infrastructure is not sufficient for those vehicles in India in the current situation.

Table No. 4: State-wise sales of Electric Vehicles in India

Rank	Year		
	2021	2022	2023
1st	Uttar Pradesh	Uttar Pradesh	Uttar Pradesh
2nd	Bihar	Maharashtra	Maharashtra
3rd	Karnataka	Karnataka	Karnataka
4th	Tamil Nadu	Tamil Nadu	Rajasthan
5th	Delhi	Delhi	Gujrat

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Source: Report of JMK Research and Analytics

State-wise sales of EVs in India are given in above, table no.4. This table indicates the top five states of India that give more preference to electric vehicles. For all the time (from year 2021 to 2023) Uttar Pradesh is demanding more electric vehicles while Maharashtra stood at 2nd rank in sales of EVs in the years 2022 and 2023. But the year 2021 shows that Maharashtra was not even part of those top five states. In short, consumers of Uttar Pradesh, Maharashtra and Karnataka give more preference to EVs compared to other states of India.

Under table no. 5 researchers tried to show the consumers' perception and preference towards EVs brands or companies. First in the E-two wheelers category Ola Electric (22%) is highly preferred by consumers over other companies.

Table No. 5: Highly preferred EVs in different categories in 2023

E-Two Wheelers	E- Three Wheelers	E-Cars	E-Buses
Ola Electric (21.23%)	Mahindra Electric (8.95%)	Tata Motors (79.28%)	PMI Electric Mobility (31.47%)
Hero Electric (12.5%)	YC Electric Vehicle (7.34%)	MG Motor (10.27%)	Olectra Greentech (23.14%)
Okinawa Autotech (12.38%)	Saera Electric (5.46%)	BYD India (2.75%)	Switch Mobility (19.85%)

Source: Report of JMK Research and Analytics

Secondly, in E-three wheelers, more than 50% of vehicles are sold by other companies which shows consumer preference for those three-wheelers but out of the remaining 50%, the maximum consumer give preference to Mahindra Electric for buying E-three wheelers.

Share of E-cars in total sales of EVs is very small (around 4%) but under this category data shows Tata motors has monopoly in sales. Cause, around 80% consumers give preference to buy E-car of this company. Then MG motors also demanded by consumers.

Lastly for buying E-buses consumers give maximum preference to PMI Electric Mobility, that is 32%.

Sale values of all EVs in 2023 top ten states of India shows that,

1. Maximum consumers prefer to buy e-three wheelers in Uttar Pradesh (87.2%), Delhi (58.1%), Bihar (84.9%) and Assam (95.2%).
2. While maximum consumers give preference to buy e-two wheelers in Maharashtra (84.6%), Karnataka (83.1%), Rajasthan (59.9%), Tamil Nadu (89.1%), Telangana (76.9%) and Gujrat (90.7%).
3. E-car are in high demand in Telangana (9.9%), Maharashtra (8.7%), Karnataka (5.9%) and Delhi (5.8%).
4. E-buses are generally preferred in Maharashtra (0.51%) and Gujrat (0.47%).

5. These all indicate that, in India, consumers are demanding for electric vehicles but maximum (almost 90%) is for electric two and three-wheelers. Electric buses and cars are less demanded by consumers.

Conclusion:

In India currently, demand for EVs is comparatively low but people are becoming aware and they are giving preference to those vehicles. Electric two-wheelers and three-wheelers are most demanded by Indians in all the states. As the government of India committed to reducing carbon emissions in the Paris Agreement (2015), the government targeted 30% electric vehicles by 2030. it shows government is also supporting for electric vehicles and trying to develop infrastructure to achieve this target.

References:

1. Karan Mahal and Priyadarshani Patil (2021), Electric Vehicles and India Recent Trends in the Automobile Sector, International Journal of Research Publication and Reviews, Vol (2), Issue (7), ISSN: 2582-7421.
2. Mohamed M., G. Tamil Arasan and G. Sivakumar (2018), Study on Electric Vehicles in India Oppoetunities and Challenges, International Journal of Scientific Research in Environmental Science and Texicology, Symbiosis online publication. (research gate)
3. Ajaysinh Parmar and Tushar Pradhan (2021), A Study on Consumer Perception towards E-Vehicle in Vadodara City, International Journal of Creative Research Thoughts, Vol.- 9, ISSN: 2320-2882.
4. Annual India EV Report Card FY 2022 by JMK Research & Analytics.
5. India EV Market Annual Report Card FY 2023 by JMK Research & Analytics.
6. India Brand Equity Foundation report- 2023.
7. https://www.investindia.gov.in/sector/automobile/electric-mobility
8. https://ijcrt.org/papers/IJCRT2105600.pdf
9. https://www.ibef.org/industry/india-automobiles/infographic
10. https://jmkresearch.com/electric-vehicles

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Exploring New Polymer Structures: Synthesis and Characterization of Methyl Co-poly(ether-azomethine) with Pendant Cardo Cyclopentylidene Moiety

Sanjay S. Ankushrao[1], Suraj D. Jadhav[1]

Department of Chemistry, Vivekanand College Kolhapur (Autonomous), Maharashtra India.

Anil A. Ghanwat[2],

School of Chemical Sciences, Punyashlok Ahilyadevi Holkar Solapur University, Solapur, Maharashtra, India.

Email id: sanjayankushrao@vivekanandcollege.ac.in

Abstract:

Through a number of stages, a new diether-diamine monomer i.e. 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC) was synthesized. It has a cardo cyclopentane ring and a pendant methyl group. By using FT-IR, ^{1}H NMR, and ^{13}CNMR spectroscopy, the structure of the novel methyl substituted diether-diamine monomer was confirmed. Taking a proportionate amount of aromatic dialdehydes with a new diamine (BAMPC) undergo polycondensation to create a series of Co-poly(ether-azomethine)s with cardo cyclopentane units. It has been investigated how solubility and thermal stability are affected by the insertion of cardo cyclopentane, a pendant methyl group, in the Co-poly(ether-azomethine)s matrix together with the dialdehydes [terephthalaldehyde and terephthalaldehyde]. poly(ether-azomethine)s exhibit Tg values between 165°C and 178°C and Td values between 456°C and 486°C indicated good thermal stability. These polyazomethines displayed solubility in several polar aprotic solvents such as DMF, NMP, DMAc, and DMSO at ambient temperature or upon heating. A poly(ether-azomethine) exhibit Tg values between 165°C and 178°C and Td values between 456°C and 486°C indicated good thermal stability. These polyazomethines displayed solubility in several polar aprotic solvents such as DMF, NMP, DMAc, and DMSO at ambient temperature or upon heating. SPAM-2,3,4,5 exhibited amorphous nature, with a large peak in the range of 2θ=20° and SPAM-1 polymer exhibited semicrystalline nature, as confirmed by an X-ray diffraction analysis. Co-poly(ether-azomethine)s have inherent viscosities between 0.20 and 0.39 dL/g.

Keywords: Diamine, Co-poly(ether-azomethine), Cyclopentylidene moiety,

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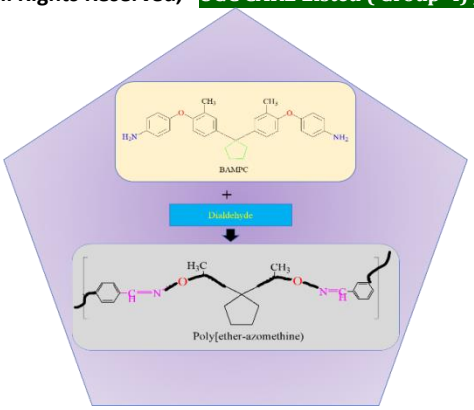

Introduction:

The polymers that have (-CH=N-) linkages in polymer backbone called as Poly-imines or poly(Schiff base)s. Poly(Schiff base)s are classes of materials identified as polyazomethines. These conjugated polymers are mostly gorgeous because they show good mechanical strength [1], good thermal stability [2], photoconductivity [3] and optical properties [4]. Since this wide range of charming properties, polyazomethines have potential applications in many fields e.g. semiconductors, battery anodes or cathodes, advanced technology materials, integrated electro optics for switching, energy storage and conversion devices, displays [5-7], electroluminescence (EL) devices [8], etc. The first polyazomethine was described in 1923 as a result of polycondensation of terephthaldehyde and benzidine [9]. Since then, conjugated aromatic polyazomethines with different moieties on both sides of CH=N group have been described [10-12]. Polyazomethines can be synthesized by solution polycondensation [13], chemical vapour deposition [14-16] and oxidative polymerizations [17].

Yet, polyazomethines are usually infusible polymers and have poor solubility problems, which would minimize their practical applications. Several modified polyazomethines, such as poly(azomethine-ester)s [18], poly(azomethine-ether)s[19], poly(azomethine-carbonate)s [20], poly(amide-azomethine-ester)s [21], poly(acrylate-azomethine)s [22], thermosetting polyazomethines [23] poly(azomethine-sulfone)s [24-27] were produced with the aim to enhance the solubility, to reduce the melting temperature and to promote specific properties such as mesomorphism [28]. Numerous approaches have been reported to enhance the solubility of polyazomethines. The insertion of flexible alkyl and alkoxy groups as the substituents has been evidenced to be effective, though at the expense of their thermal stability [29-31]. The insertion of bulky substituents such as tetraphenylethylene, triphenylamine and diphenyl fluorene has been investigated [32-34]. The co-polymerization of electron rich, solubility-enhancing aromatic or heterocyclic units such as carbazole, thiophene and fluorene [35-38] has also been discovered.

Aromatic polyazomethines are usually synthesized by solution polymerization and melt polymerization technique. Polyazomethines with a wide range of applications have had frequent increasing interest due to having a lot of valuable properties such as excellent mechanical strength and high thermal stability as well as their optoelectronic properties and semi-conductivity [39-41]. Yet, these applications have been limited by their poor solubility in common organic solvents and low molecular weights. Moreover, the relatively rare availability of new dialdehyde monomers also hindered the chemical structure modifications of polyazomethines. Several approaches have been reported to enhance the solubility of polyazomethines. The insertion of flexible alkyl and alkoxy groups as the substituents has been proved to be operative, although at the expense of their thermal stability [42-44]. The integrations of bulky substituents such as tetraphenylethylene, triphenylamine and diphenylfluorene have been investigated [45-47]. The co-polymerization as well as electron rich, solubility-enhancing aromatic or heterocyclic unit such as carbazole, thiophene and fluorene [48-51] has also been discovered.

The chemical alterations of polyazomethines are mainly attained by synthesizing new diamine and then polymerizing them with commercially available dialdehydes TPA and/or IPA. These efforts targeting at either solubility improvement or investigating their thermal stability. Hence here in reported the synthesis of new series of poly(ether-azomethine)s from newly synthesized methyl substituted diamines and from commercial IPA/TPA.

Experimental methods

2.1 Materials

1. All the solvents / chemicals were purified before use by following the standard procedures.
2. 3-mercapto propanoic acid, 10% Pd/C, terephthaldehyde & isophthaldehyde were purchased from Sigma Aldrich and used as received.
3. Potassium carbonate (K_2CO_3) was dried under vacuum at 150°C for 6 h.
4. DMF was vaccum distilled from P2O5 and DMAc was purified by vaccum distillation from barium oxide.
5. Cyclopentanone, 4-fluoronitrobenzene were purchased from Spectrochem and O-cresol, hydrazine hydrate purchased from S.D. fine chemicals and used as received.

2.2 Synthesis of new methyl substituted diether-diamine monomer

2.2.1 Synthesis of 1, 1-bis (4-hydroxy 3-methyl phenyl) cyclopentane (BHMPC)

In a 250 mL three necked round bottom flask equipped with HCl gas deep tube, reflux condenser and magnetic stirrer were placed 64.80 g (0.60 mol) of o-cresol and 8.4 g (0.1 mol) of cyclopentanone and 0.2 mL 3-mercaptopropanoic acid. To this reaction mixture dry HCl gas was

bubbled at room temperature. The reaction mixture becomes solid in 2 h. The solid reaction mixture was dissolved in ethyl acetate (600 mL) and neutralized by washing with aq. NaHCO3 solution 3 X 200 mL, followed by washing with distilled water 2 X 200 mL. The organic layer was dried over magnesium sulfate, decanted and distilled off to obtain viscous liquid. Then upon addition of pet ether in viscous liquid, solid product was separated. The solid product was washed with water and dried under vaccum. Finally, the bisphenol was reprecipitated through methanol-water mixture [52].

Yield: 15.10 g (65 %)

M.P.:140°C

2.2.2 Synthesis of 1, 1-bis[4-(4-nitro phenoxy)-3-methyl phenyl] cyclopentane (BMNPC)

In a 500 mL three neck round bottom flask equipped with calcium chloride guard tube, thermowell, nitrogen gas inlet and magnetic stirrer were placed 11.28 g (0.04 mol) 1, 1-bis (4-hydroxy 3-methyl phenyl) cyclopentane (BHMPC) and 12.56 g (0.08 mol) 4-fluoronitrobenzene in 60 mL N, N-dimethyl formamide (DMF), then 11.04 g (0.08 mol) of anhydrous K2CO3 was added. The resulting reaction mixture was refluxed for 8 h. Then allowed to cool at room temperature and water was added in reaction mixture to precipitate the product. The product was isolated by filtration, washed with water then washed with ethyl acetate and finally dried under vacuum [53].

Yield: 22.86 g (98%),

M.P.: 270°C.

IR: 3062 cm-1 (Aromatic –CH stretch), 2959, 2870 cm-1 (Aliphatic –CH stretch) 1505, 1346 cm-1 (-NO2 stretching), 1256, 1178 cm-1 (C-O-C stretching).

^{1}H NMR (400MHz, DMSO-d6), δ (ppm): 8.13 (d, 4H), 7.31 (d, 4H), 7.12 (d, 4H), 6.87 (s, 2H), 2.31(s, 6H), 2.08 (m, 4H), 1.60 (m, 4H).

2.2.3 Synthesis of 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC)

In a 250 mL single neck round bottom flask equipped with calcium chloride guard tube and magnetic stirrer were placed 13.10 g (0.025 mol) of the 1, 1-bis [4- (4-nitro 3-methyl phenoxy) phenyl] cyclopentane (BMNPC) and 0.284 g of 10% Pd/C and 13.5 g hydrazine hydrate in 100 mL 75:25 mixture of ethanol and N, N'-dimethyl acetamide. The resulting reaction mixture was kept at refluxed temperature for 10 h. The progress of reaction was monitored by TLC. At the end reaction mixture was filtered while hot to remove the catalyst. The obtained filtrate was poured into 500 mL of water under vigorous stirring to give a light-yellow product. Finally, product was filtered, washed with ethanol and dried. BAMPC recrystallized from DMAc-water system [54].

Yield: 9.86 g (85 %) **M.P.:** 160°C.

IR: 3464, 3377 cm-1 (-NH2 stretching), 3010, 2957, 2869, 1276, 1165 cm-1

^{1}H NMR (400MHz, CDCl3), δ (ppm): 7.28 (s, 2H), 7.11 (d, 2H), 7.02 (d, 2H), 6.78 (s 4H), 3.35 (s, 4H), 6.68 (s, 4H), 2.25(s, 10H), 1.70(m, 4H).

^{13}C NMR (100MHz, CDCl3), δ (ppm): 153.93, 149.80, 143.28, 141.84, 129.79, 127.84, 125.26, 119.77, 116.75, 116.27, 54.64, 38.94, 23.02, 16.55.

2.3 Synthesis of poly (ether-azomethine)s from 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane

In a 100 mL three necked round bottom flask equipped with a reflux condenser, a magnetic stirrer, a calcium chloride guard tube and a nitrogen gas inlet were placed [0.001 mol; 0.464 g of 1, 1-bis[4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC)] in 3 mL N, N-dimethyl acetamide (DMAc) containing 5% lithium chloride (0.150 g). After the mixture became clear, 0.134 g (0.001 mol) terephthaldehyde (TPA) was added in flask and the resulting mixture was stirred overnight. Finally, the polymerization mixture was heated at 140°C for 4 h. The resulting viscous mass was added to a large excess of water. The fibrous polymer was isolated by filtration. The polymer (SPAM-1) was washed several times with hot water to remove any inorganic impurities and was dried under vacuum at 60°C overnight. The yield was 99% and the inherent viscosity of polymer in NMP was 0.39 dL/g. The polyazomethines and co-polyazomethines SPAM-2 to SPAM-5 were synthesized with varying mol proportion of TPA and IPA by similar procedure [55].

Results and Discussion:

In order to obtain processable polyazomethines, a new diamine monomer with ether linkage, cardo moiety and pendant methyl group *viz*, 1, 1-bis[4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane was utilized. To study the effect of ether linkage, cyclopentylidene cardo moiety and methyl substitution on solubility behavior, a series of co-poly(ether-azomethine)s was synthesized by high temperature solution polycondensation of 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane with commercially available aromatic dialdehydes such as terephthaldehyde, isophthaldehyde and a mixture of terephthaldehyde and isophthaldehyde.

Homo and Co-polyazomethines were characterized by inherent viscosity measurements, solubility tests, FTIR spectroscopy, X-ray diffraction, thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).

3.1 Synthesis of 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane

In the first step, cyclopentanone was reacted with o-cresol by using HCl gas in the presence of 3-mercapto propanoic acid as catalyst to obtain the bisphenol (BHMPC). The bisphenol followed by reacts with 4-chloronitrobenzene in presence of anhydrous K_2CO_3 to yield intermediate dinitro

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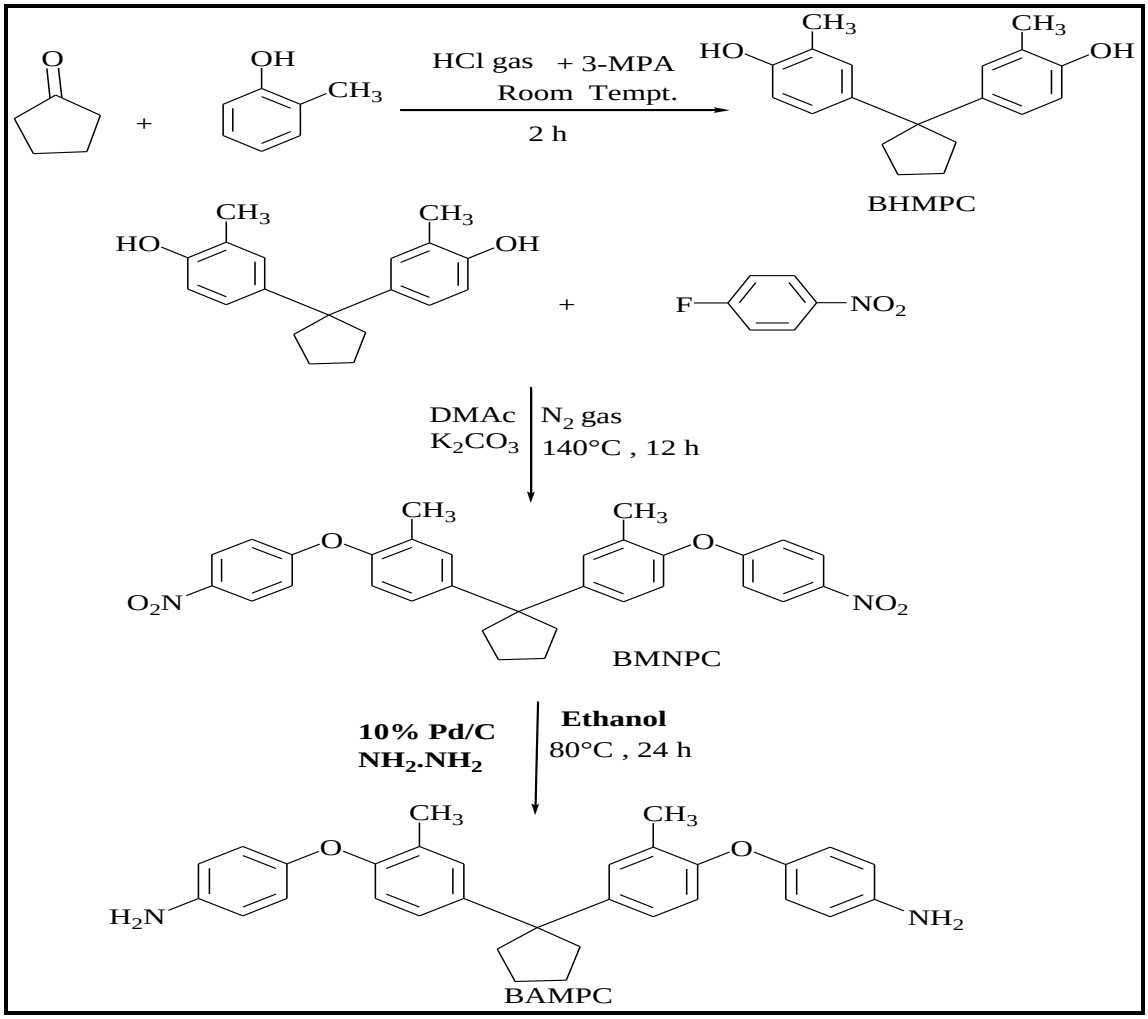
compound *viz.*, 1, 1-bis [4-(4-nitro phenoxy)-3-methyl phenyl] cyclopentane (BMNPC). Pure BMNPC was characterized by FT-IR, ^{1}H-NMR spectroscopy.

BMNPC was characterized by FT-IR, ^{1}H-NMR spectroscopy.



Scheme 3.1 Synthesis of 1, 1-bis[4-(4-amino phenoxy)- 3-methyl phenyl]cyclopentane

FT-IR spectrum of BMNPC (**Fig.1)** exhibited characteristic absorption bands at 1505 cm^{-1} (asymmetric -NO_2 stretching) and 1346 cm^{-1} (symmetric -NO_2 stretching). The band at 3062 and 2959 cm^{-1} were assigned to aromatic –CH stretch and aliphatic –CH stretch respectively. The band at 1255 and 1178 exhibits C-O-C stretching which indicates presence of ether linkages in di-nitro compound.

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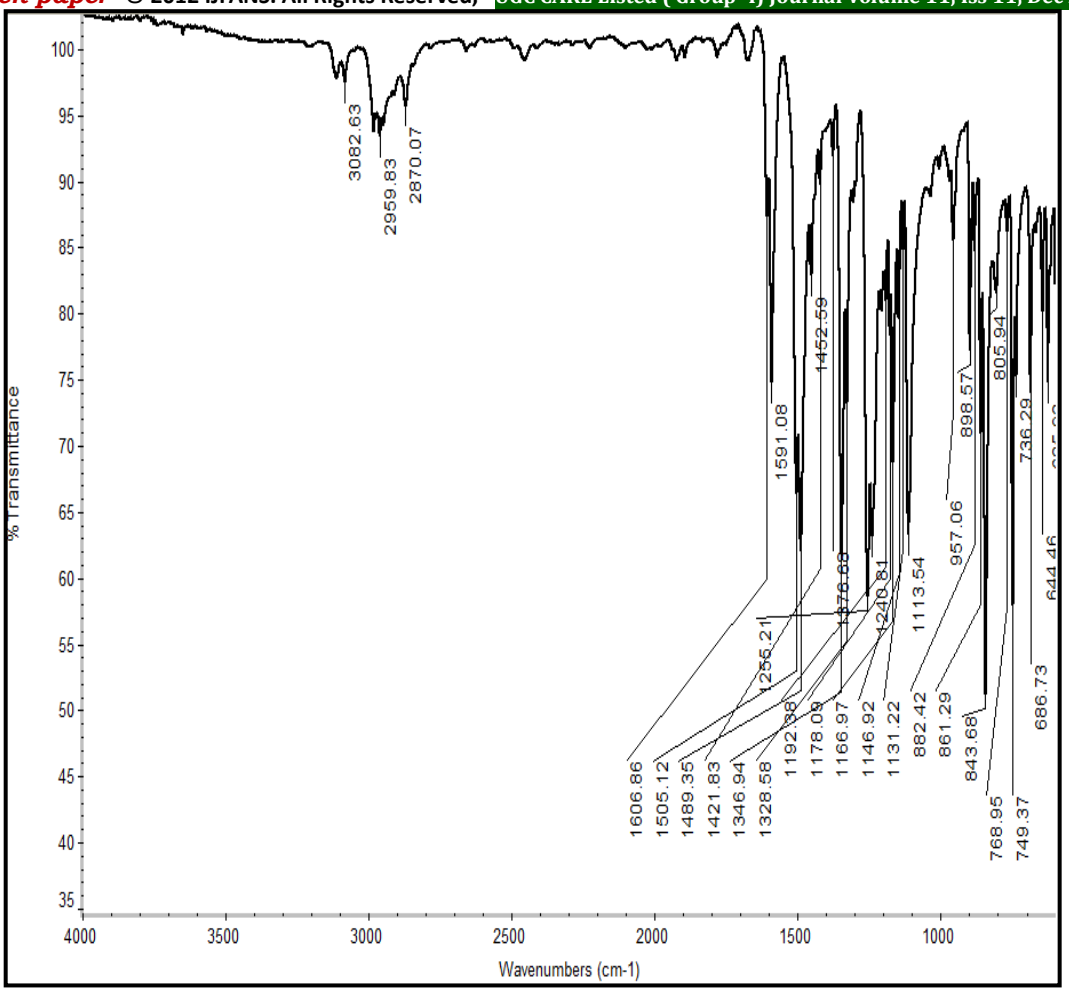

Fig..1 FT-IR spectrum of 1, 1-bis [4- (4-nitro phenoxy)-3-methyl phenyl] cyclopentane

^{1}H-NMR spectrum of BMNPC is depicted in **Fig. 2** The aromatic protons 'h' and 'g' appeared in the range 8.13 δ, ppm and 7.31 δ, ppm as doublet and which is corresponding to aromatic protons of phenyl ring attached to nitro group. The aromatic proton 'c' , 'd' and 'e' appeared in the range 7.12 δ, ppm and 6.87 δ, ppm as singlet and doublet respectively which is corresponding to aromatic protons of phenyl ring attached to cyclopentane ring. The proton 'f' flanked by two methyl groups displayed a peak at 2.08 δ, ppm as singlet and the aliphatic protons 'a' and 'b' appeared as two multiplets at 1.60 and 2.31 δ, ppm, respectively.

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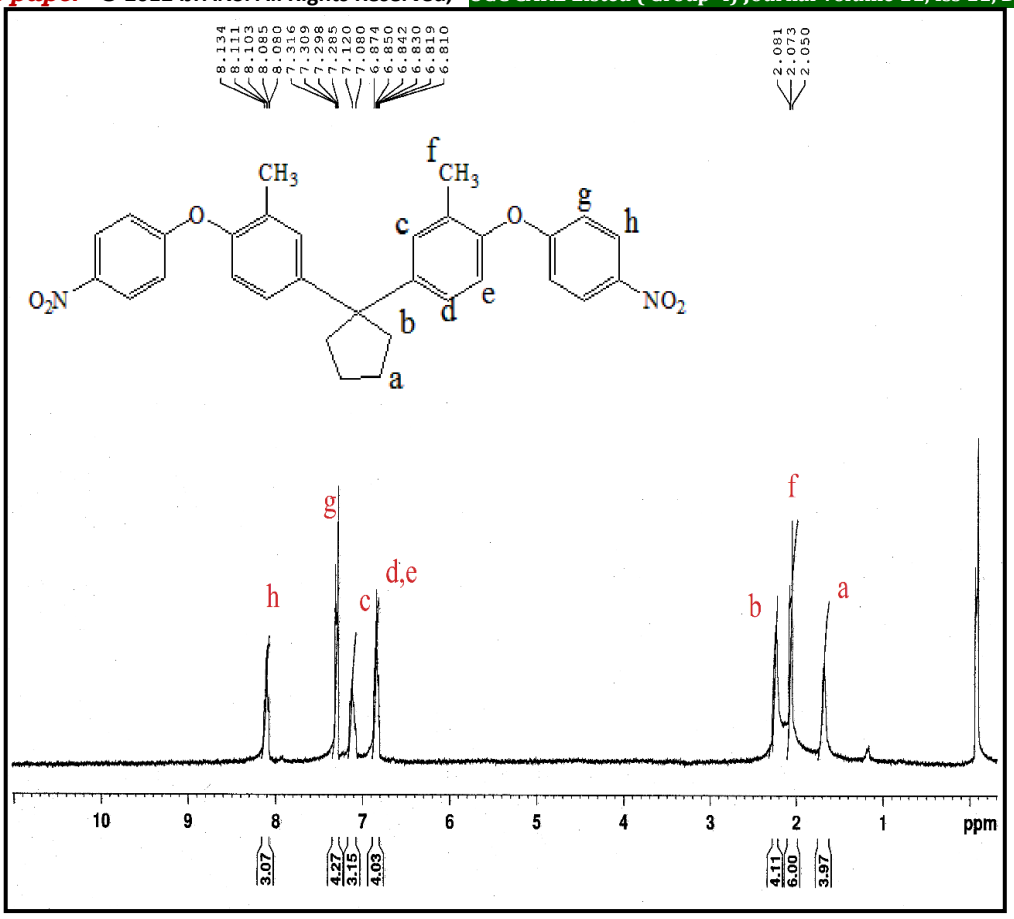

Fig. 2 ^{1}H NMR spectrum of 1, 1-bis[4- (4-nitro phenoxy)-3-methyl phenyl] cyclopentane

In the next step, BMNPC was reduced to the diamine *viz.*, 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC) by catalytic hydrogenation using hydrazine hydrate and Pd-C (10 wt.%). The crude diamine was purified by recrystallization from DMAc-water and was characterized by FT-IR, ^{1}H-NMR, ^{13}CNMR and Mass spectroscopy.

FT-IR spectrum of BAMPC (**Fig. 3)** exhibited N-H stretching absorption bands at 3464 (asymmetric N-H stretching) and 3377 cm-1 (symmetric N-H stretching) and C-O-C stretching at 1223 cm^{-1} and 1122 cm^{-1}. Band at 3010 cm^{-1} is due to aromatic C-H stretching and band at 2957 and 2869 cm^{-1} is due to aliphatic C-H stretching of cyclopentane moiety.

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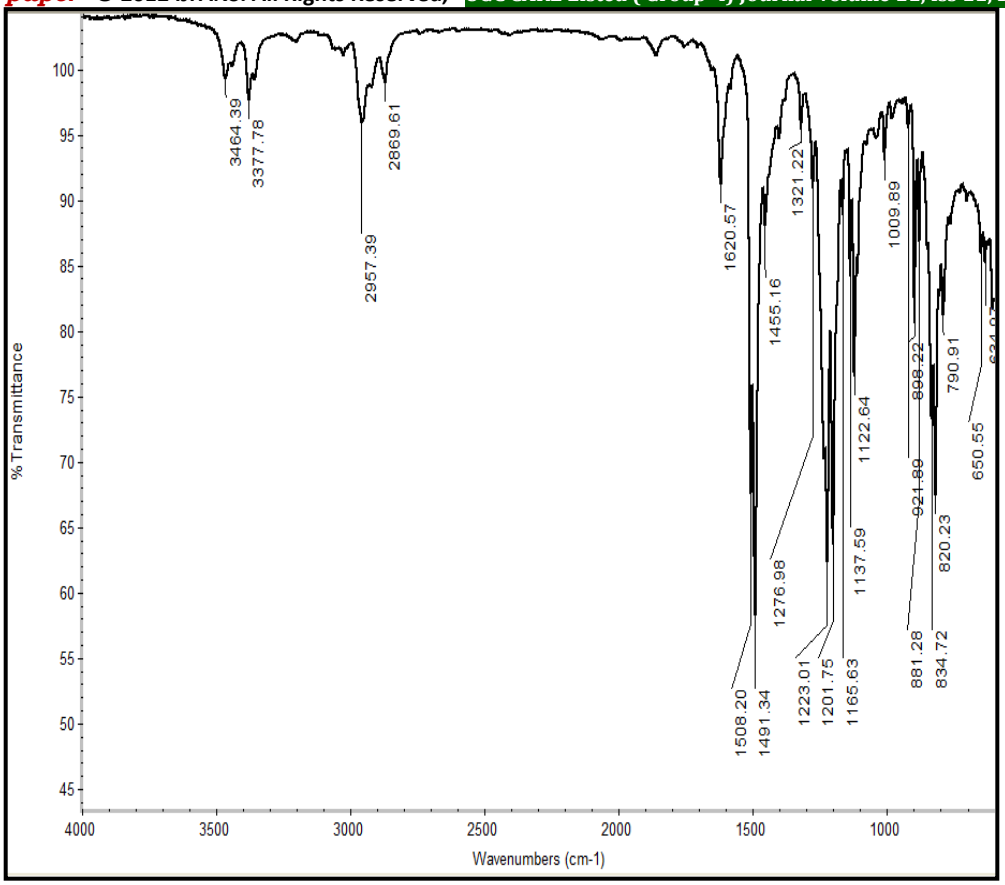

Fig. 3 FT-IR spectrum of 1, 1-bis [4- (4-amino phenoxy)- 3-methyl phenyl] cyclopentane

^{1}H-NMR spectrum of 1,1-bis[4-(4-aminophenoxy)-3-methyl phenyl]cyclopentane (BAMPC) is represented in **Fig.4**. The aliphatic protons 'a' and 'b' were observed for methylene group of cyclopentylidene ring at 1.70 and 2.25 δ, ppm. The aliphatic protons 'f' at 2.25 δ, ppm overlapped with proton 'b' and it is corresponding to methyl group attached to aromatic ring. The aromatic protons'd' and 'e' displayed peaks at 6.78 and 6.68 δ, ppm, appered as doublet respectively. The aromatic proton 'g'and 'i' appeared as a doublet at 7.02 δ, ppm and 7.28 δ, ppm corresponding to phenyl ring attached to cyclopentylidene ring.The proton 'h' appeared as a singlet at 7.11 δ, ppm. The signal at 3.35 δ, ppm is due to $-NH_2$ protons.

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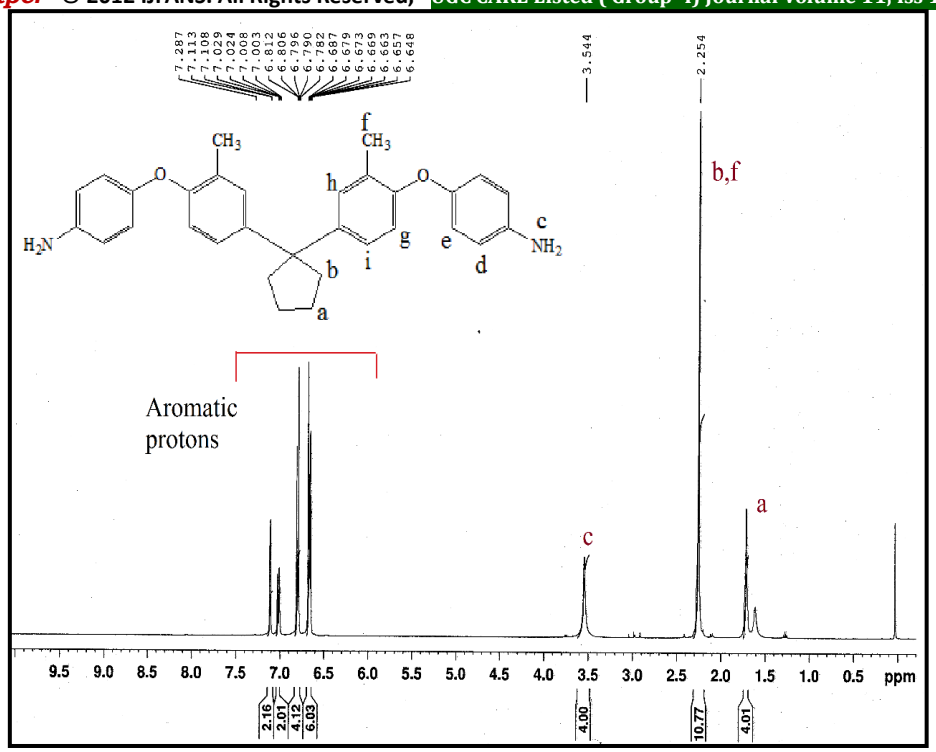

Fig. 4 ^{1}H NMR spectrum of 1, 1-bis [4- (4-amino phenoxy)- 3-methyl phenyl] cyclopentane

^{13}C-NMR spectrum of 1,1-bis[3-methyl-4-(4-amino phenoxy)phenyl]cyclopentane (BAMPC) along with assignments is presented in **Fig. 5**. ^{13}C NMR spectrum showed fourteen NMR signals to 14 types of different carbons atoms. The NMR signals appeared at 127.84, 125.26, 119.77, 116.75, 116.27 δ; corresponding to aromatic CH carbons. The tertiary carbons showed signals at 153.93, 149.80, 143.28 (C-NH_2), 141.84, 129.79 δ, and 54.64 δ whereas CH_2 carbon gave NMR signals at 38.94, 23.02 δ confirming aliphatic cyclopentylidene ring. The carbon showed signal 16.55 δ confirming methyl group attached to aromatic ring.

DEPT spectrum (**Fig. 6**) of BAMPC also confirms the structure of amino compound, all the quaternary carbons are absent in the spectrum and the peaks of CH and CH_3 carbons are upper sides at 129.79, 125.26, 119.80, 116.71, 116.27 δ and 16.58 respectively. The peaks of CH_2 appeared at down side at 38.93, 23.0 δ.

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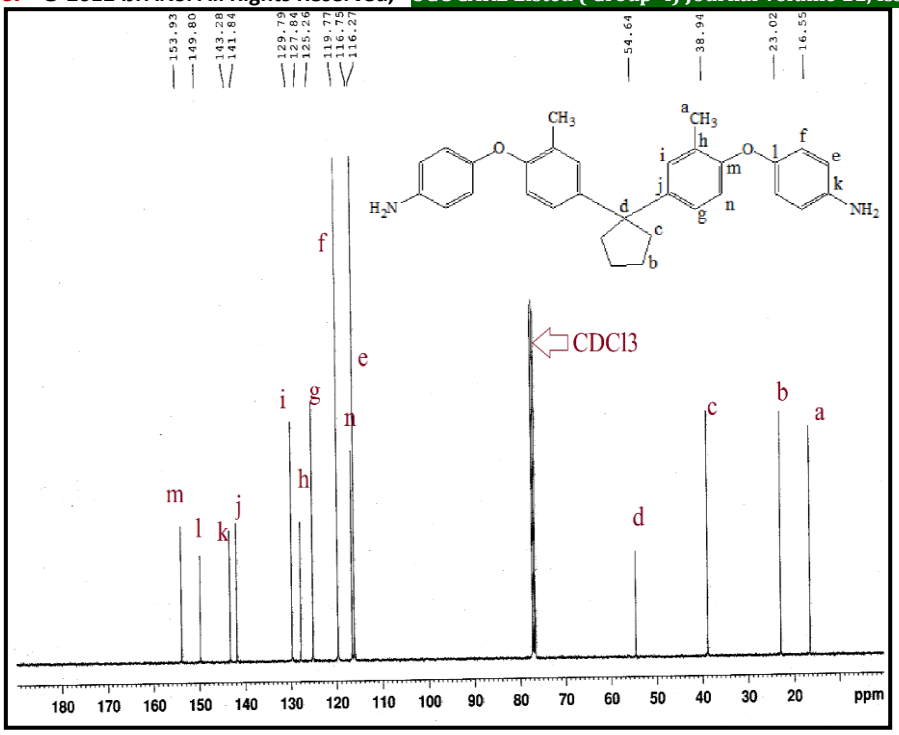


Fig.5 ^{13}C NMR spectrum of 1, 1-bis [4- (4-amino phenoxy) - 3-methyl phenyl] cyclopentane

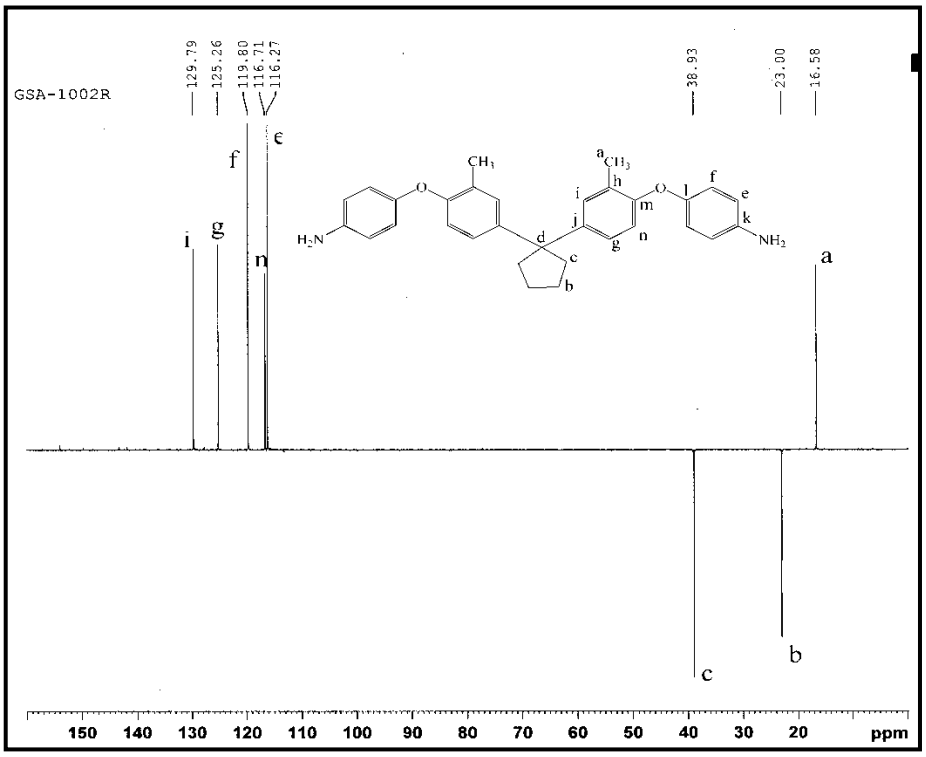


Fig. 6 DEPT-135 spectrum of 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane

The mass spectrum of (**Fig.7**) BAMPC showed molecular ion peak at m/e 465 corresponding to molecular weight of BAMPC.

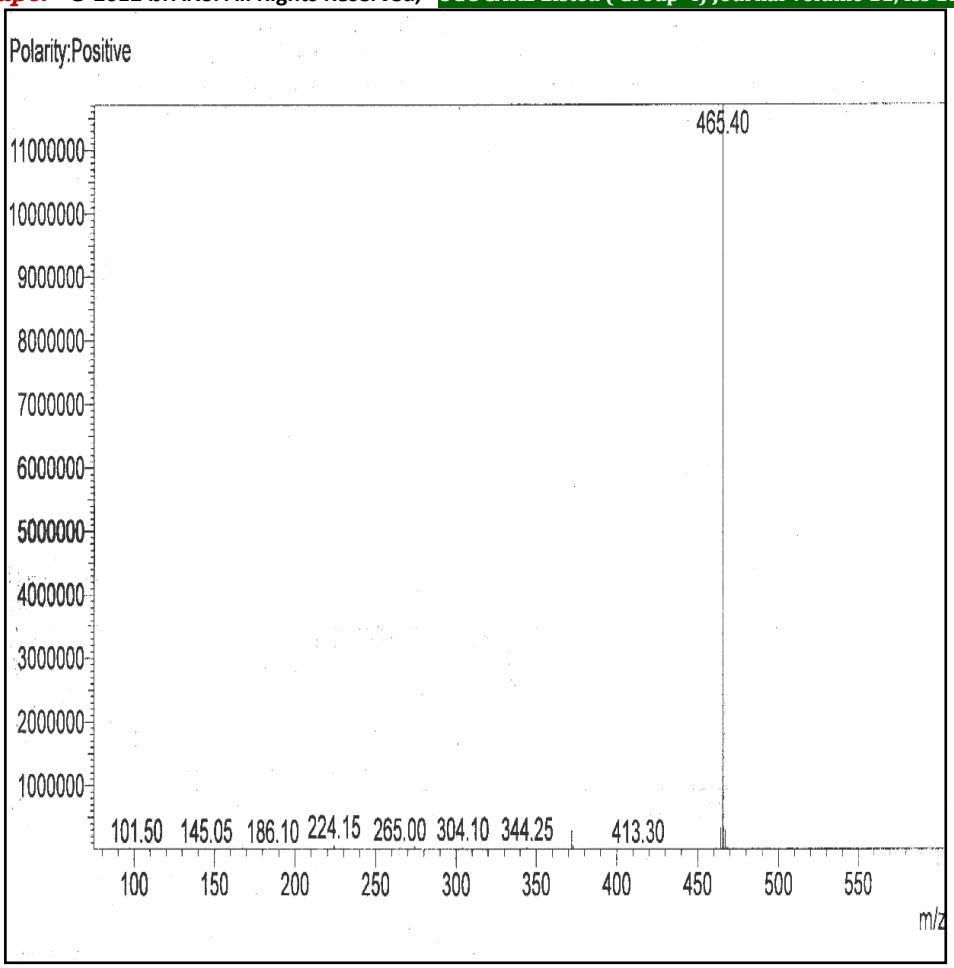
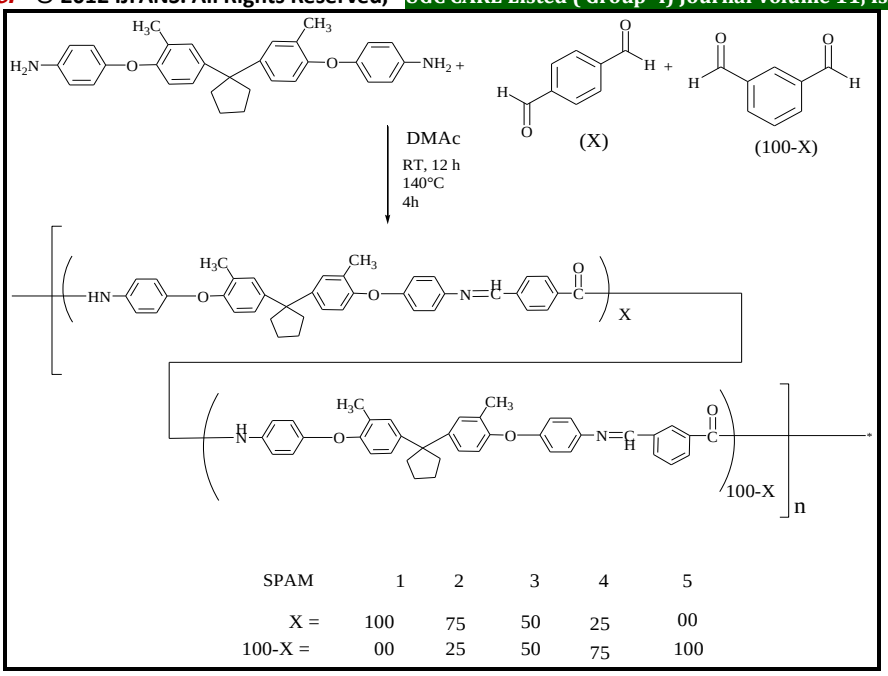


Fig.7 Mass spectrum of 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane

3.2 Synthesis of poly(ether-azomethine)s from 1, 1-bis[4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane

A series of methyl substituted homo and co-poly(ether-azomethine)s were synthesized as outlined in **Scheme 4.2** by elevated temperature solution polymerization of BAMPC with dialdehydes TPA and/or IPA in DMAc containing LiCl. Lithium chloride was used to absorb water formed during the polycondensation. The polymerization proceeded smoothly giving highly viscous solution. The resulting polymers were precipitated by pouring the viscous solutions in water.

The inherent viscosities of all these polymers were determined in NMP and ranged from 0.20 to 0.38 dL/g. The data of these poly (ether-azomethine)s are presented in **Table 4.1.**



Scheme 3.2 Synthesis of poly(ether-azomethine)s (SPAM-1 to SPAM-5)

Table 1. Yield and Viscosity of Poly(ether-azomethine)s

Polymer Code	Monomers			Yield %	Inherent Viscosity dL/g [a]
	Diamine BAMPC Mol %	TPA Mol%	IPA Mol%		
SPAM-1	100	100	0	99	0.39
SPAM-2	100	75	25	98	0.28
SPAM-3	100	50	50	97	0.33
SPAM-4	100	25	75	98	0.20
SPAM-5	100	0	100	99	0.24

[a]Inherent viscosity was measured at a concentration of 0.5 % (W/V) in NMP at 30°C

Structural Characterization:

The polymers were characterized by the infrared spectroscopy. The IR spectrum of poly (ether-azomethine) SPAM-1, **Fig. 8** showed the characteristic absorption at 1624 cm^{-1} (CH = N stretching). The sharp bands occurring at 1229 and 1121 cm^{-1} in the spectra of the polymers are due to the asymmetrical and symmetrical vibrations of the(C-O-C) ether linkage. The presence of bands at 2970 and 2865 cm^{-1} can be assigned to assymetric and symmetric aliphatic (C-H stretching) vibrations. The vibration at 827 cm^{-1} indicates para catenation of aromatic rings.

The IR spectrum of poly (ether-azomethine) SPAM-3, **Fig. 9** showed the characteristic absorption at 1623 cm^{-1} (CH = N stretching). The sharp bands occurring at 1229 and 1156 cm^{-1} in the spectra of the

polymers are due to the asymmetrical and symmetrical vibrations of the(C-O-C) ether linkage. The presence of bands at 2969 and 2846 cm^{-1} can be assigned to asymmetric and symmetric aliphatic (C-H stretching) vibrations. The vibration at 832 cm^{-1} indicates para catenation of aromatic rings.

The IR spectrum of poly (ether-azomethine) SPAM-5, **Fig. 10** showed the characteristic absorption at 1621 cm^{-1} (CH = N stretching). The sharp bands occurring at 1234 and 1122 cm^{-1} in the spectra of the polymers are due to the asymmetrical and symmetrical vibrations of the(C-O-C) ether linkage. The presence of bands at 2970 and 2872 cm^{-1} can be assigned to assymetric and symmetric aliphatic (C-H stretching) vibrations. The vibration at 835 cm^{-1} indicates para catenation of aromatic rings.

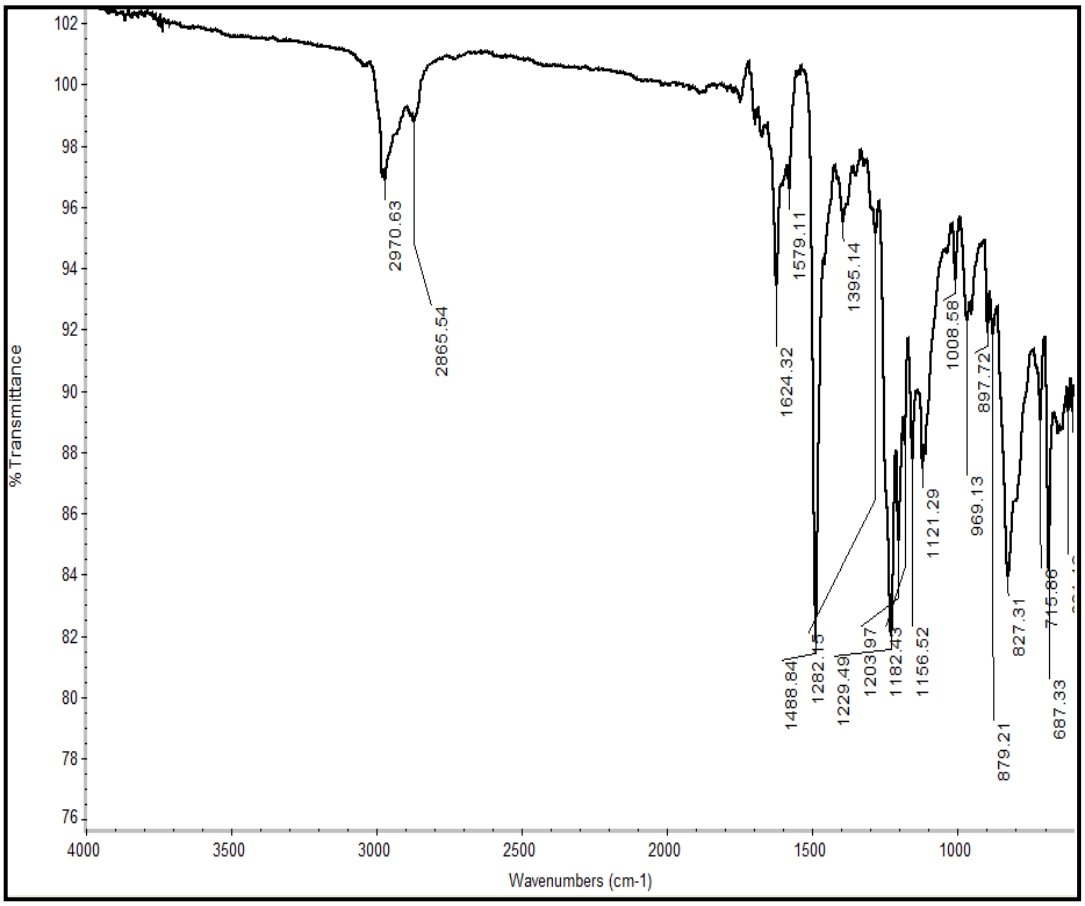


Fig. 8 FT-IR spectrum of SPAM-1

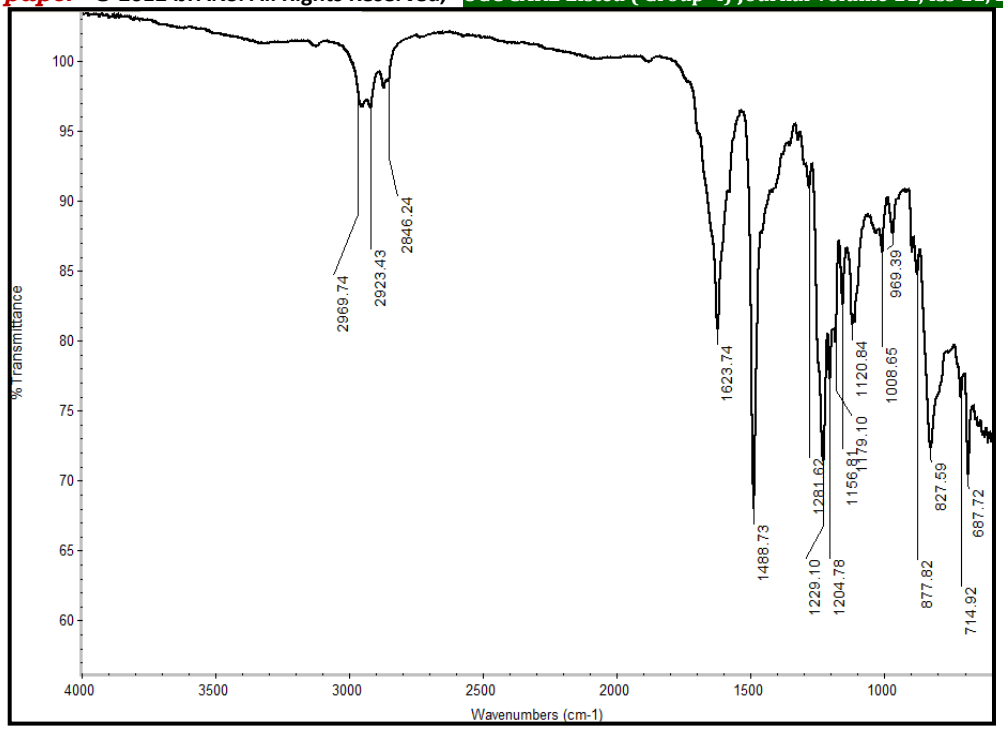


Fig. 9 FT-IR spectrum of SPAM-3

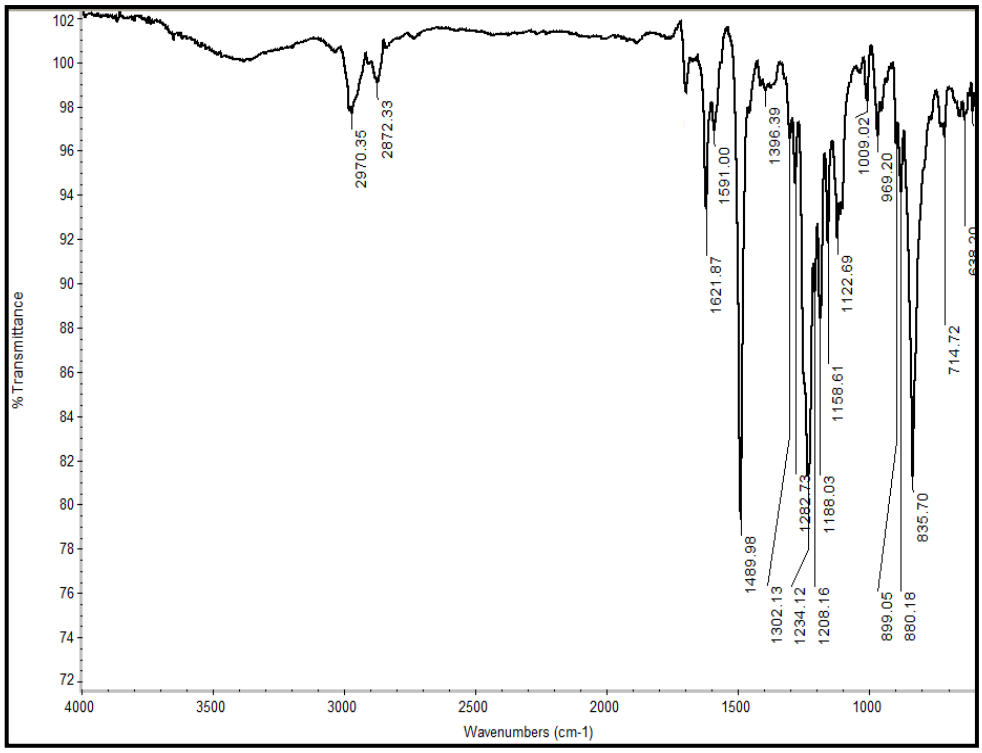


Fig 10 FT-IR spectrum of SPAM-5

Solubility properties

Solubility characteristics of methyl substituted poly(ether-azomethine)s are summarized in **Table 2**. It is observed that the entire poly (ether-azomethine) SPAM-1 to SPAM-5 exhibited solubility

in organic solvent N-methylpyrrolidone (NMP) and also shows partial solublity in solvents such as THF and DCM. All these Polyazomethines (SPAM-1 to SPAM-5) are insoluble in solvents such as DMF, DMAc and DMSO. Polymer SPAM-1 synthesized from terepthaldehyde (TPA) exhibit less solubility due to its stiff structure attributed more close packing of polymer chians. But polyazomethine SPAM-4 shows better solubility in solvents DMF, DMAc, NMP and DMSO, thus good improvement in solubility of these polymer, as expected; can be attributed to the copolymerization of novel diamine with TPA and IPA ,introduction of cardo cyclopentylidene moiety, pendant methyl substitution and ether linkages in the polymer backbone.

Table 2. Solubility behavior of Poly(ether-azomethine)s

Polymer Code	Solvents							
	DMF	DMAc	DMSO	NMP	THF	$CHCl_3$	DCM	$C.H_2SO_4$
SPAM-1	-	-	-	+	±	-	+	+
SPAM-2	±	±	-	+	±	-	+	+
SPAM-3	±	±	-	+	±	-	+	+
SPAM-4	+	+	+	+	±	-	±	+
SPAM-5	±	±	±	+	±	-	±	+

+ : Soluble ; - : Insoluble on heating; ± : Sparingly soluble

Thermal properties:

Thermal behaviour of polymers was evaluated by means of thermogravimetry and differential scanning calorimetry. **Table 3.** incorporate the thermal data such as glass transition temperature (T_g), initial decomposition temperature (T_i), 10 % decomposition temperature (T_d) and residual weight at 900°C.

Table 3. Physical properties of Poly(ether-azomethine)s

Polymer Code	Thermal behaviour [b]			
	T_i °C	T_d °C	Tg °C	Residual Wt % at 900°C
SPAM-1	416	486	178	18
SPAM-2	414	474	175	19
SPAM-3	410	456	170	18
SPAM-4	414	484	170	17
SPAM-5	409	470	165	16

[b] Temperature at which onset of decomposition was recorded by TG at **a** heating rate of 10°C/min.

Tg- Glass transition temperature determined at second heating by DSC at a heating rate of 10°C/min

T_d – Temperature of 10% decomposition

T_i – Initial decomposition temperature.

The thermal stability of the methyl substituted poly(ether-azomethine)s outlined in **Fig. 11** was studied at a heating rate of 10°C/min in nitrogen atmosphere by thermogravimetric analysis. T_d values were in the range of 456°C to 486°C. In general, these polymers, like other poly-Schiff bases, exhibited good thermal stability in nitrogen; 10% weight loss only takes place when they are heated beyond 456°C in nitrogen. The initial decomposition temperature (T_i) were in the range of 409°C to 416°C. The residual weight at 900°C were in the range of 16%-19%.

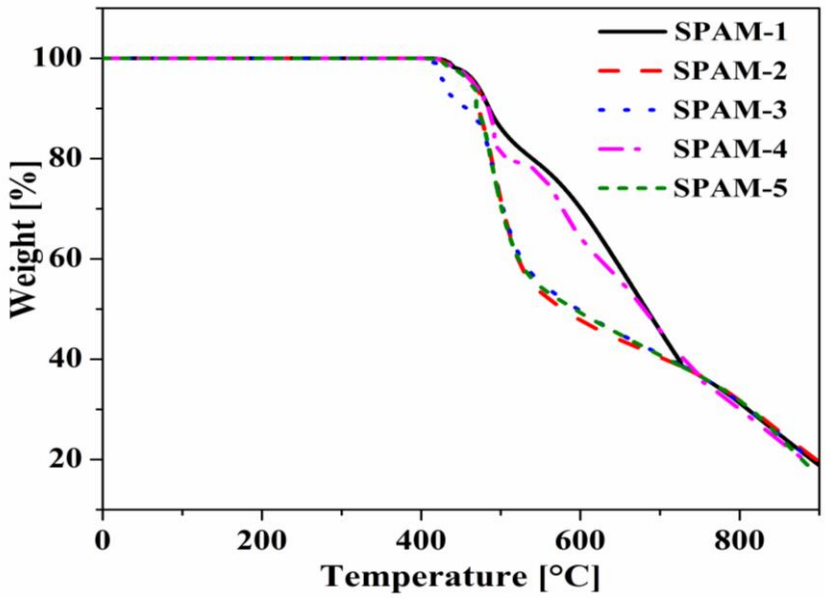


Fig. 11 TGA curve of Poly(ether-azomethine)s SPAM-1 to SPAM-5

The DSC curves **(Fig. 12)** represent the T_g values of methyl substituted poly (ether-azomethine)s. All these polyazomethines exhibits a T_g indicative of an amorphous or glassy morphology. The glassy morphology of these polyazomethines is due to the presence of cardo groups and pendant methyl substitution in the polymer backbone as well as copolymerization, which inhibited the crystalline packing. All the polymers show T_g in between 165-178°C**.** The higher T_g of SPAM-5 compared to the T_g of other polymers is due to the usage of terephthaldehyde (TPA) which exhibits rigid structure attributed more close packing of polymer chians.

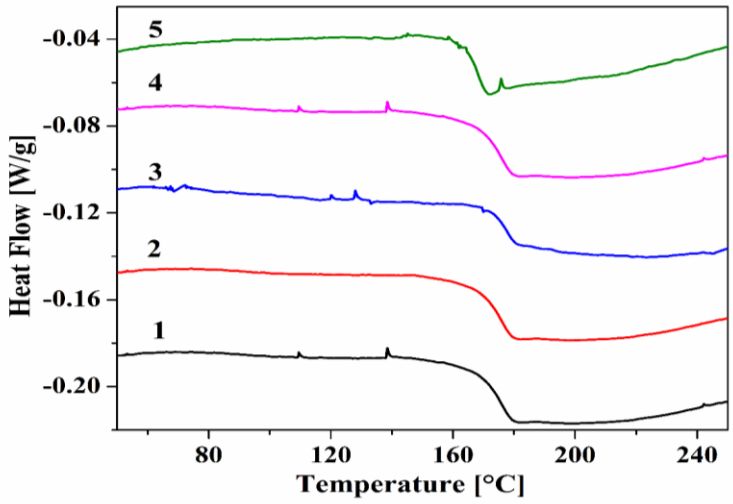


Fig 12. DSC curve of Poly(ether-azomethine)s SPAM-1 to SPAM-5

X-Ray diffractograms of polymers exhibited a broad halo in the wide angle region (at about 2θ ≈ 20°) indicating that, the polymers were amorphous in nature. The methyl substituted Poly (ether-azomethine)s were also characterized by the wide angle X-ray diffractometer. The X-ray diffraction pattern of all poly (ether-azomethine)s is shown in **Fig 13**. It is observed that, the polymer (SPAM-4) is highly amorphous in nature. This may be attributed to the copolymerization of novel diamine with IPA and TPA, introduction of cardo cyclopentylidene moiety of novel diamine monomer, methyl substitution and ether linkages which may have disrupted the chain regularity and packing leading amorphous nature. On the contrary, SPAM-1 polymer exhibited semicrystalline nature; this may be due to presence of para catenation of TPA leading to the close packing of the chains.

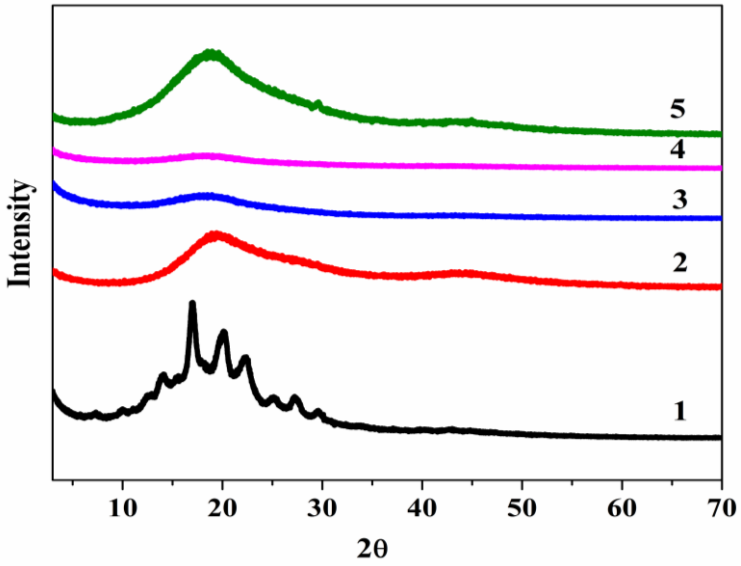


Fig. 13 XRD curve of Poly (ether-azomethine)s SPAM-1 to SPAM-5

Conclusions:

We have successfully synthesized and characterized poly(ether-azomethine)s with copolymerization, ether linkage, pendant methyl substitution, and a cardo cyclopentylidene moiety. The resulting polymers showed medium to reasonably moderate molecular weights (0.20-0.39 dL/g). SPAM-4 exhibited enhanced solubility in various solvents, attributed to the unique molecular structure. X-ray diffraction patterns revealed the polymers' amorphous nature, except for SPAM-1, which was semicrystalline. The polyazomethines displayed robust thermal stability (Td: 456°C-486°C), and their glass transition temperatures (Tg: 165°C-178°C) suggested broad processing flexibility. This study offers valuable insights into the synthesis, structure, and thermal properties of these novel polymers.

References:

1. Catanescu, O.; Grigoras, M.; Colotin, G.; Dobreanu, A.; Hurduc, N.; Simionescu, C.; Eur. Polym. Journal, 37, 2213, 2001.
2. Ribera, D.; Mantecon, A.; Serra, A.; J. Polym. Sci. A, Polym. Chem.,40, 4344, 2002.
3. Suh, S. C.; Shim, S. C.; Synthetic Metals, 114, 91-95, 2000.
4. Janusz, J.; Rev. Adv. Mate. Science, 8, 82-85, 2004.
5. Jarzabek, B.; Journal of Non-Crystalline Solids, 352, 1660-1662, 2006.
6. Aly, K. I.; Khalaf, A. A.; Journal of Applied Polymer Science, 77, 1218-1229, 2000.
7. Grigoras, M.; Antonoaia, N. C.; Polymer International, 54, 12, 1641-1646, 2005.
8. El-Shekeil, A.; AI-Khader, M.; Abeer, O.; Bakr, A.; Synthetic Metals, 43, 147-152, 2004.
9. Puertolas, J. A.; Carod, E.; Diaz-Calleja, R.; Cerrada, P.; Orioi, L.; Pinol, M.; Serrano, J. L.; Macromolecules, 30, 773,1997.
10. Niu, H.; Huang, Y.; Bai, X.; Li, X.; Zhang, G.; Materials Chemistry and Physics, 86, 33-37, 2004.
11. Hui, Z.; Gandini, A.; Eur Polym Journal, 28, 1461, 1992.
12. Dutta,P. K.; Jain, P.; Sen, P.; R.; Trivedi, P.; Sen, K.; Dutta, J.; European Polymer Journal, 39, 1007-1011, 2003.
13. Suh, S. C.; Shim, S. C.; Synthetic Metals, 114, 91-95, 2000.
14. Weaver, M. S.; Bradley, D. D. C.; Synth. Metals, 83, 61-66, 1996.
15. Tatsuura, S.; Sotoyama, W.; Appl. Phys. Leu., 62, 2182, 1993.
16. Ng, S. C.; Chan, H. S. O.; Wong, P. M. L.; Tan , K. L.; Tan, B. T. G.; Polymer, 39, ,20, 4963-4968, 1998.
17. Chevrot, C.; Henri, T.; Synthetic Metals, 118, 157-166, 2001.
18. Shukla, U.; Rao, K.V.; Rakshit, A. K.; J. Appl. Polym. Sci., 88,153-160, 2003.
19. Aly, K. I.; Ahmed, R. A.; Liquid Crystals, 27, 451-458, 2000.

20. Sun, S. -J.; Chang, T. -C.; Li, C. -H.; Eur. Polym. J., 29, 951-955, 1993.
21. Li, C. -H.; Chang, T. -C.; J. Polym. Sci., Chem., 29, 361-367, 1991.
22. Tanaka, H.; Shibahara, Y.; Sato, T.; Ota, T.; Eur. Polym. J., 2, 1525-1530, 1993.
23. Mormann, W.; Brocher, M.; Polymer, 40,193-198, 1998.
24. Cozan, V.; Butuc, E.; Stoleriu, A.; Rusa, M.; Rusu, M.; Ni, Y.; Ding, M.; J. Macromol. Sci., Pure Appl. Chem., A32, 1243-1262, 1995.
25. Cozan, V.; Gaspar, M.; Butuc, E.; Stoleriu, A.; Eur. Polym. J., 37, 1-8, 2001.
26. Cozan, V.; Avram, E.; Eur. Polym. J., 39, 107-114, 2003.
27. Marin, L.; Cozan, V.; Bruma, M.; Proceedings of 8th International Symposium on Polymers for Advanced Technologies, 13-16, Budapest, Section A, September 2005.
28. Choi, M. K.; Kim, H. L.; Suh; D. H.; Jour. of appli. polym. sci., 101,1228-1233,2006.
29. Yang, J.; Polymer, 46, 10478-10483, 2005.
30. Liou, G. -S.; Lin, H. Y.; Hsieh, Y. L.; J. Appli. Polym. Sci . part-A, 45, 4921-4932, 2007.
31. Niu, H. -J.; Huang, Y. -D.; Material Letters, 58, 2979-2983, 2004.
32. Niu, H. -J.; Kang, H.; Cai, J.; Wang, C.; Polym.Chem, 2, 2804-2817, 2011.
33. Liu, C. -L.; Chen, W. -C.; Macromol. Chem. Phys., 206, 2012-2222, 2005.
34. Park, K. H.; Tani, T.; Kakimoto, M.; Imai, Y.; Macromol Chem Phys., 199,1029-1033, 1998.
35. Wang, C.; Shieh, S.; Legoff, E.; Kanatzidis, M. G.; Macromolecules, 29, 3147-56, 1996.
36. Tsai, F. C.; Chang, C. C.; Liu, C. L.; Chen, W. C.; Jenekhe, S. A.; Macromolecules, 38,1958-66, 2005.
37. Kim, H. C.; Kim, J. S.; Kim, K. S.; Park, H. K.; Baek, S.; Ree, M.; J. Polym. Sci. Part A Polym. Chem., 42, 825, 34, 2004.
38. Grigoras, M.; Antonoaia, N. C.; Polym. Int., 54, 1641, 6, 2005.
39. Yang, C. J.; Jenekhe, S. A.; Chem. Mater, 6,196–203, 1994.
40. Wang, C. G.; Shieh, S.; LeGoff, E.; Kanatzidis, M. G.; Macromolecules, 29, 3147-56, 1996.
41. Grigoras, M; Catanescu, C. O.; J. Macromol Sci: Part C Polym. Rev., 44, 31-73, 2004.
42. Park, S. B.; Kim, H.; Zin, W. C.; Jung, J. C.; Macromolecules, 26,1627-32,1993.
43. Yang, C. J.; Jenekhe, S. A.; Macromolecules, 28,1180-96, 1995.
44. Thomas, O.; Inganas, O.; Andersson, M.R.; Macromolecules, 31, 2676-8, 1998.
45. Liou, G. S.; Lin, H. Y.; Hsieh, Y. L.; Yang, Y. L.; J. Polym. Sci. Part-A Polym. Chem., 45, 4921-32, 2007.
46. Matsumoto, T.; Yamada, F; Kurosaki, T.; Macromolecules, 30, 3547-52, 1997.
47. Park. K. H.; Tani, T.; Kakimoto, M.; Imai, Y.; Macromol. Chem. Phys., 199, 1029-33, 1998.
48. Wang. C.; Shieh, S.; Legoff, E.; Kanatzidis, M. G.; Macromolecules, 29, 3147-56, 1996.

49. Tsai, F. C.; Chang, C. C.; Liu, C. L.; Chen. W. C; Jenekhe, S. A.; Macromolecules, 38, 1958-66, 2005.
50. Kim, H. C.; Kim, J. S.; Kim, K. S.; Park, H. K.; Baek, S.; Ree, M.; J. Polym Sci. Part A Polym Chem, 42, 825-34, 2004.
51. Grigoras, M.; Antonoaia, N. C.; Polym. Int., 54, 1641-60, 2005.
52. Ankushrao, S. S.; Gugwad, V. M.; Ubale, V. P.; Maldar, N. N.; Ghanwat, A. A.; Polym. Sci. - Series B, 60(3), 263–272, 2018.
53. Ankushrao, S. S.; Patil, Y. S.; Ubale, V. P.; Maldar, N. N.; Ghanwat, A. A.; J. Macromol. Sci., Part A: Pure and Applied Chem, 54(6), 411–417, 2017.
54. Mahindrakar, J. N., Patil, Y. S., Salunkhe, P. H.; Ankushrao, S. S.; Kadam, V. N., Ubale, V. P.; Ghanwat, A. A.; Macromol. Sci., Part A: Pure and Appli. Chem., 55(9), 658–667, 2018.
55. Ankushrao, S. S.; Ghanwat, A. A.; Patil, Y. S.; Kadam, V. N.; J. Adv. Sci. Res., 12(3), 2021.

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Study Of Work Life Balance As An Element Of Qwl Of Women Employees In Kolhapur District

Dr. Revati Patil
Assistant Professor,
Department of Commerce, Vivekanand College, Kolhapur(Autonomous)
Email ID: revatirpatil26@gmail.com

Abstract:

Work Life Balance is an important element of QWL which include the variables Reading books, Listening to music, Priorities and plan work, Shares with family take into confidence, Inviting friends or relatives, Having holiday, gym, yoga, walk, playing an instrument, Defining work and life boundaries, Good working relationship, Accepting the fact that respondents cannot be everything to everyone etc. Actually these are new ways of having work-life balance and sample respondents are accepting the things gradually. It indicates work life balance is practically supporting QWL concept at work. Organisational help in work life balance have also be essential element as QWL element. It includes variable such as Family sick leaves, On or near day care centre, High pay and reward Favourable situations for both employer and employees, struggle for better performance, Respect at workplace, Facilities at workplace, Maternity and parental leaves, alternative work job, part-time Employee assistance programmes, Having home and family life, Having opportunities in climbing career ladders, Freedom and personal space, High support system at both home and work etc. Present study focuses on these elements of QWL of women employees working in service providing institutions in Kolhapur city.

Keywords: QWL, Work Life Balance, women Employees, service providing institutions, Organisational Help.

Introduction:

Today's employers think that women employees having qualities of high sense of responsibility, most trustworthy, can handle pressure, tidy and methodical, meeting deadlines, can analyze effectively, can multi-task, maintain harmony, Good communicators and fast learners. Hence maximum women employees from Kolhapur city are working in Telecom, HR, Advertising, IT, Insurance, Consultancy, Health Care, Banking and Educational Services. So it was felt necessary to understand the nature and extent of Quality of Work Life provided and performance of women employees at work. Hence considering the whole situation of services organizations and conducive work environment for women to work effectively and enthusiastically. Simultaneously, these is today's need to maintaining flexibility in work organisation which helps to maintain work life balance

to women employees for the highest level of Quality of Work life in an organisation. This remains effective for betterment of work life balance for women employees.

Literature Review:

Biswajeet Pattanayak(2006) has covered concept Quality of Work Life (QWL) and mentioned that, highly focusing on use of technology for higher productivity, created negative impact on the working environment among the employees and realized importance of societal support and technical innovations which is intense through Quality of Work Life (QWL). It also refers to general characteristics of QWL and the role of the superior in QWL. Further he concludes there is positive correlation between Quality of Work Life (QWL) and Quality of Life (QL).

Michael G. And Walter R. Gove(1983) attempted to 'strip away' some of functionalisms serious short coming, and then to combine it with certain perspectives from microeconomic theory in order to help explain the work patters of married women, the household task performance of both spouses, and finally selected aspects of marital quality. Their approach is relatively value-free by comparison to those of some feminists and other advocates of family change. Work-house work role allocation based on certain theories and assumptions in economics and sociology, allow future research focus on identifying those sets of circumstances that make one type of work-housework role allocation more successful than another. It would also allow (us) to separate out aspects of the allocation system for study other than wife's work status, especially the allocation of household as it relates to similarly utility.

Objective of the study:

1. To understand role of working women in familial, organizational and social scenario.
2. To study Work Life Balance of women employees working in various service sectors in selected sample area.

Research Methodology: The survey of various service sectors in selected sample area was conducted to collect information through well-structured questionnaire. The total of 777 women employee respondents were interviewed from Kolhapur service providing institustions. The sample size was collected on the basis systematic stratified sampling method. The secondary data was gathered from internet, article, magazines, journals and library. Descriptive statistics has made of factors affecting QWL with the use of ANOVA as a statistical tool.

Table No. 4.1 Sample Selection

Sr. No.	Particulars	Total Population	No. of Sample Selected
1	Management Representative	74	68
2	Women Employees	Infinite Population	709
3	Total No. of Samples Selected		777

Above explained number of sample respondents has considered for the present study.

Data Analysis and Discussion:

Table No.5.1 Work Life Balance

Sr. No.	Particulars	N	Mean	Std. Deviation	Variance
A	**Service Area = Finance**				
1	Reading books (novels, autobiographies, business magazines, spiritual)	73	4.123	.927	.860
2	Listening to music	71	3.633	.974	.950
3	Priorities and plan work	72	3.388	1.107	1.227
4	Shares with family take into confidence	73	3.753	1.164	1.355
5	Inviting friends or relatives	74	3.324	.966	.934
6	Having holiday, gym, yoga, walk, playing an instrument	73	3.411	1.267	1.607
7	Defining work and life boundaries	74	3.527	1.113	1.239
8	Good working relationship	74	3.635	1.255	1.577
9	Accepting the fact that you cannot be everything to everyone.	73	3.411	1.392	1.940
B	**Service Area = Education**				
1	Reading books (novels, autobiographies, business magazinesspiritual)etc)	77	4.181	.983	.967
2	Listening to music	78	3.923	.879	.773
3	Priorities and plan work	78	3.923	1.003	1.007
4	Shares with family take into confidence	77	3.805	1.225	1.501
5	Inviting friends or relatives	76	3.526	1.101	1.213
6	Having holiday, gym, yoga, walk, playing an instrument	76	3.565	1.214	1.476
7	Defining work and life boundaries	73	3.698	1.023	1.047
8	Good working relationship	75	3.586	1.197	1.435
9	Accepting the fact that you cannot be everything to everyone.	78	3.564	1.201	1.444
C	**Service Area = Banking**				
1	Reading books (novels, autobiographies, business magazinesspiritual)etc)	73	4.082	1.037	1.076
2	Listening to music	74	4.108	.987	.974
3	Priorities and plan work	73	4.150	.937	.880
4	Shares with family take into confidence	69	3.623	1.112	1.238
5	Inviting friends or relatives	73	3.547	1.143	1.307
6	Having holiday, gym, yoga, walk, playing an instrument	73	3.753	1.233	1.522
7	Defining work and life boundaries	70	3.985	1.083	1.174
8	Good working relationship	73	4.109	1.048	1.099
9	Accepting the fact that you cannot be everything to everyone.	70	3.900	1.181	1.396
B	**Service Area = Telecom**				
1	Reading books (novels, autobiographies, business magazinesspiritual)	72	4.152	1.056	1.117
2	Listening to music	72	3.777	.922	.851
3	Priorities and plan work	71	3.802	1.141	1.303
4	Shares with family take into confidence	72	3.888	1.120	1.255
5	Inviting friends or relatives	72	3.416	1.171	1.373
6	Having holiday, gym, yoga, walk, playing an instrument	72	3.513	1.113	1.239

7	Defining work and life boundaries	68	3.529	1.190	1.417
8	Good working relationship	72	3.875	1.221	1.491
9	Accepting the fact that you cannot be everything to everyone.	72	3.736	1.363	1.859
E	**Service Area = Insurance**				
1	Reading books (novels, autobiographies, business magazines spiritual)	77	3.662	1.095	1.200
2	Listening to music	77	4.207	.731	.535
3	Priorities and plan work	77	4.155	.650	.423
4	Shares with family take into confidence	77	4.194	.761	.580
5	Inviting friends or relatives	75	3.906	.841	.707
6	Having holiday, gym, yoga, walk, playing an instrument	75	3.960	.861	.742
7	Defining work and life boundaries	74	3.932	.816	.667
8	Good working relationship	76	4.171	.661	.437
9	Accepting the fact that you cannot be everything to everyone.	77	4.285	.645	.417
F	**Service Area = Postal**				
1	Reading books (novels, autobiographies, business magazinesspiritual)	65	4.153	.852	.726
2	Listening to music	65	4.046	.738	.545
3	Priorities and plan work	65	4.076	.796	.635
4	Shares with family take into confidence	64	4.125	.899	.810
5	Inviting friends or relatives	65	3.892	1.017	1.035
6	Having holiday, gym, yoga, walk, playing an instrument	64	3.812	1.021	1.044
7	Defining work and life boundaries	63	3.936	.820	.673
8	Good working relationship	65	4.000	.829	.688
9	Accepting the fact that you cannot be everything to everyone.	63	4.000	.967	.935
G	**Service Area = IT**				
1	Reading books (novels, autobiographies, business magazinesspiritual)	76	3.710	1.186	1.408
2	Listening to music	76	3.947	.991	.984
3	Priorities and plan work	76	3.289	1.273	1.622
4	Shares with family take into confidence	76	3.986	.856	.733
5	Inviting friends or relatives	76	3.697	1.083	1.174
6	Having holiday, gym, yoga, walk, playing an instrument	76	3.750	.896	.803
7	Defining work and life boundaries	76	3.421	.753	.567
8	Good working relationship	76	3.631	1.273	1.622
9	Accepting the fact that you cannot be everything to everyone.	76	4.144	1.151	1.325
H	**Service Area = Healthcare**				
1	Reading books (novels, autobiographies, business magazines spiritual)	75	3.360	1.342	1.801
2	Listening to music	76	3.618	1.119	1.252
3	Priorities and plan work	73	3.835	1.000	1.000
4	Shares with family take into confidence	74	3.851	1.016	1.032
5	Inviting friends or relatives	72	3.805	1.056	1.117
6	Having holiday, gym, yoga, walk, playing an instrument	74	3.797	.843	.712
7	Defining work and life boundaries	68	3.705	1.065	1.136
8	Good working relationship	75	4.173	.704	.497
9	Accepting the fact that you cannot be everything	73	3.972	.832	.694

	to everyone.				
I	**Service Area = Consultancy**				
1	Reading books (novels, autobiographies, business magazines spiritual)	76	3.973	1.045	1.093
2	Listening to music	76	3.394	.817	.669
3	Priorities and plan work	76	3.328	.719	.517
4	Shares with family take into confidence	74	3.175	1.231	1.517
5	Inviting friends or relatives	76	3.723	.9179	.843
6	Having holiday, gym, yoga, walk, playing an instrument	74	3.405	.920	.847
7	Defining work and life boundaries	76	3.868	1.158	1.342
8	Good working relationship	76	3.986	.871	.760
9	Accepting the fact that you cannot be everything to everyone.	75	3.266	1.177	1.387

(Source: Field Work)

Table No. 5.1 shows the results of opinions of respondents about the concept of work life balance. The author has considered nine variables to define work life balance situation of selected sample respondents. Here, the 1st variable has scored highest mean in finance, education, telecom, postal and consultancy is 4.12, 4.18, 4.15, 4.15 and 3.97 respectively. Whereas, 3rd variable has scored mean 4.15 in banking sector, 9th variable has scored mean 4.28, 4.14 in insurance and IT sector and 8th variable has scored mean 4.17 in healthcare sector. ***The value of Standard Deviation of all variables is in between 0.73 to 1.39 which shows close relationship of related opinions.***

Table No. 5.2 Organisational Help in Work Life Balance

Sr. No.	Particulars	N	Mean	Std. Deviation	Variance
A	**Service Area = Finance**				
1	Family sick leaves	73	3.794	.985	.971
2	On or near daycare center	71	3.225	.959	.920
3	High pay and rewards	70	3.128	1.190	1.418
4	Favorable situations for both employer and employees	71	3.633	1.085	1.178
5	Struggle for better performance	73	3.438	1.301	1.694
6	Respect at workplace	72	3.611	1.145	1.311
7	Facilities at workplace	73	3.780	1.003	1.007
8	Maternity & parental leaves	71	3.366	1.221	1.493
9	Alternative work job , part-time	73	3.643	1.134	1.288
10	Employee assistance program	72	3.222	1.128	1.274
11	Having home and family life	73	3.547	1.143	1.307
12	Having opportunities in climbing career ladders	71	3.633	1.124	1.264
13	Freedom and personal space	73	3.575	1.104	1.220
14	High support system at both home and work	73	3.465	1.291	1.669
B	**Service Area = Education**				
1	Family sick leaves	75	3.720	1.020	1.042
2	On or near daycare center	71	3.000	1.108	1.229
3	High pay and rewards	74	3.148	1.068	1.142
4	Favorable situations for both employer and employees	76	3.368	1.187	1.409
5	Struggle for better performance	70	3.514	1.113	1.239
6	Respect at workplace	77	3.987	.895	.802
7	Facilities at workplace	76	3.644	.962	.925
8	Maternity & parental leaves	72	3.375	1.143	1.308

9	Alternative work job, part-time	72	2.833	1.233	1.521
10	Employee assistance program.	67	3.074	1.234	1.525
11	Having home and family life	69	3.376	1.201	1.444
12	Having opportunities in climbing career ladders	72	3.263	1.210	1.465
13	Freedom and personal space	73	3.589	1.038	1.079
14	High support system at both home and work	77	3.597	1.216	1.481
C	**Service Area = Banking**				
1	Family sick leaves	73	4.137	.787	.620
2	On or near daycare center	68	3.823	1.118	1.252
3	High pay and rewards	71	3.493	1.119	1.254
4	Favorable situations for both employer and employees	70	3.928	1.120	1.256
5	Struggle for better performance	71	4.154	.872	.761
6	Respect at workplace	74	4.067	.955	.913
7	Facilities at workplace	74	4.040	1.052	1.108
8	Maternity & parental leaves	68	3.867	1.077	1.161
9	Alternative work job , part-time	71	3.591	1.282	1.645
10	Employee assistance program.	73	3.931	.947	.898
11	Having home and family life	73	4.013	.992	.986
12	Having opportunities in climbing career ladders	73	3.945	1.052	1.108
13	Freedom and personal space	74	4.000	1.046	1.096
14	High support system at both home and work	73	4.178	.947	.898
D	**Service Area = Telecom**				
1	Family sick leaves	63	4.365	.747	.558
2	On or near daycare center	61	3.590	.844	.713
3	High pay and rewards	63	3.698	.994	.988
4	Favorable situations for both employer and employees	63	3.809	1.013	1.028
5	Struggle for better performance	62	3.564	1.300	1.692
6	Respect at workplace	63	3.793	1.034	1.070
7	Facilities at workplace	63	3.714	1.197	1.433
8	Maternity & parental leaves	63	3.238	1.279	1.636
9	Alternative work job , part-time	63	3.031	1.135	1.289
10	Employee assistance program.	63	3.619	1.127	1.272
11	Having home and family life	61	3.688	1.088	1.185
12	Having opportunities in climbing career ladders	61	3.327	1.261	1.591
13	Freedom and personal space	63	3.571	1.266	1.604
14	High support system at both home and work	63	3.476	1.293	1.673
E	**Service Area = Insurance**				
1	Family sick leaves	73	3.890	.906	.821
2	On or near daycare center	68	3.000	1.106	1.224
3	High pay and rewards	72	3.625	.970	.942
4	Favorable situations for both employer and employees	72	3.958	.739	.548
5	Struggle for better performance	73	3.821	.855	.732
6	Respect at workplace	73	4.137	.673	.453
7	Facilities at workplace	72	3.972	.838	.703
8	Maternity & parental leaves	71	4.056	.772	.597
9	Alternative work job , part-time	72	2.972	1.186	1.408
10	Employee assistance program.	69	3.594	1.088	1.186
11	Having home and family life	73	3.972	.985	.971
12	Having opportunities in climbing career ladders	73	3.753	.909	.827
13	Freedom and personal space	73	3.972	.832	.694
14	High support system at both home and work	73	3.958	.934	.873
F	**Service Area = Postal**				
1	Family sick leaves	64	3.937	1.021	1.044
2	On or near daycare center	65	3.507	1.091	1.191

3	High pay and rewards	64	3.437	1.021	1.044
4	Favorable situations for both employer and employees	64	3.828	1.162	1.351
5	Struggle for better performance	65	3.753	.984	.970
6	Respect at workplace	64	4.171	.724	.526
7	Facilities at workplace	65	3.861	1.170	1.371
8	Maternity & parental leaves	62	4.000	.600	.361
9	Alternative work job , part-time	64	3.281	1.030	1.063
10	Employee assistance program.	63	3.634	1.140	1.300
11	Having home and family life	64	3.875	1.000	1.000
12	Having opportunities in climbing career ladders	63	3.682	1.147	1.317
13	Freedom and personal space	65	3.984	.819	.672
14	High support system at both home and work	65	3.769	.843	.712
G	**Service Area = IT**				
1	Family sick leaves	76	4.000	.673	.453
2	On or near daycare center	76	3.684	.867	.752
3	High pay and rewards	76	3.381	.863	.746
4	Favorable situations for both employer and employees	76	3.684	.715	.512
5	Struggle for better performance	76	3.671	.854	.730
6	Respect at workplace	76	4.000	1.019	1.040
7	Facilities at workplace	76	3.592	.786	.618
8	Maternity & parental leaves	76	3.855	1.162	1.352
9	Alternative work job , part-time	76	3.657	1.102	1.215
10	Employee assistance program.	76	3.815	.778	.606
11	Having home and family life	70	3.800	.972	.945
12	Having opportunities in climbing career ladders	76	3.368	1.364	1.862
13	Freedom and personal space	76	3.723	.974	.949
14	High support system at both home and work	76	3.657	.973	.948
H	**Service Area = Healthcare**				
1	Family sick leaves	74	4.135	.941	.886
2	On or near daycare center	71	3.042	1.164	1.355
3	High pay and rewards	71	3.662	1.054	1.113
4	Favorable situations for both employer and employees	71	3.605	1.127	1.271
5	Struggle for better performance	70	3.671	1.059	1.122
6	Respect at workplace	71	4.042	.818	.670
7	Facilities at workplace	68	3.779	1.048	1.100
8	Maternity & parental leaves	69	4.246	.829	.688
9	Alternative work job , part-time	69	3.405	1.216	1.480
10	Employee assistance program.	70	3.285	1.023	1.048
11	Having home and family life	70	3.785	.866	.751
12	Having opportunities in climbing career ladders	69	3.420	1.090	1.188
13	Freedom and personal space	71	3.873	.909	.827
14	High support system at both home and work	71	3.831	1.041	1.085
I	**Service Area = Consultancy**				
1	Family sick leaves	76	4.039	.958	.918
2	On or near daycare center	74	3.364	.837	.701
3	High pay and rewards	76	3.578	.969	.940
4	Favorable situations for both employer and employees	76	3.618	.672	.452
5	Struggle for better performance	76	4.078	.976	.954
6	Respect at workplace	75	3.573	.791	.626
7	Facilities at workplace	75	3.093	1.117	1.248
8	Maternity & parental leaves	74	3.797	.936	.876
9	Alternative work job , part-time	74	3.094	.981	.964
10	Employee assistance program.	73	3.178	1.134	1.287
11	Having home and family life	76	4.092	.982	.965

12	Having opportunities in climbing career ladders	76	3.842	.880	.775
13	Freedom and personal space	75	3.000	1.052	1.108
14	High support system at both home and work	76	3.618	.893	.799

(Source: Field Work)

Table No. 5.2 shows the results of opinions of respondents about organisational help in getting work life balance. The author has considered fourteen variables to study the work life balance and organisation's role in it. Here, 1st variable has scored highest mean in finance, telecom and IT sector is 3.79, 4.36 and 4.00 respectively. Whereas, 6th variable has scored 3.98 in educations sector, 14th variable has scored 4.17 in banking sector, 6th variable has scored 4.13 in insurance sector, 5th variable has scored 4.17 in postal sector, 8th variable has scored 4.24 in health and finally 11th variable has scored 4.09 mean in consultancy sector. ***The Standard Deviation values of all variables in all sectors are in between 0.60 to 1.29 which shows close relation of results of related opinions.***

Descriptive Statistics:

Table No. 6.1.1 Descriptive Statistic of Work Life Balance

Sr. No.	Particulars	N	Mean	Std. Deviation	Variance
1	mq35	671	3.798630	.6254999	.391
2	Valid N	671			

(Source: Field Work)

Above Table No. 4.89a shows descriptive analysis of Work Life Balance in which author has processed on nine variables i.e. "Reading books (novels, autobiographies, business magazines, spiritual etc.), Listening to music, Priorities and plan work, Shares with family take into confidence, Inviting friends or relatives, Having holiday, gym, yoga, walk, playing an instrument, Defining work and life boundaries, Good working relationship, Accepting the fact that you cannot be everything to everyone" are categorised under one category i.e. Work Life Balance. ***The mean value has score 3.79 and SD value is 0.62 which shows results are too closed with related opinions.***

Table No. 6.1.2 ANOVA of Regression Of Work Life Balance

Sr. No.	Particulars	Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	16.723	8	2.09	5.639	0
2	Within Groups	245.414	662	0.371		
3	Total	262.138	670			

(Source: Field Work)

Table No. 4.89b shows that there is significant difference into Work Life Balance under three variables and QWL of selected samples since the significance level of test is 0.05.

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Table No. 6.1.3 Tukey HSD of Work Life Balance

Sr. No.	Service Sector	Service Sector	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1	Finance	Education	-0.20315	0.0985	0.5	-0.50969	0.103388
		Banking	-.3361994*	0.099763	0.022	-0.64667	-0.02573
		Telecom	-0.16227	0.10079	0.799	-0.47593	0.151398
		Insurance	-.4712692*	0.099117	0	-0.77973	-0.16281
		Postal	-.4172759*	0.103504	0.002	-0.73939	-0.09517
		IT	-0.14635	0.099436	0.868	-0.4558	0.163105
		Healthcare	-0.22088	0.099117	0.388	-0.52934	0.087577
		Consultancy	0.011913	0.099436	1	-0.29754	0.321366
2	Education	Finance	0.203152	0.0985	0.5	-0.10339	0.509692
		Banking	-0.13305	0.098161	0.914	-0.43853	0.172435
		Telecom	0.040885	0.099204	1	-0.26785	0.349616
		Insurance	-0.26812	0.097504	0.133	-0.57156	0.035324
		Postal	-0.21412	0.101961	0.474	-0.53143	0.103184
		IT	0.056805	0.097829	1	-0.24765	0.361255
		Healthcare	-0.01773	0.097504	1	-0.32117	0.28571
		Consultancy	0.215065	0.097829	0.408	-0.08939	0.519515
3	Banking	Finance	.3361994*	0.099763	0.022	0.025731	0.646668
		Education	0.133048	0.098161	0.914	-0.17244	0.438531
		Telecom	0.173933	0.100458	0.727	-0.1387	0.486564
		Insurance	-0.13507	0.098779	0.91	-0.44248	0.172339
		Postal	-0.08108	0.103181	0.997	-0.40218	0.240029
		IT	0.189852	0.0991	0.603	-0.11855	0.498258
		Healthcare	0.115317	0.098779	0.963	-0.19209	0.422726
		Consultancy	.3481126*	0.0991	0.014	0.039707	0.656518
4	Telecom	Finance	0.162266	0.10079	0.799	-0.1514	0.475931
		Education	-0.04089	0.099204	1	-0.34962	0.267845
		Banking	-0.17393	0.100458	0.727	-0.48656	0.138698
		Insurance	-0.309	0.099817	0.052	-0.61964	0.001634
		Postal	-0.25501	0.104174	0.26	-0.57921	0.069187
		IT	0.015919	0.100133	1	-0.2957	0.327542
		Healthcare	-0.05862	0.099817	1	-0.36925	0.25202
		Consultancy	0.17418	0.100133	0.722	-0.13744	0.485802
5	Insurance	Finance	.4712692*	0.099117	0	0.16281	0.779729
		Education	0.268117	0.097504	0.133	-0.03532	0.571558
		Banking	0.13507	0.098779	0.91	-0.17234	0.442479
		Telecom	0.309003	0.099817	0.052	-0.00163	0.619639
		Postal	0.053993	0.102556	1	-0.26517	0.373157
		IT	.3249222*	0.09845	0.028	0.018539	0.631305
		Healthcare	0.250387	0.098127	0.21	-0.05499	0.555766
		Consultancy	.4831824*	0.09845	0	0.1768	0.789565
6	Postal	Finance	.4172759*	0.103504	0.002	0.095165	0.739387
		Education	0.214124	0.101961	0.474	-0.10318	0.531433
		Banking	0.081077	0.103181	0.997	-0.24003	0.402182
		Telecom	0.25501	0.104174	0.26	-0.06919	0.579206
		Insurance	-0.05399	0.102556	1	-0.37316	0.26517
		IT	0.270929	0.102865	0.175	-0.04919	0.591052
		Healthcare	0.196393	0.102556	0.604	-0.12277	0.515557
		Consultancy	.4291892*	0.102865	0.001	0.109066	0.749312
7	IT	Finance	0.146347	0.099436	0.868	-0.16311	0.455799
		Education	-0.0568	0.097829	1	-0.36126	0.247646

		Banking	-0.18985	0.0991	0.603	-0.49826	0.118553
		Telecom	-0.01592	0.100133	1	-0.32754	0.295703
		Insurance	-.3249222*	0.09845	0.028	-0.63131	-0.01854
		Postal	-0.27093	0.102865	0.175	-0.59105	0.049194
		Healthcare	-0.07454	0.09845	0.998	-0.38092	0.231847
		Consultancy	0.15826	0.098771	0.804	-0.14912	0.465643
8	Healthcare	Finance	0.220883	0.099117	0.388	-0.08758	0.529342
		Education	0.017731	0.097504	1	-0.28571	0.321172
		Banking	-0.11532	0.098779	0.963	-0.42273	0.192092
		Telecom	0.058616	0.099817	1	-0.25202	0.369253
		Insurance	-0.25039	0.098127	0.21	-0.55577	0.054993
		Postal	-0.19639	0.102556	0.604	-0.51556	0.12277
		IT	0.074536	0.09845	0.998	-0.23185	0.380918
		Consultancy	0.232796	0.09845	0.305	-0.07359	0.539179
9	Consultanc y	Finance	-0.01191	0.099436	1	-0.32137	0.297539
		Education	-0.21507	0.097829	0.408	-0.51952	0.089385
		Banking	-.3481126*	0.0991	0.014	-0.65652	-0.03971
		Telecom	-0.17418	0.100133	0.722	-0.4858	0.137443
		Insurance	-.4831824*	0.09845	0	-0.78957	-0.1768
		Postal	-.4291892*	0.102865	0.001	-0.74931	-0.10907
		IT	-0.15826	0.098771	0.804	-0.46564	0.149122
		Healthcare	-0.2328	0.09845	0.305	-0.53918	0.073587

(Source: Field Work)

Above table shows post hoc test about impact of Performance Management on QWL of selected sample respondents of nine service sectors i.e. Finance, Education, Banking, Telecom, Insurance, Postal, IT, Healthcare and Consultancy. The table reveals that impact of Work Life Balance on QWL that there is significant difference between opinions of finance and, banking, finance and insurance, finance And postal, insurance and IT, insurance and consultancy, postal and consultancy, consultancy and banking, consultancy and insurance sector since the significant level test is 0.05.

Table No. 6.2.1 Descriptive Statistic of Organisational Help In Maintaining Work Life Balance

Sr. No.	Particulars	N	Mean	Std. Deviation	Variance
1	mq36	653	3.666497	.5834924	.340
2	Valid N (listwise)	653			

(Source: Field Work)

Above Table No. 6.2.1 shows descriptive analysis of Organisational help in maintaining Work Life Balance in which author has processed on fourteen variables i.e. “Family sick leaves, On or near day-care centre, High pay and rewards, Favourable situations for both employer and employees, Struggle for better performance, Respect at workplace, Facilities at workplace, Maternity & parental leaves, Alternative work job, part-time, Employee assistance programme**,** Having home and family life, Having opportunities in climbing career ladders, Freedom and personal space, High support system at both home and work” are categorised under one category i.e. Organisational help in maintaining Work Life Balance. ***The mean value has score 3.66 and SD value is 0.58 which shows results are too closed with related opinions.***

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Table No. 6.2.2 ANOVA of Regression Organisational Help In Maintaining Work Life Balance

Sr. No.	Particulars	Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	13.75	8	1.719	5.316	0
2	Within Groups	208.232	644	0.323		
3	Total	221.982	652			

(Source: Field Work)

Table 6.2.2 shows that there is significant difference into Organisational help in maintaining Work Life Balance under three variables and QWL of selected samples since the significance level of test is 0.05.

Table No. 6.2.3 Tukey HSD of Organisational Help In Maintaining Work Life Balance

Sr. No.	Service Sector	Service Sector	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1	Finance	Education	0.071242	0.0926	0.998	-0.21696	0.359446
		Banking	-.4270283*	0.093802	0	-0.71897	-0.13508
		Telecom	-0.09719	0.097784	0.986	-0.40153	0.207154
		Insurance	-0.26505	0.093802	0.11	-0.55699	0.026901
		Postal	-0.24201	0.096973	0.236	-0.54383	0.059802
		IT	-0.19669	0.093187	0.467	-0.48673	0.093339
		Healthcare	-0.2007	0.093802	0.447	-0.49265	0.091247
		Consultancy	-0.06298	0.093187	0.999	-0.35301	0.227051
2	Education	Finance	-0.07124	0.0926	0.998	-0.35945	0.216963
		Banking	-.4982701*	0.092276	0	-0.78547	-0.21107
		Telecom	-0.16843	0.096321	0.716	-0.46822	0.13136
		Insurance	-.3362868*	0.092276	0.009	-0.62348	-0.04909
		Postal	-.3132564*	0.095498	0.03	-0.61048	-0.01603
		IT	-0.26794	0.091651	0.085	-0.55319	0.017316
		Healthcare	-0.27194	0.092276	0.08	-0.55914	0.015256
		Consultancy	-0.13422	0.091651	0.872	-0.41948	0.151028
3	Banking	Finance	.4270283*	0.093802	0	0.135082	0.718974
		Education	.4982701*	0.092276	0	0.211073	0.785467
		Telecom	.3298425*	0.097478	0.021	0.026457	0.633228
		Insurance	0.161983	0.093482	0.726	-0.12897	0.452935
		Postal	0.185014	0.096664	0.604	-0.11584	0.485868
		IT	0.230335	0.092865	0.243	-0.0587	0.519366
		Healthcare	0.226329	0.093482	0.274	-0.06462	0.51728
		Consultancy	.3640468*	0.092865	0.003	0.075016	0.653078
4	Telecom	Finance	0.097186	0.097784	0.986	-0.20715	0.401526
		Education	0.168428	0.096321	0.716	-0.13136	0.468215
		Banking	-.3298425*	0.097478	0.021	-0.63323	-0.02646
		Insurance	-0.16786	0.097478	0.733	-0.47125	0.135527
		Postal	-0.14483	0.100533	0.882	-0.45772	0.168067
		IT	-0.09951	0.096886	0.983	-0.40105	0.202037
		Healthcare	-0.10351	0.097478	0.979	-0.4069	0.199872
		Consultancy	0.034204	0.096886	1	-0.26734	0.335749
5	Insurance	Finance	0.265045	0.093802	0.11	-0.0269	0.556991
		Education	.3362868*	0.092276	0.009	0.04909	0.623484
		Banking	-0.16198	0.093482	0.726	-0.45294	0.128968
		Telecom	0.167859	0.097478	0.733	-0.13553	0.471245
		Postal	0.02303	0.096664	1	-0.27782	0.323885
		IT	0.068352	0.092865	0.998	-0.22068	0.357383

		Healthcare	0.064346	0.093482	0.999	-0.22661	0.355297
		Consultancy	0.202064	0.092865	0.423	-0.08697	0.491094
6	Postal	Finance	0.242015	0.096973	0.236	-0.0598	0.543831
		Education	.3132564*	0.095498	0.03	0.016031	0.610481
		Banking	-0.18501	0.096664	0.604	-0.48587	0.115841
		Telecom	0.144829	0.100533	0.882	-0.16807	0.457724
		Insurance	-0.02303	0.096664	1	-0.32389	0.277824
		IT	0.045321	0.096068	1	-0.25368	0.344319
		Healthcare	0.041315	0.096664	1	-0.25954	0.342169
		Consultancy	0.179033	0.096068	0.639	-0.11996	0.478031
7	IT	Finance	0.196693	0.093187	0.467	-0.09334	0.486725
		Education	0.267935	0.091651	0.085	-0.01732	0.553186
		Banking	-0.23034	0.092865	0.243	-0.51937	0.058696
		Telecom	0.099507	0.096886	0.983	-0.20204	0.401052
		Insurance	-0.06835	0.092865	0.998	-0.35738	0.220679
		Postal	-0.04532	0.096068	1	-0.34432	0.253676
		Healthcare	-0.00401	0.092865	1	-0.29304	0.285025
		Consultancy	0.133712	0.092244	0.878	-0.15339	0.420809
8	Healthcare	Finance	0.200699	0.093802	0.447	-0.09125	0.492646
		Education	0.271941	0.092276	0.08	-0.01526	0.559138
		Banking	-0.22633	0.093482	0.274	-0.51728	0.064623
		Telecom	0.103514	0.097478	0.979	-0.19987	0.4069
		Insurance	-0.06435	0.093482	0.999	-0.3553	0.226606
		Postal	-0.04132	0.096664	1	-0.34217	0.259539
		IT	0.004006	0.092865	1	-0.28503	0.293037
		Consultancy	0.137718	0.092865	0.863	-0.15131	0.426749
9	Consultancy	Finance	0.062982	0.093187	0.999	-0.22705	0.353014
		Education	0.134223	0.091651	0.872	-0.15103	0.419475
		Banking	-.3640468*	0.092865	0.003	-0.65308	-0.07502
		Telecom	-0.0342	0.096886	1	-0.33575	0.26734
		Insurance	-0.20206	0.092865	0.423	-0.49109	0.086967
		Postal	-0.17903	0.096068	0.639	-0.47803	0.119964
		IT	-0.13371	0.092244	0.878	-0.42081	0.153386
		Healthcare	-0.13772	0.092865	0.863	-0.42675	0.151313

(Source: Field Work)

Above table shows post hoc test about impact of Organisational help in maintaining Work Life Balance on QWL of selected sample respondents of nine service sectors i.e. Finance, Education, Banking, Telecom, Insurance, Postal, IT, Healthcare and Consultancy. The table reveals that impact of Organisational help in maintaining Work Life Balance on QWL that there is significant difference between opinions of finance and banking, education and banking, education and insurance, education and postal, education and healthcare, banking and telecom, banking and consultancy sector since the significant level test is 0.05.

Conclusion:

It describes up to what extent service organization were helping to sample respondents to have work life balance and found the leading contributing factor is family sick leaves and opportunities in climbing career ladders almost in all service organization These results drawn attention to the other factor related to organization help in WLB sample respondent opined that such organizational helps

reduce they stress level and improve performance of sample respondent which ultimately Support QWL of women.

Suggestions:

It is to be suggested that as per difference in service organization helps in terms of WLB would have different .one of the most significant findings was sample respondent in different service expecting respect at work place. It indicate changing attitude of sample respondents they are quite demanding about relevant WLB aspect `than earlier one. Hence service organization has to think over what sample respondent are exactly expecting regarding WLB for instance banking ,insurance, consultancy and financial service organization have to be move stress on delegating field work to their women employees than office work or administrative work and they get experienced in field work they will have practical work experience also as they face number of critical situation and number of people its help to boost their confidence level and performance at work ,overall, it improve their QWL.Many banks, including HDFC, ICICI, and AXIS are exploring the options to launch contact-less credit and debit –cards in the Market shortly. The cards, which use near field communication (NFC) Mechanism, will allow customer to transact without having to insert or swipe. This innovative practices at banking creates need of having QWL practices.

References:

1. Biswajeet Pattanayak(2006) "Human Resource Management" *3rd edition, Prentice Hall of India Pvt. Ltd. New Delhi (274-283)*
2. Deepa Mathur(1972) "Women, Family and Work', Rawat publication, New Delhi(1972), (PP 18-117)
3. E. Kelly and P. Moen with E. Tran"Workplace flexibility improves Employee's Health Behaviour". *Journal of Health and Social Behaviour P.p 46.*
4. J. G. Gizywacz "Re-conceptualizing the Work-Family interface-An Ecological Perspectives on the correlates of Positive and Negative Spillover between work & family". *Journal of occupational Health Psychology(p.p.111-126).*
5. Michael G. And Walter R. Gove(1983) "At Home, And At work – The Family's Allocation of Labour", *Sage Publication , Beverly Hills (p.p. 51-88)*
6. Promilla Kapur(1972)), "Marriage and the Working Women in India" Abridged Edition, Vikas Publication, Delhi (1972), (PP 1-67).
7. S. Katyal (2014) "An Empirical Research Study to Analyze the Quantity of Core Workforce in Colleges of Sonepat". *Abhinav International monthly referred journal of research in Management and Technology, Vol. 3 Issue 5th*

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

8. Sriranganayagi P.(2014) "*Quality of Work Life of Women Employees in Banking Sector: A Study With Reference to Coimbatore District"* Mother Teresa Women's University http://hdl.handle.net/10603/17708.

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Ir TV Remote Based Speed Control Of Single Phase Ac Motor

P. S. Jadhav[1], G. B. Jirage[2], P. R. Bagade[2] C. B. Patil[2]
1,2 Vivekanand College, Kolhapur (Autonomous)
Email : psj.eln@gmail.com

Abstract:

This article outlines the development and implementation of a speed control system for a single-phase AC motor using an infrared receiver module based on PIC microcontroller. The proposed speed control method allows users to remotely operate the AC motor. In this system, volume (+ /-) button on the remote control can e utilized to adjust the speed of the AC motor. When a push button on the remote controller is pressed, the infrared light-emitting diode transmits the signal that is received by the receiver in the infrared sensor module interfaced with micro-controller. Subsequently, the micro-controller interprets this signal, enabling control over the firing angle of the AC voltage controller. As a result, the AC motor operates at the desired speed as commanded by the remote controller.

Keywords: *PIC microcontroller, IR sensor, Triac, AC motor, zero crossing detector.*

Introduction

Now days, electronic components play a crucial role in various household devices, including the regulation of motor speed in washing machines, the control mechanisms of vacuum cleaners, the dimming functionality of lamps, and the heating systems in coffee vending machines. This trend is on the rise due to the growing demand for advanced features, coupled with the affordability and increasing sophistication of electronics-based solutions [1]. Induction motor speed can be controlled by using scalar control that is V/F converter, vector control, direct torque control, space vector control modulation and fuzzy logic controller method [2].As reported in[3] Altera FLEX 10K100A CPLD device has been used to control ac motor speed by using PWM technique. P. Kiran Kumar et.al controlled the speed of ac motor by using GSM technique [4]. Bhardwaj, S. et.al controls the speed of ac motor by applying varying voltage to the motor by using triac [5]. This paper presents the design and development of a system for speed control of a single-phase AC motor using an infrared receiver module.

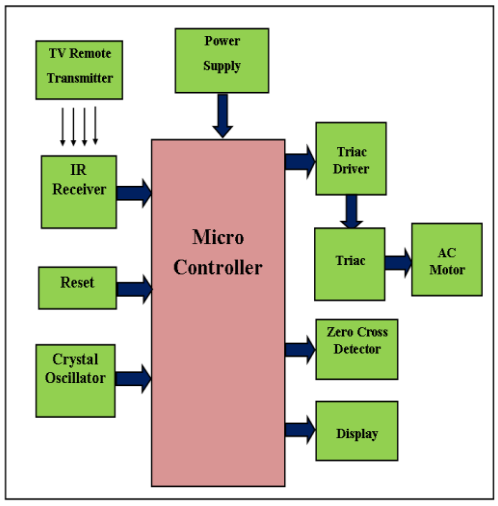

Fig1. Block diagram of IR remote based speed control of single phase ac motor

Fig. 1 illustrates the proposed method's block diagram, comprising an IR transmitter, receiver, a microcontroller, and a driver circuit for an AC motor. In the present system Philips IR remote is used. It operates on RC5 protocol. The IR sensor module is responsible for receiving IR pulses transmitted from a remote location and converting them into electric pulses, which are then supplied to the microcontroller. The microcontroller processes the input signals and produces control output, which is subsequently applied to the driver circuit responsible for operating the AC motor speed.

The current system utilizes a Philips IR remote operating on the RC5 protocol. In Fig.2, the RC5 protocol is depicted with two initial logical "1" start pulses. It's crucial to highlight that half a bit time elapses before the receiver detects the actual beginning of the message. Extended RC-5 introduces a modification, adopting a single start bit and reassigning bit S2 to command bit 6, resulting in a total of 7 command bits. To ensure compatibility with the original RC-5 protocol, the value of S2 must be inverted to obtain the 7^{th} command bit, preserving the initial 64 commands. The 3rd bit functions as a toggle bit, inverting each time a key is released. This feature enables the receiver to differentiate between a continuously pressed key and one that is repeatedly pressed. Following the toggle bit, the subsequent 5 bits represent the IR device address, transmitted with the Most Significant Bit (MSB) first. Subsequently, a 6-bit command follows, also sent with the MSB first. A complete message comprises 14 bits, resulting in a total duration of 25 ms. Occasionally, a message may seem shorter due to idle time in the first half of start bit S1. Additionally, if the last bit of the message is logic "0," the last half bit of the message remains idle.

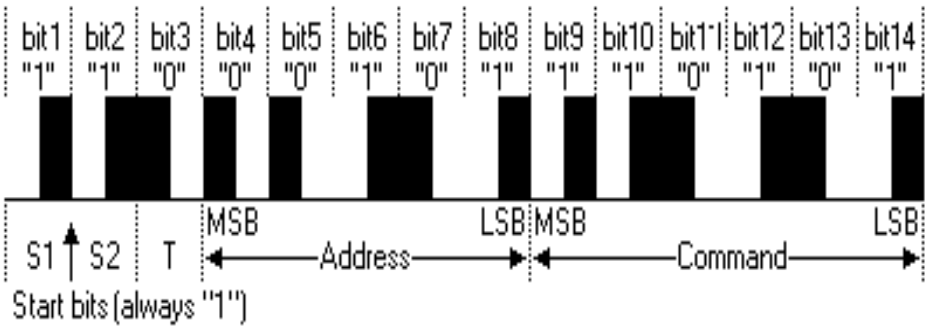

Fig. 2: RC5 Protocol

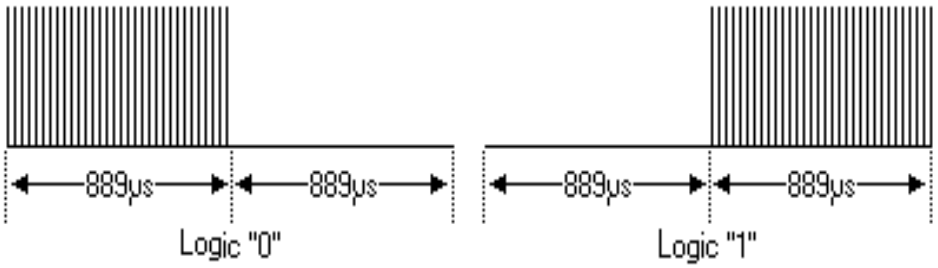

Fig 3. RC5 Protocol modulation

The protocol uses biphase modulation as in Fig.3 of a 36 kHz IR carrier frequency. All bits are of equal length of 1.778ms in this protocol, with half of the bit time filled with a burst of the 36 kHz carrier and the other half being idle. In the given encoding scheme, a logical '0' is denoted by a burst occurring during the initial half of the bit time, while a logical '1' is indicated by a burst taking place in the latter half of the bit time. The pulse/pause ratio for the carrier frequency of 36 kHz is either 1/3 or 1/4. This ratio has been chosen to minimize power consumption. [6].

2. Hardware Implementation of system

The schematic diagram is displayed in Fig.4.

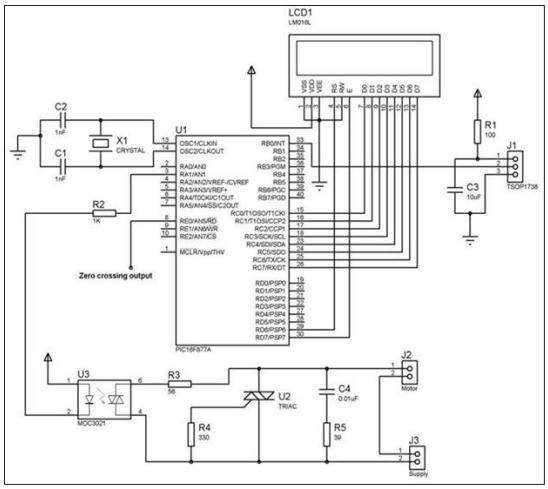

Fig.4. Schematic diagram of IR TV remote based speed control of single phase ac motor

In the current system, a PIC 16F877A microcontroller with an 8-bit architecture is employed, featuring five ports and operating at a clock frequency of 20MHz. The system utilizes a TSOP-1738 sensor module to receive infrared (IR) signals from a remote transmitter. This IR sensor module demodulates the received signals into a format compatible with the microcontroller, allowing it to process the data, decode input, and implement control actions.

The IR receiver is connected to pin B0 of the PIC, and when a key is pressed on the remote control, the sensor captures the corresponding data, which is then recorded by the PIC. The system employs a TRIAC-based circuit, utilizing a BT136 TRIAC, to control the speed of a motor. The firing pulses for the TRIAC are generated by the PIC through an optocoupler (MOC3021), providing electrical isolation. A zero-crossing detection circuit, implemented with another optocoupler, assists in determining the appropriate firing angles.

In the current system, a PIC 16F877A microcontroller with an 8-bit architecture is employed, featuring five ports and operating at a clock frequency of 20MHz. The system utilizes a TSOP-1738 sensor module to receive infrared (IR) signals from a remote transmitter. This IR sensor module

demodulates the received signals into a format compatible with the microcontroller, allowing it to process the data, decode input, and implement control actions.

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Fig.5. Hardware of the IR TV remote based speed control of single phase AC motor

Software part: The software implementation is done through micro C.Fig.6 shows the flow chart of the system.

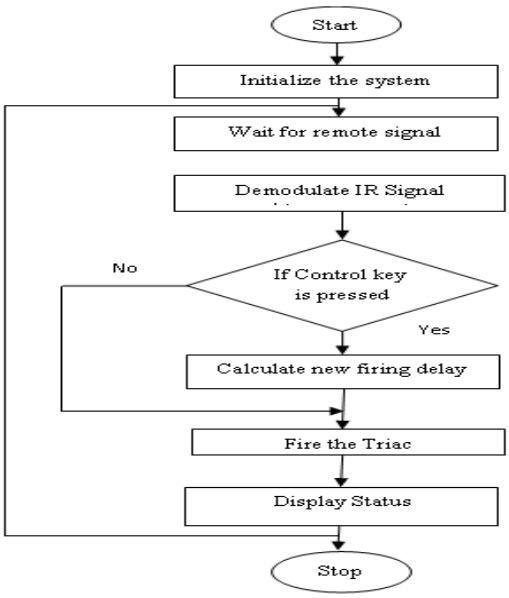

Fig.6. Flow chart of the software Implementation

3. Result

Speed control of single phase AC motor using IR remote is effectively implemented. The speed of AC motor and corresponding voltage drop across opto-coupler is exhibited in Table1.The speed of ac

motor is measured with tachometer. Graph Plot of Speed% vs. RPM and Graph Plot of Speed% vs. V are shown in Fig.7 (a) and 7(b).

Table 1: Experimental Results

Sr. No.	Speed%	RPM	voltage across Opto coupler (V)
1	0%	0	0
2	20%	980	0.34
3	40%	1160	0.39
4	60%	1220	0.45
5	80%	1280	0.5
6	100%	1330	1.13

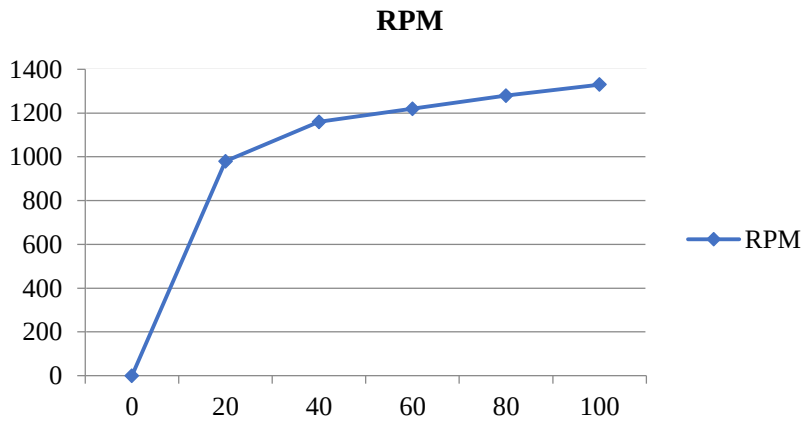

Fig 7(b). Graph Plot of Speed% vs RPM

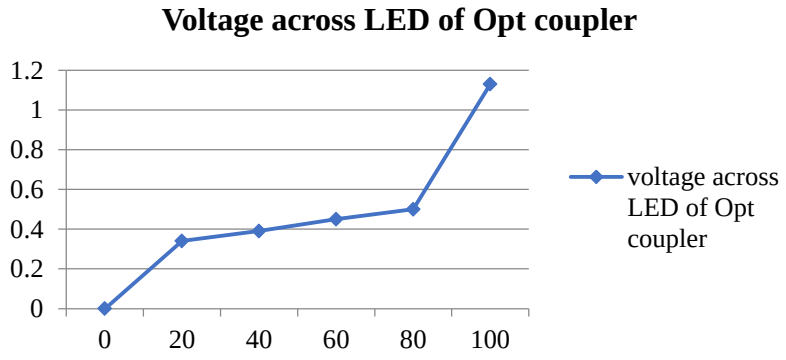

Fig. 7(b) .Graph Plot of Speed% vs V

4. Conclusion

The IR TV remote-based speed control system for a single-phase AC motor, implemented using a PIC 16F877A microcontroller and TSOP-1738 sensor module, offers an efficient and user-friendly solution. The integration of TRIAC-based speed control, zero-crossing detection, and an opto coupler ensures precise adjustments to the motor's speed with electrical isolation. By harnessing the capabilities of the PIC microcontroller and incorporating advanced control features, this system presents a versatile and adaptable solution for applications requiring dynamic speed control of single-phase AC motors through the convenience of an IR TV remote. The

successful integration of hardware components and software algorithms makes this system a robust and practical choice for various industrial and domestic settings.

References:

1. E. Fitzgerald, Charles kingsley jr, Stephen Umans "Electric machinery", Mc Graw-Hill Higher Education, Sixth Edition.
2. Rahman Sharjil, "A review on Induction Motor Speed Control Methods" International Journal of Core Engineering and Management, ISSN:2348 9510,Vol:3,Issue.5,pp:116-124,August 2016.
3. Ming-Fa Tsai and Hsien-Chang Chen, "Design and implementation of a CPLD-based SVPWM ASIC for variable-speed control of AC motor drives," 4th IEEE International Conference on Power Electronics and Drive Systems. IEEE PEDS 2001 - Indonesia. Proceedings (Cat. No.01TH8594), Denpasar, Indonesia, 2001, pp. 322-328 vol.1, doi: 10.1109/PEDS.2001.975334.
4. P. Kiran Kumar, G. Joga Rao, M. Titus Viswanath, P. Rohith Kumar, Ch. Srinivas ,K.Srinath, B. Venkatesh, "Speed Control of AC Motor Using GSM" International Journal of Scientific Research in Science, Engineering and Technology, Volume 7 , Issue 2 ,2020,pp:66-70.
5. Bhardwaj, S., Varshney, Y., Sharma, K., & Bhardwaj, U. (2016). "Speed Control of Single Phase Induction Motor Using TRIAC and RPM Measurement by Contactless Tachometer". Journal of Electrical and Electronics Engineering.Vol.2,Issue 5,PP:40-45
6. Philips RC5 Protocol **https://www.sbprojects.net/knowledge/ir/rc5.php** browsed on 3rd of January 2024.

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The Role And Functions of Teachers In Improving Effective Learning In Classes

Dr. Surekha. S. Awate[1], Mrs. P.C. Parishwad[2]
Dept. of Commerce, Vivekananda Collage, Kolhapur (Autonomous)

Abstract:

This study aims to describe the role and function of teachers in enhancing effective learning, inhibiting factors and solutions to teacher barriers in carrying out the roles and functions of teachers at the Schools and Colleges. This study used a descriptive qualitative approach with a case study design. Data collection techniques used are observation, interview, and documentation. Which is mentioned that the teacher is a professional educator with the main task of educating, teaching, guiding, directing, training, evaluating, and evaluating students in early childhood education informal education, basic education, and secondary education.

Keywords: Teacher's role, Teacher's function, Effective learning

Introduction:

The teacher is one of the important elements and must exist besides students. One of the important elements, when the school is built, is the teacher, the teacher is reputed as a benchmark in creating intelligent and talented generation. The teacher is the key where the student is very depending on them, the existence of the teacher is influenced by the student's life at school. The teacher is also known as the source of knowledge for the student in the class. A good teacher is a person who can make alterations and able to influence the student in some aspects, such as scientific, action, norm, and behavior. One thing that should be owned to be a teacher is the ability to teach the education process, the teacher has an important role as the key in both formal and informal educations. The teacher is also known as the person who has a lot of knowledge in society. So that teacher is respected by the local people because they are reputed as intelligent person. Teacher can be said as the parent of the student in the school which makes them have the authority and duty to guide the student like the parent at home. In elementary education, the student still very needs guidance, so the teacher is demanded to be active and able to build the student's character. The role of the teacher to make fun learning can strive for the teacher being more creative and professional. In the learning process, the teacher has the responsibility to bring and change the student to be an intelligent generation and able to make the student pursue their goal, has been said in his research that education is hoped to be able to make the student achieve happiness for real and back to the natural character of a human being. The research conducted because the researcher observes based on the condition of the ongoing learning process. This is also being the reason why the researcher conduct the research in beside the total of the students are and the interest of the society in choosing private school, especially on Muslim society as a place to pursuethe education than public school which is better.

Learning is like the heart of the education process. Good learning will make an effective class that usually makes a good graduate. The planning of learning is one of goal to make a good result for education at school so that student can receive the subjects as it should be. The teacher as an educator and a person who gives knowledge toward the students should understand well about education policy. Besides that, the teacher also should understand that the teacher is not one of the sources of knowledge, although the duty, role, and function in the teaching-learning process are very important.

Methods:

The research used descriptive qualitative, state that qualitative research which resulted in descriptive words both orally and written from the source which is observed. The descriptive approach is research that aims at describing something which relates to the existing phenomenon and happens in the research process which is done.

Meanwhile, states that qualitative research is the analyzing of the pursuit the social life with the social picture which happens as performance interpretation. This research planning uses a case study plan. The descriptive case study generally uses to answer the problem which relates to the what, why, and how to question. So, the implementation of this research is to find out the role and function of the teacher in the class to increase the effectiveness of learning in schools. In the data collection use an intensive interview procedure with 2 interviewees (classroom teacher and Different school teacher), it is done to describe the role and function of the teacher in the learning process to run effectively. Moreover, the observation technique is also used to observe directly how the process of learning is and social interaction between stakeholders at school.

The researcher also uses a documentation study. Supporting document used as proof of data source is an ongoing learning process video. In the process of interview with classroom teacher grade 3 appear that there are many problems happened in doing the function of the teacher such as the existence of students as group special needs children, it happens because there only one teacher in the class which makes teacher confused in guiding the students who has two different characteristic between Special and the normal one. It is also being an obstacle of the teacher is doing their function as an instructor.

Results

The Role of Teacher

The result of the research about the role and function of the teacher in the class to increase learning effectiveness in the teacher acts actively in the learning process. When the teaching- learning process is ongoing, the teacher plays a role in building the character of the students, teacher able to create the student's behavior and always make student to get used to sit down and not make a noise. Besides that, the teacher also able to play a role as a parent at school. The teacher shows the togetherness between student and teacher and loves the student wholeheartedly. When there is

conversation in the class, the teacher educates and guides them patiently. The teacher does not differentiate students.

In the teacher plays a role actively in the teaching-learning process as its role and functions. The teacher was very enthusiastic about increasing the activeness and courage of the students. After the teacher giving the subject material, the teacher will give some questions to the students and directly ask them to come forward and answer it.

The Function of Teacher

Based on the observation in the writer classifies that classroom teacher has done 11 its functions such as: (1) educator, has the responsibility by coming on time during teaching process; (2) teaching, teacher gives a brief explanation at the beginning of learning; (3) mentoring, teacher gives directive to students who less understand about the material; (4) advising, teacher gives advice toward the crowds students; (5) classroom administrator, teacher manages the students who make noise; (6) corrector, teacher gives a value from the learning's result of the student; (7) inspiratory, teacher gives guidance to the students in the teaching-learning process;(9) organization, teacher makes the rules of classroom to make the student disciplines; (9) motivator, teacher motivates the students by telling a success story; (10) facilitator, teacher gives reading book to the students to do the assignment; and (11) evaluator, teacher gives a reflection and additional assignment to be more confident.

In addition, teacher who is in the examination room also have done about 12 functions such as: (1) educator because teacher comes on time before students come; (2) teaching, teacher give an explanation before the examination is started; (3) advising, teacher gives an advice to the students who do not understand yet about the examination; (4) classroom administrator, teacher manages the class by concentrating worksheet in one of center computer; (5) corrector, teacher always give a value after doing examination; (6) information, teacher gives additional information about new knowledge; (7) organization, teacher makes the rules; (8) motivator, teacher act friendly to build up the student's learning desire; (9) initiator, teacher uses technology to make learning process easier; (10) facilitator, teacher gives a source of learning which is computer; (11) mediator, teacher uses IT media for learning process; (12) teacher is being an evaluator in the learning process. So, the teacher plays their role to run its functions that should be done by the teacher in the class and the learning process indirectly.

Effective Learning:

The result which is gotten by observing shows that the learning process at school is ongoing effectively when there is no disability student both mentally and physically in the class. The observation which was held in resulted that there is one disability student that makes the learning

process is not effective. There is a difficulty which is faced by the teacher here due to one disability student that makes the class so noisy.

Besides that, the observation result shows there are differences between the learning process in the examination situation and the learning process as usual. The huge differences appear because the examination situation force students to be more focus and stay silent, the teacher also more relax in doing their functions as an educator and also as instruction because the class situation is conducive and effective. The sensitivity level of the students toward the instruction that is given by the teacher is also different. The technique of data analysis is used in this research is the analysis of field power, to powers support alteration.

Discussion:

The teacher has an important role in achieving the education goal because the teacher is the main role in applying for the learning process and education program in the school. In the teaching-learning process, the teacher has a duty and obligation to guide, motivate, and facilitate the students in studying. The teacher has a responsibility and right in managing the class. Whether good or not and conductive or not the class depends on the teacher on how they control or manage their class. In managing the class, the teacher has to be able to look at everything which happened in the class to help children's development process.

In other words, the teacher is as known as an educator. An educator is a person who can teach and able to help students in solving the problem that is faced. A teacher or educator is a person who tries to improve, help, and guide every potential of students. State that teachers' role in the studying process focus on: (1) educate children by giving guidance and motivation to achieve their both long term and short- term goals; (2) give facilitation, media, and good study experience; and (3) help in building students' characteristics such as attitude, behavior, and norms.

In applying the role of the teacher in the class always give guidance and motivation to create a conductive class. The teacher also plays a role as a facilitator by giving reading books to the students and help the student to be a better student by being polite to the teacher. So, in the teaching-learning process teacher is not only able to give and deliver knowledge but also able to improve development students' behavior. In the learning process, the effectiveness and efficiency of learning very depend on the teacher's role. In the education world, ideal teacher can be an: (1) innovator, the teacher is able to give developing of knowledge toward the students;

(2) transmitter who is able to be a bridging toward the students; (3) organizer, the teacher is able to create an educative process which is able to be responsible formally or informally.

According to generally the role of the teacher in managing the class are: (1) can push the students in developing each responsibility toward the surrounding;

(2) build up the students' understanding in order to understand and adapt the attitude with the class' rules;

(3) able to grow up students' feeling about their obligation to be active in the class. Meanwhile, there are some of the teacher's role in managing the class, those are (1) take care of class condition, (2) guide the intellectual and social of the students in the class, (3) can lead the learning process effectively and efficiently. In the some of the teachers able to push students to develop their responsibility toward their surroundings such as students aware of keeping clean their school environment. The teacher is also able to lead and give guidance toward the students about the teaching-learning process in the class bydoing opening before the class is begun.

The teacher does not only have an important role in the school but also has an important role in the family andsociety. The role of the teacher in the school, family, and society. In the school, the teacher has roles as a learning planner, learning manager and class, assessor of the students, learning guidance, and adviser of the students. Meanwhile, in the family, the teacher has a role as a family developer. In society, the teacher has rolesas a social developer, social innovator, and social agent.

The teacher can do their role in organizing class by a guide and advise the intellectual and social process of the students, the teacher is also able to create the responsibility of the student to do their obligation as the rules and activity in the class. It relates to that have stated in detail about teaching strategies that aim at building the class' norms in reciprocity. Another opinion comes from which declare about teacher's strategies in managing the class is the teacher who makes cooperative situation among the students which have appeared spontaneously as prototypical case and start the discussion all the obligation class and students' wishes. Teacher as control holder in the class has the important functions and duties which are as follows: (1) educator, teacher is educator who is becoming character, research, and identification for the students and its surrounding; (2) instructor means a person who give a guideline in order to make other know about a knowledge or advice; (3) advisor in this case able to be called as an activity in guiding students in their development clearly by giving step and direction which relate to education goal; (4) trainer, education and learning process needs skills training both intellectually so demand on the teacher to do as a trainer; (5) teacher is an consultant for the students; (6) class manager, teacher as the class manager should be able to organize the class well; (7) demonstrator, teacher have to try help student in understanding by demonstrate what teacher taught; (8) teacher as corrector have to differentiate between good and bad values; (9) teacher as inspirator have to be able to give good inspiration for students' improvement; (10) as informant, teacher have to be able to give information the development of knowledge and technology beside some oflesson material for every lesson that is programmed in the curriculum; (11) organizer, teacher also have to play their role as part of school organization who also has the main duty and function to organize academic activity, arrange the school's rules, arrange the academic calendar, etc.;

(12) motivator, teacher should be able to motivate the student to be more spirit and active in studying; (13) initiator, teacher should initiate some improvement ideas in education world; (14) as facilitator, teacher should try in providing source of knowledge which support in achieving the goal and learning process; (15) innovator, teacher is a source of idea; (16) as mediator, teacher have to has knowledge and good understanding about education world; and (17) teacher is demanded to be an good and honest evaluator by giving a score in the aspect of attitude and test of the students.

Based on the observation most of the teacher uses some of the functions that have been explained above but not every function is done by them due to the differences of attitude among the teachers. Based on observation and interview on to difference teachers, the researcher found that they applied 11 to 12 functions of the teacher in the class which is used to be done by the teacher there. On the other hand, 3 teachers that have been interviewed said that being a teacher is one of their pride due to able to give a good example of the students and give an understanding to the students about the lesson. The teacher does not only play a role in the school but also reputed as a teacher outside of the school.

Those are based on ever taught, three words which include understand, feel, and do, remind about every lesson, life goal that we believe is needed an understanding, awareness, and sincerity in doing it. Know and understand is not enough if they do not feel, aware, and there is no meaning if they do not do and strive for it. Just like knowledge without good deed like a tree with no fruit. The teacher based on three main duties, those are professional duty, human being duty, and social duty. Professional duties from the teacher are continuing knowledge, skills, and other values that should be known by the students.

Besides the function of the teacher the teacher is also doing their function in the learning process, those are instructional function, educational function, and managerial function. Instructional function relates to the role of the teacher as an educator that educates their students to have the strong characteristic. Meanwhile, managerial function relates to the role of the teacher as a class manager that is managing class administration to support the learning process.

Teacher is also doing 12 functions of the teacher in the class during the examination which relate to the theory by which explains about 17 functions and teacher's duties which very important. The teacher here has shown 12 functions of the teacher by applying it in the class. It is not only applied in the learning process but also in the examination period. Although all functions cannot be applied altogether the teacher tries to habituate the students to make a good learning process. The example is after using learning media, they have to keep them in its place to make it look good, so this habitable to be applied by the students. The function of the teacher as an educator, advisor, and instructor can be used.

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States that effective learning able to be materialized by doing some steps as follows: (1) decide the class' rules (class routine) the teacher has to apply the teacher's functions which relates to the class condition. The teacher may not blame or hate the student because of the students' bad habits. In this case, the teacher can create the new habits of the student by giving the rules in the learning process especially in the first meeting; (2) Start the activity on time. In this case, the teacher has to be responsible because of their profession as a teacher. which make teacher have to keep their good attitude and behavior in front of the students. If the teacher often comes late in starting the learning process, so the learning process will not run effectively; (3) managing the lesson to make effective learning so the teacher has to manage and keep the teaching-learning process. The teacher also has to play the role as class organizer; (4) grouping the student when the teacher plays the role as educator and instructor, the teacher also have to understand about students' characteristic if needed the students have to make a group so that they can work together and able to manage themselves to socialize with their friends; (5) ending the lesson, in the end of the lesson, students are hoped to give feedback toward the material have been taught by the teacher, so that the teacher has to do the function as reflector and corrector for the students.

Based on the theory that has been explained above, has done the steps that shouldbe done to create the learning process effectively. Unfortunately, there is a problem while doing those steps, that is grouping student, in this step teacher has difficulty when grouping the students to make them work as a team because it is applied in and also there is 1 disability student who is different from others who are very active. It blocks the teacher because this student is very hard to be controlled and often disturbs his friends.

In this case, the teacher has to play double roles because the teacher has to look after the different students. To make it easier, the school should prepare the shadow teacher to make the learning process more effective. Unfortunately, based on the observation the school did not prepare the shadow teacher yet to solve this problem, but the teacher only asks for help toward the helping teacher or other class' teacher to join in looking after the different students.

Conclusion:

The role of the teacher in the teaching-learning process in the class is one of the success benchmarks or the effectiveness of learning for the students. It can be proved by the result of group observation where the role of the teacher as a learning controller conductively to make the teaching-learning process effective and easy to be understood by the students. There are some of the students' characteristics that should be controlled by the teacher as a controller in the class.in this school found one disability student who should be solved by the teacher to make an effective situation in the learning process and able to be understood by all the students.

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The role of the teacher in the teaching-learning process in the class can be related to some of the teacher's functions. This function can be proved by the result of the observation. The group finds out some functions in the 2 different classes, a class teacher can uses 12 functions that relate to the theory. The function is from the educator to the motivator.

The effective learning able to be happened by doing some steps as follows: (1) decide the class rules; (2) start the learning process on time; (3) organize the lesson; (4) grouping the students; and (5) end the lesson. Based on the comparison between the theory and the observation there are some problems because of grouping students which consist of one disability student and the school did not have a shadow teacher to solve the problem.

Reference:

1. Sudaryono. 2017. *Methodology Penelitian*. Depok: Raja Grafindo Persada.
2. Ulfatin, N. 2013. *Metode Penelitian Kualitatif di Bidang Pendidikan*. Malang: Bayumedia Publishing.
3. Mulyasa, E. M. 2005. *Menjadi Guru, Menciptakan Pelajaran Kreatif dan Menyenangkan*. Bandung: Remaja Rosdakarya.
4. Abrashy, A. A. 1970. *Dasar-dasar Pokok Pendidikan Islam*. Jakarta: Bulan Bintang.
5. Ahmadi, A., and Supriyono, W. 2004. *Psikologi Belajar*. Jakarta: Rineka Cipta.
6. Syamsuddin, M. A. 2003. *PsikologiPendidikan*. Bandung:Remaja Rosda Karya.
7. Nurabadi, A. 2016. *Manajemen Kelas Berbasis Peserta Didik*. Malang: Universitas Negeri Malang.
8. Surya, M. 1997. *Psikologi Pembelajaran dan Pengajaran*.Bandung: PPB-IKIP Bandung.
9. Yamaji, A. 2016. Teacher Discourse Supporting Peer Collaboration in Mathematics. *International Journal for Lesson and Learning Studies*, 5(3), 255-270.
10. Wardani, K. 2010. *Peran Guru dalam Pendidikan Karakter menurut Konsep Pendidikan Ki Hajar Dewantara*. Proceedings of the 4th International Conference on Teacher Education, Bandung, Universitas Pendidikan Indonesia.
11. Rahmaniar, F. A. 2016. *Tugas Guru Pendamping Khusus (GPK) dalam Memberikan Pelayanan Pendidikan Siswa Berkebutuhan Khusus di Sekolah Inklusif SD Negeri Giwangan Jogjakarta*. Research report. Yogyakarta: Universitas Negeri Yogyakarta.

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Antigenotoxic Potential of Mucilage Extracted from Medicinal Plants

Dr. Alvikar Annapurna R.

Department of Botany, Vivekanand College Kolhapur,

(Autonomous, Maharashtra, India

Eamil:alvikar2112botany@gmail.com

Abstract:

Due to the compounds' affinity for mammalian systems, the *Allium cepa* assay is frequently employed to assess the antigenotoxicity of the substances. Mucilage was extracted from the leaves of *Aegle marmelos* and the fruits of *Bridelia scandens* for this investigation. The antigenotoxic potential of the mucilage at various concentrations was evaluated in comparison to pure water as a negative control and mercuric chloride as a positive control. The *Allium cepa* root tips were treated with mercuric chloride and mucilage aqueous extracts pre-, post-, and simultaneously. Compared to mercuric chloride, it was found that pre-, post-, and simultaneous treatments of the mucilage aqueous extract stimulated the mitotic index. As a result, the mucilage extracts from the fruits of *Bridelia scandens* and the leaves of *Aegle marmelos* have the potential to be antigenotoxic against the chromosomal aberrations in *Allium cepa* caused by mercuric chloride. These extracts can also be safely used as a coating for different kinds of pharmaceutical tablets and as a tool to counteract the genotoxic effects of various hazardous chemicals and environmental pollutants.

Keywords: Fruits of *Bridelia scandens*, Leaves of *Aegle marmelos*, Chromosomal aberration, Mitotic index.

Introduction:

The term "genotoxicity" describes a substance's capacity to harm live cells' DNA, or genetic material. The DNA may undergo structural changes, chromosomal abnormalities, or mutations as a result of this damage. Chemicals, radiation, and some biological agents are examples of genotoxic agents. [1]. In survival scenarios, the impact on *Allium* chromosomal irregularity (CA) could serve as a useful test for the universal detection of genotoxin.[4,5] due to the greater connection of the *Allium cepa* test or experiment with mammalian systems. [4]. Additionally, mixed role oxidases like hepatocytes from mammals are present in the root cells of *A. cepa*, and they can drive promutagens to mutagens. [6). Herbal remedies have been made from medicinal plants for ages, and these plants have been beneficial in treating and preventing various forms of human inflammation.[2]. In addition to their use in herbal medicine, medicinal plants are a rich source of biologically active compounds, some of which are utilized to make stock modish stimulants [3]. Flavonoids and organosulfur compounds, which are abundant in mucilaginous plants, may be able to counteract or lessen the harmful effects of genotoxic chemicals.

Material and Method:

The leaves of *Aegle marmelos* and the fruits of *Bridelia scandens* were gathered from several areas within the Kolhapur District. The procedure of [7] was followed to extract the mucilage content, and the amount of mucilage recovered was noted. The anti-genotoxic potential of a mucilaginous plant extract was assessed in four distinct trials conducted in identical settings. 30ml of distilled water was used to soak three grams of oven-dried mucilage powder from *Bridelia scandens* fruits and *Aegle marmelos* leaves for a whole day at room temperature (27–30°C). After being filtered via Whatman filter paper, the extract was used as a stock and refrigerated for storage. Onion (*Allium cepa*) bulbs of uniform size were purchased from the nearby market. Nine identically sized commercial bulbs (3–4 g) were utilized for each treatment. Antigenotoxicity of mucilaginous plant extract samples was carried out by using method of [8].

The mitotic index (MI) was determined by using formula,

Mitotic index (MI) = Number of cells in mitosis X 100

Total number of cells analysed

Different chromosomal aberrations were characterized and percent chromosomal appearing frequency with and without extract in cells were calculated.

Result and discussion:

In comparison to the positive control, the mitotic index increased before, after, and concurrently with mercuric chloride and mucilage extract treatment (Table No. 1). The effects of 0.5 and 1% mucilage extracts reduced the clastogenic and physiological abnormalities.(Table 2.). *Aegle marmelos* extract lowers physiological and clastogenic aberration in simultaneously treated roots, although pretreatment of *Bridelia scandens* mucilage resulted in a more significant percent suppression of chromosomal aberrations (Table No-3). A growing number of people are looking for and using universal plant items to counteract genotoxic or carcinogenic effects. Usually employed, the antigenotoxic assay can demonstrate the protective effect against reagent and additional material exchanges in the form of hereditary material. [9].

Antigenotoxicity activity:

Table No 1. Effect of Pre, Post and Simultaneous treatments of Mercuric chloride and aqueous extracts of fruits of *Bridelia scandens*, Leaves of *Aegle marmelos*on Mitotic index in *Allium cepa.*

I-Pre, II-Post and III- Simultaneous treatments.

NC- Negative control (Distilled water)

PC- Positive control (0.75 ppm Mercuric chloride)

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Sr. No	Concentration	Continue extract	I	II	III
1	Negative control			68.18	
2	Posiive control			55.25	
		Brideliascandens(fruits)			
1	0.50%	75.93	56.84	83.86	80.41
2	1%	70.44	69.07	81.41	81.52
		Aegle marmelos(leaves)			
1	0.50%	83.19	86.49	92.49	86.32
2	1%	89.93	63.39	85.46	81.03

Table 2. Effect of Pre, Post and Simultaneous treatments of Mercuric chloride on extracts of fruits of *Bridelia scandens*, Leaves of *Aegle marmelos*on physiological and clastogenic aberrations in root tip cells of *Allium cepa*

I-Pre, II-Post and III- Simultaneous treatments.

	NC	PC	0.5% Treatment				1% Treatment			
			Contine extract	I	II	III	Contine extract	I	II	III
Physiological aberrations (PA)					*Bridelia scandens*					
C-Mito	2	6	4	9	4	3	4	2	4	2
Delayed anaphase	3	3	2	5	-	2	1	4	2	1
Laggards	3	5	3	7	3	2	3	1	3	5
Stickiness	-	5	5	1	13	9	7	5	5	2
Vagrants	-	6	4	-	-	2	2	3	-	1
Total PA	8	25	18	22	20	18	17	15	14	11
Clastogenic aberrations (CA)										
Bridges	2	5	3	3	5	2	4	2	4	2
Rings	1	3	1	2	-	1	1	3	3	1
Breaks	2	9	4	5	3	3	3	4	2	3
Total CA	5	17	8	10	8	6	8	9	9	6
Total abberations	13	42	27	25	19	22	25	22	25	14
Physiological aberrations (PA)					*Aegle marmelos*					
C-Mito	1	4	2	3	5	2	4	1	7	2
Delayed anaphase	2	2	2	2	-	1	1	-	5	3
Laggards	2	3	-	5	4	1	3	4	2	6
Stickiness	-	4	8	4	3	4	-	6	6	4
Vagrants	-	3	1	1	4	1	5	2	5	-
Total PA	5	16	13	15	16	9	13	13	25	15
Clastogenic aberrations (CA)										
Bridges	2	5	3	1	5	2	2	5	4	5
Rings	1	3	1	-	-	-	1	2	2	-
Breaks	2	9	2	6	1	4	2	5	5	1
Total CA	4	17	6	7	6	6	5	12	11	6
Total abberations	13	42	20	25	19	18	21	27	25	33

NC- Negative control (Distilled water)

PC- Positive control (0.75 ppm Mercuric chloride)

Table No-3 Effect of Pre, Post and Simultaneous treatments of ethanolic extracts of fruits of *Bridelia scandens*, Leaves of *Aegle marmelos* on percent inhibition of genotoxicity induced by Mercuric chloride in root tip cells of *Allium cepa*.

Sr No	Types of Abberent cells	NC	PC	0.5%				1%			
Bridelia scandens											
				Continue extract	I	II	III	Continue extract	I	II	III
1	No of cells with (PA)	8	25	18	21	19	17	16	14	13	10
2	PI of PA			41.17	17.64	29.41	41.17	47.05	58.82	64.70	82.35
3	No of cells with (CA)	5	17	9	12	14	18	10	11	7	8
4	PI of CA			66.66	41.66	25	-	58.33	50	83.33	75
5	(PA± CA)	13	42	27	34	34	36	37	26	21	19
6	PI of (PA± CA)			50.62	25.48	24.48	21.68	15.24	52.13	71.31	78.21
Aegle marmelos											
1	No of cells with (PA)	8	25	17	19	18	9	13	13	27	15
2	PI of PA			47.05	35.29	41.17	94.11	70.58	70.58	-	58.82
3	No of cells with (CA)	5	17	12	9	5	8	5	6	13	0
4	PI of CA			41.66	66.66	100	75	100	91.66	33.33	-
5	(PA± CA)	13	42	29	28	23	17	18	19	40	15
6	PI of (PA± CA)			42.82	46.27	60.41	31.27	81.60	80.21	6.89	90.10

I-Pre, II-Post and III- Simultaneous treatments, PI- Percent inhibition, PA-Physiological aberrations, CA- Clastogenic aberrations, PI=a-b/a-c x 100. Where a - number of aberrant cells induced by Positive control, b– number of aberrant cells induced by mucilaginous plant extract and c – number of aberrant cells induced by negative control.

Conclusion:

The results of this investigation showed that mucilage pre-, post-, and simultaneous treatments with aqueous extracts increased the mitotic index and decreased clastogenic and physiological abnormalities. This suggests that the mucilage of *Bridelia scandens* fruits and *Aegle marmelos* leaves exhibited antigenotoxic capability against *Allium cepa* mercuric chloride-induced aberration. This may be the result of chromosomal aberration correction. Consequently, mucilage, as a polymer, can be effectively utilized to coat pharmaceutical tablets, ideally for the treatment of cancer. Additionally, this mucilage might be employed as a tool to lessen the genotoxic effects of different dangerous substances and environmental contaminants.

References:

1. S. U. Shah, IOSR Journal of Pharmacy and Biological Sciences. Volume 1, Issue 2
a. (2012) pp 43-54.
2. A. Al-Asmari, A. M. Al-Elaiwi, M. Tariq, A. AlEid and S.M. Al-Asmary, Evid.
a. Based Complementary Altern., (2014) 1-22.
3. Ea. Palombo, ,Evid. Based Complementary Alternat Med., (2011) 1-15.

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 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, Dec 2022

4. W. Grant, Mutation Research, 99 (1982) 273- 291.
5. D. Feretti, A. Zerbini, C. Ceretti, M. Monarca, Food Additives and Contaminants,
a. 24 (2007) 561-572
6. P. Jaffery and H.S. Rathore, The Internet Journal of Toxicology, 4(1)(2007) 1-12.
7. S. B. Narkhede, G. Vidyasagar, A. G. Jadhav; A. R. Bendale and K. N. Patel, J.
a. Chem.Pharm.Res. 2(6) (2010) 161-16.
8. S. Sharma and P.L. Vig, Scientic Research and Essays, 7(13)(2012) 1385-1392.
9. G. Rani, K. Kaur, R. Wadhwa, S. C. Kaul and A. Nagpal, Food ChemToxicol 43
a. (2005) 95-98.

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Invisible Shields: How cryptography Safeguards our digital lives

S.P. Thorat[1], G. B. Kolhe[2], Neha Rajesh Shinde[3], Vaishnavi Sudesh Patil [4], and Sandesh Daji Jadhav[5]

[1,2,3,4,5]Vivekanand College, Kolhapur, Maharashtra, India – 416003

[1]email: thoratsanjay15@gmail.com

[2]email: gauravkolhe510@gmail.com

[3]email: nrshinde1503@gmail.com

[4]email: paritvaisnavi7@gmail.com

[5]email: sandeshdj1718@gmail.com

Abstract :

Ensuring the integrity and confidentiality of voting processes is paramount in democratic societies. Traditional voting systems face numerous challenges, including ballot tampering, coercion, and logistical constraints. In response, cryptographic techniques have emerged as a promising solution to mitigate these vulnerabilities and enhance the security of electoral systems. This paper explores the application of cryptography in voting, focusing on cryptographic protocols such as homomorphic encryption, blind signatures, and verifiable shuffles. We discuss how these techniques enable end-to-end verifiability, voter privacy, and tamper resistance in electronic and remote voting systems. Additionally, we examine the trade-offs and challenges associated with cryptographic voting systems, including usability concerns, trust assumptions, and scalability issues. Through a comprehensive review of existing research and real-world implementations, this paper highlights the potential of cryptography to safeguard the integrity and trustworthiness of electoral processes, thereby fostering greater confidence in democratic institutions.

Keywords and Phrases: hash function, ciphers,algorithms, encryption, decryption.

Introduction:

Cryptography plays the duty of a sentinel protecting our digital interactions at a time when information is a currency and data security is a fundamental requirement. Beyond simple encryption, cryptography—the art and science of secure communication—has evolved into the cornerstone of contemporary cyber security, guaranteeing authenticity, secrecy, and integrity in our digital age.

The goal of this project is to investigate the many facets of cryptography, including its historical foundations, developing techniques, and modern applications. This programme intends to bring forward the different uses of data and to demystify the mysterious methods in which it is protected, decrypted, and used by breaking down the complexity of cryptographic algorithms.

The primary objective of this project is to both clarify the basic concepts of cryptography and examine its applications in protecting confidential data in a variety of contexts. Each component is

essential to strengthening our digital infrastructure, whether it is the strong hashing algorithms protecting data integrity or the asymmetric encryption approaches protecting financial transactions.

This initiative aims to clarify both the theoretical ideas and real-world applications of cryptography through its investigation. It hopes to further knowledge of how cryptography protects our digital life and the critical role it plays in thwarting possible security threats by doing this.

At the completion of this project, it is hoped that a thorough grasp of the workings and applications of cryptography will be attained, opening the door to well-informed debates and new developments in this dynamic area

Cryptography:

What is Cryptography?

The practice of hiding or encoding a message so that only the intended recipient can read it is called cryptography**.** The application of cryptography to encode information has been used for thousands of years. Today, it is still used in e-commerce, bank cards and computer passwords. Accessing and decrypting data is done using modern encryption techniques, including ciphers and algorithms such as 128-bit and 256-bit encryption keys. Modern encryption systems such as Advanced Encryption Standard (AES) are considered virtually unbreakable. Message encoding is used to ensure that the message can only be read and processed by its recipient and is a hot topic in cryptography. Cryptography is another name for cybersecurity techniques that combine computer science, engineering, and mathematics to create complex codes that hide the meaning of a word. Although it has its roots in ancient Egyptian hieroglyphs, cryptography is important to prevent unauthorized reading when they are in circulation. It uses mathematical techniques and techniques to turn one word into several words to protect credit cards, emails, online searches, personal information and digital signatures. The practice of storing or concealing information so that only the intended recipient can read it is called cryptography. The application of cryptography to encode information has been used for thousands of years. Today, it is still used in e-commerce, bank cards and computer passwords. Accessing and decrypting data is done using modern encryption techniques, including ciphers and algorithms such as 128-bit and 256-bit encryption keys. Modern encryption systems such as Advanced Encryption Standard (AES) are considered virtually unbreakable. Message encoding is used to ensure that the message can only be read and processed by its recipient and is a hot topic in cryptography. Cryptography is another name for cybersecurity techniques that combine computer science, engineering, and mathematics to create complex codes that hide the meaning of a word. Although it has its roots in ancient Egyptian hieroglyphs, cryptography is important to prevent illegal reading during transmission. It uses mathematics and techniques to convert text into multiple numbers to protect credit card transactions, emails, online searches, personal information, and digital signatures.

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Importance and relevance of cryptography in modern world

Technology has made our lives easier, but it has also made our personal information more vulnerable. Computers are designed to follow your instructions without making mistakes, but sometimes you don't want them to reveal confidential information. Most of us talk about privacy in our daily lives. Whether it's about the information available or whether your digital footprint is being tracked, the answer to this question has never been clearer. Due to increased restrictions, there are concerns about cyber attacks and privacy violations. This is what cryptography does. This is the science of hiding things. It takes data and encrypts it so that the computer cannot decrypt it without permission. Let's take an example where you need to send some confidential information to other people around the world. You can't send the message to the recipient because he or she is halfway around the world, and you don't want anyone to read or modify the message because it contains sensitive information. When you send a message, there are many people responsible for managing the communication between you and the recipient. Communications can be mistaken or fall into the wrong hands, giving them access to private information. If the intermediary acts unfairly, he has two options: He can either keep the information to himself, or listen carefully and allow the communication to continue. Therefore, it is recommended to encrypt data when sending sensitive or private messages. Communications can be accessed using encryption technology that will prevent someone from intercepting it and determining its content. Encryption is crucial in today's digital age, where a word can be sent to anyone in the world with one click. Thanks to the advent of digital encryption, we are approaching a time when privacy will change forever, at least when it comes to digital communications. Access your private messages in a few clicks from your smartphone. In the digital age, encryption technology is often used for purposes other than encrypting private information. Businesses are increasingly using it to protect their intellectual property and secure their communications.

Why do we need Cryptography?

Everything we do online today is monitored and recorded by many companies, including banks, credit card companies, Google, Facebook and more. Most people are not aware of the information available on the internet. Never before have we seen so much data collected, analyzed and stored. Moreover, working power and computer power are increasing simultaneously, allowing companies to collect, analyze and store more information. Many consumers are unaware of the many new security threats that come with all this additional information. This is a particular problem in the context of large amounts of data. Big data has great consequences but also dangers. It is generally believed that hackers pose an additional risk to individuals and businesses. They are always looking for new ways to achieve their goals. As a result, cyber attacks are on the rise as hackers try to bypass the network or steal data. This means that attacks can be carried out by more motivated individuals

and groups. By 2022, the average cost of a data breach will reach $4.35 million. It is estimated that 71% of data crimes are money-related and cybercrime will cost the world economy $10.5 trillion annually by 2025. Cryptography is more important than ever As cyber attacks become more frequent, organizations and individuals can protect their information. and communications resulting from unauthorized access.

Importance of Cryptography

Encryption is the practice of modifying data so that only the intended recipient can decrypt it. Without encryption, privacy and confidentiality would not be possible in the digital world. Everything can be easily stolen. The importance of cryptography has increased over time, especially considering the increase in cyber attacks. It is important for network security as it prevents theft, unauthorized access and data loss. It also helps protect the privacy of Internet users. Businesses and individuals can increase their security and privacy by encrypting sensitive data. Another feature it provides allows users to verify that the messages they send or receive come from the intended source. "Encryption" means secret, "graphics" means written. Encryption technology converts information (text) into a secret form that can only be read by those who need the key. The information is then placed in a secure database and encrypted. In fact, the foundation of all online interactions is digital trust, and most people who use encryption regularly don't even know it.

Purpose of Cryptography

Cryptography uses mathematical techniques and methods to encrypt and decrypt information to ensure that only authorized users can access it. The two main goals of encryption are user authentication and protection of the accuracy, integrity and confidentiality of information. Another basis of the cryptographic system that allows users to verify information and prove themselves is the digital signature.

Types Of Cryptography

Cryptography is a field of mathematics concerned with information and communications security. In the narrow sense, it is the practice of converting readable data into an unreadable format.

Key encryption (symmetric encryption)

In symmetric encryption, a key is used for data encryption and decryption. This means that data is encrypted and decrypted using the same key. It is one of the most secure forms of coding and is suitable for many situations. Symmetric encryption is sometimes called secret key encryption because the sender and receiver must share the same key to complete the encryption decision. It is very secure because it is impossible for someone without the key to decipher the information.

Asymmetric Encryption :

In this method, two keys are used to encrypt and decrypt data. The encryption process uses the recipient's public key, while the decryption process uses the recipient's private key. Private keys and

public keys are different. Only the recipient of the plan knows his private key, so even if anyone can access the public key, he or she is the only one who can decipher it. RSA algorithm is the most commonly used asymmetric key encryption algorithm.

Hash function

This algorithm does not use any keys. Since the fixed-length hash value is calculated as text, it is difficult to reconstruct the contents of plaintext. Hash functions are often used to encrypt passwords in operating systems.

Feasible Use Of Cryptography

Electronic Poll Book

The electronic poll book is the first electronic voting machine that voters may encounter at the polling station. These are three-ring files containing digitally altered voter registration documents. Election officials can search for voters, identify them, and take additional steps to ensure they vote validly using an electronic ballot. These voting books contain sensitive information that could be compromised in a variety of ways if disclosed. If the electronic voting book captures the order in which people vote, it can be used to remove anonymous votes. The attacker simply matches the voting data with the data from the computerized ballot to determine how each voter voted. This could lead to voter intimidation. Electronic voting books store a lot of voting data; therefore, it must use a protocol such as AES to access data in transit and data at rest. In addition to protecting voter privacy, this also prevents hackers from controlling data or otherwise affecting the system. Electronic voting requires the use of a cashier's check to verify its legitimacy prior to use. If your computer's hash matches its hash value, it is generally accepted that the software is safe to use and genuine.

What is AES encryption and how does it work?

The message you want to encrypt (called plaintext) is first divided into blocks according to the encryption process. Since the block size of AES is 128 bits, the data is divided into 4x4 lines of 16 bytes each (16x8 = 128 bytes). If your message is "Please Buy me some potato chips," the first block will look like this:

b	m	o	p
u	e	m	o
y		e	t
	s		a

Key expansion: For each different type of encryption, many new keys are created using the original key in a process called key expansion. Rijndael's main work is used to provide these new 128-bit

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round keys, which are a simple and easy way to create new key encryption. If the first key is "key boring 1":

k			i
e	a	b	n
y	r	o	g
s	e	r	1

Then each of the new keys might look something like this once Rijndael's key schedule has been used:

14	29	1h	s5
h9	9f	st	9f
gt	2h	hq	73
ks	Dj	df	hb

When AES encryption is really used, each of these keys is produced from an organised procedure, even if they appear to be random characters (the example above is fictitious).

Add round key

In this step, because it is the first round, our initial key is added to the block of our message:

b	m	o	p
u	e	m	o
y		e	t
	s		a

+

k			i
e	a	b	n
y	r	o	g
s	e	r	1

An XOR cypher, an additive encryption method, is used to accomplish this. Even if it appears that these can't be added together, remember that this is really done in binary. The characters serve only as a stand-in to help with comprehension. Assume for the moment that the outcome of this mathematical operation is:

h3	jd	zu	7s
s8	7d	26	2n
dj	4b	9d	9c
74	el	2h	hg

Substitute bytes

Every byte is replaced in this stage in accordance with a preset table. This resembles the example given at the beginning of the article in that it codes the sentence by replacing each letter in the sentence with the letter that follows it in the alphabet (hello becomes ifmmp).

This system is a little bit more intricate, however it's not always logical. Alternatively, the algorithm can seek up a pre-established table that states, for instance, that h3 becomes jb, s8 becomes 9f, dj becomes 62, and so on. Let us assume that following this stage, the predefined table provides us with:

jb	n3	kf	n2
9f	jj	1h	js
74	wh	0d	18
hs	17	d6	px

Mix coloums

It's a little difficult to describe this stage. Let's simply suppose that each column has a mathematical equation applied to it in order to further disperse it, to exclude much of the arithmetic and make things simpler. Assume that this is the outcome of the procedure:

ls	j4	2n	ma
83	28	ke	9f
9w	xm	3l	m4
5b	a9	cj	ps

Add round key again

Do you recall the round keys we created at the beginning utilising Rijndael's key schedule and our original key? This is the point at which we put them to use. We apply the first round key we generated to the outcome of our mixed columns:

ls	j4	2n	ma
83	28	ke	9f
9w	xm	3l	m4
5b	a9	cj	ps

+

14	29	1h	s5
h9	9f	st	9f
gt	2h	hq	73
ks	dj	df	hb

Let’s say that this operation gives us the following result:

9d	5b	28	sf
ls	df	hf	3b
9t	28	hp	8f
62	7d	15	ah

If you think so, we are still a long way from it. After the last set of keys is added, the process returns to the bit-tuple key step, where each value is updated according to the specified table. When you're done, go back to moving lines and move each line one, two, or three spaces to the left. Then run the

balance line again. Another round key was added later. And it's not over yet. As mentioned at the beginning, the AES size is 128, 192 or 256 bits. There are nine rounds when using a 128-bit key. 11 when a 192-bit key is used. 13 when a 256-bit key is used. Thus, the data is modified at each stage, up to thirteen times per stage, as it passes through the byte conversion, row conversion, column shuffling, and key stages. Once the user's vote is verified, the vote is approved by the voters. Traditional vote book or electronic vote book. Voters can obtain tokens or smart cards to use electronic voting machines (DRE) directly at polling stations, allowing them to vote on the device. These cards usually have encryption keys on them that tell the computer that the holder has the right to vote. Similar to electronic voting software, DRE software requires legal verification before use. The check must be successful to ensure that the number has not been changed or tampered with. If the hashes match, the program will be safe to use.

Storage

Votes that have been cast should be encrypted and kept on the DRM for storage. This makes it far more difficult for attackers to change votes and stops them from being viewed. Regretfully, during storage, votes aren't always encrypted. In some instances, researchers have even bought vintage voting machines from eBay and looked at the results of the previous election in which they were utilised. This indicates that when the election was over, the votes were still on the machine, unencrypted, and hadn't even been deleted. This is a serious breach of privacy and security.

Transmission

To stop hackers from stealing votes and changing the outcome, votes must also be encrypted while they are in route. Security protocols such as TLS are frequently utilised in transmission. This is a hybrid system that incorporates additional security elements together with symmetric techniques like AES and public-key encryption cyphers like RSA. Switzerland has started employing quantum key distribution in recent years to determine whether there is a chance that hackers may be able to intercept its encryption keys.

Tabulation :

The most important aspect of the election is the outcome. Attackers could change the winner if they could figure out how to modify it covertly. In the event if foes were discovered before to the election's conclusion and the attacks were halted, a great deal of distrust would be ingrained in the system, leading many voters to doubt the election's validity. Verifying that the vote tallying equipment is running the appropriate software is crucial. This implies that in order to confirm that the code hasn't been altered, checksums are required. Additionally, these devices must be protected so that only authorized personnel can access them. Keys need to be stored securely to prevent attackers from manipulating the results.

Digital ID Card:

The ability to sign documents using the public card and the identity of the significant partner is one of the most important. While a person's public key can be used to identify themselves, their private key can be used to create a digital signature. People download ballot papers to their laptops to vote. The USB card reader they plug in then reads their ID. They enter their PIN number to verify their identity. Voters also have the option of using a different identity system linked to their mobile phone number. They input both the number and their PIN into the programme. The voter's information is verified by the systems in both situations by cross-referencing it with the electoral register. Because an attacker would need to obtain both the voter's PIN and digital identity card, it becomes extremely difficult to cast fake ballots.

Public key encryption

We can use two envelope methods to ensure the security and anonymity of voting. When a user votes on their computer and enters the voting system, random numbers are added to the database. Votes cast and numbers generated are then encrypted using a public voting key. This creates an inner envelope that conceals the voter's identity.

Digital signatures

Once the ballot is encrypted and placed inside the envelope, the voter's key is used to sign the ballot. The ballot is then sent to the electronic voting machine. It is protected by the TLS security protocol during transmission. When you share sensitive information online, such as when you log into your bank account or enter your password on Facebook, TLS, a model of different encryption protocols, keeps your data safe. When you visit a website that uses TLS, you will see a small green lock to the left of the URL and the website address starts with https instead of http. After that all votes are collected and scheduled. Voters' qualifications are also verified and double voting to remove unqualified votes (permitted under the Estonian system, but only the last vote is accepted against coercion).

Sorting the votes and removing digital signatures

After that, the voter's electoral district is used to sort the i-votes, and the digital signatures are eliminated. In doing so, the voter's identify is removed from the ballot. After then, the votes are randomly distributed across several servers in a mix network, rendering it impossible to link a vote to the voter's identity. This measure helps to avoid intimidation and preserves the vote's confidentiality.

Decryption and final count :

Following that, the shuffled votes are sent to an air-gapped server so that the encryption may be broken. Because this server isn't linked to the internet or any other networks, hackers can't virtually compromise it. Next, using the private key unique to that election, the votes are decoded.

The key is not in the hands of one individual; several election officials work together to finish the key assembly. The authorities must insert their authentication tokens into the server and then enter their

PIN numbers in order to decode the vote. Because an attacker would have to compromise every official to have access, it would be more harder to interfere with the election results.

The votes are moved to an air-gapped vote counting server after they have been decrypted so that they may be promptly totaled. The election winner can be declared when the ballots have been tallied.

When combined, these techniques allow for the relatively safe and anonymous conduct of an online vote through the use of cryptography and careful organisational procedures.

Verifying the vote:

A lot of individuals have doubts about voting online. Ultimately, you are unable to view the actual traffic flowing between the servers and your machine. When using a paper ballot, you physically place it in the box and put your confidence in the unbiased observers to handle the rest.

We can implement a verification mechanism that lets individuals examine their ballots and feel more at peace in order to allay their anxieties. Voter verification can only be completed using an app on a phone or tablet, even though online votes must be cast through an application on the voter's PC.

This division serves as a security precaution. If the voter's computer were used for both procedures, an attacker would only need to infiltrate one device to secretly alter the voter's vote. Both devices would need to be compromised by the attackers.

Upon finishing the voting process, a QR code appears on the user's computer screen. Using the election app on their phone or tablet, the voter may scan it. The voter may then verify that their vote was cast accurately by using the app, which will show their ballot as it was received by the server.

Cryptography is essential to the security of any electronic or online voting systems that are going to be employed.

Methodology:

Digital signature

The message's integrity is ensured by the digital signature system, which may also be used to identify the message's source.

RSA digital signature:

The RSA digital signature technique consists of three algorithms: Key Generation, Signing, and Verification.

An asymmetric cryptography algorithm is the RSA algorithm. In actuality, asymmetric refers to the fact that it operates on both the public and private keys. As implied by the name, the private key is kept secret while the public key is distributed to everybody.

Asymmetric cryptography example:

1. A client requests data from the server by sending its public key to it, such as a browser.
2. The data is sent by the server encrypted with the client's public key.
3. After receiving this data, the client decrypts it.

Because this is asymmetric, even if someone else has the browser's public key, only the browser itself is able to decode the data. The notion! Large integers are hard to factorise, which is the foundation for the RSA concept. Two numbers make up the public key, one of which is the product of two big prime numbers. The same two prime numbers are also used to generate the private key. Therefore, the private key is compromised if the huge integer can be factorised. As a result, the key size determines the encryption strength entirely, and the strength of the encryption rises exponentially as the key size is doubled or tripled. RSA keys are normally 2048 or 1024 bits long, but experts predict that 1024-bit keys will soon be cracked. However, it appears to be an impossible feat as of yet.

The mechanism behind the RSA algorithm :

Generating Public Key:

Select two prime no's. Suppose P = 53 and Q = 59.

Now First part of the Public key : n = P*Q = 3127. We also need a small exponent say e : But e Must be An integer. Not be a factor of Φ(n).

1 < e <

1 < e < Φ(n) [Φ(n) is discussed below], Let us now consider it to be equal to 3. Our Public Key is made of n and e

Generating Private Key:

We need to calculate Φ(n) : Such that Φ(n) = (P-1)(Q-1) so, Φ(n) = 3016 Now calculate Private Key, d : d = (k*Φ(n) + 1) / e for some integer k For k = 2, value of d is 2011.

Now we are ready with our – Public Key (n = 3127 and e = 3) and Private Key(d = 2011) Now we will encrypt “HI”: Convert letters to numbers : H = 8 and I = 9 Thus Encrypted Data c = (89e)mod n Thus our Encrypted Data comes out to be 1394 Now we will decrypt 1394 : Decrypted Data = (cd)mod n Thus our Encrypted Data comes out to be 89 8 = H and I = 9 i.e. "HI"

Advantages:

Security:

The RSA technique is frequently used for safe data transfer as it is thought to be extremely secure.

Public-key cryptography:

The RSA algorithm needs two distinct keys for encryption and decryption since it is a public-key cryptography technique. The data is encrypted using the public key and decrypted using the private key.

Key exchange:

Secure key exchange, or the exchange of a secret key between two parties without transferring the key across a network, is possible with the use of the RSA algorithm.

Digital signatures: Digital signatures utilising the RSA technique allow a sender to sign a communication with their private key and a recipient to confirm the signature with the sender's public

key. Speed: Due to its effectiveness and speed, the RSA approach is well-suited for use in real-time applications.

Widely used:

The RSA algorithm has been widely developed in a number of disciplines and applications, including online banking, e-commerce, and secure communications.

Conclusion:

The importance of encryption to India's technology infrastructure will only increase as it moves closer to becoming a digital superpower. India's transition from a developing to a developed country would be made easier if its foundation is established, and any democracy's foundation is elections. This will assist in preparing both India and the globe for the future.

Finally, cryptography is a fundamental component of digital security that cannot be overlooked. Its importance goes beyond simple encryption; it preserves the basis of confidence by guaranteeing the privacy and accuracy of the data that contemporary societies depend on. Cryptography will always be important for protecting data, facilitating safe transactions, and maintaining privacy. This means that strong cryptographic solutions will always be required.

References:

[1] M. K. Lim, Y. Li, C. Wang, and M. Tseng, "A literature review of blockchain technology applications in supply chains: A comprehensive analysis of themes, methodologies and industries," Computers & Industrial Engineering, vol. 154, p. 107133, Apr. 2021, doi: 10.1016/j.cie.2021.107133.

[2] Y.-X. Kho, S.-H. Heng, and J.-J. Chin, "A review of cryptographic electronic voting," Symmetry, vol. 14, no. 5, p. 858, Apr. 2022, doi: 10.3390/sym14050858.

[3] J. Bethencourt, D. Boneh, and B. Waters, "Cryptographic methods for storing ballots on a voting machine.," Network and Distributed System Security Symposium, Jan. 2007, [Online]. Available: http://crypto.stanford.edu/~dabo/pubs/papers/votestore.pdf

[4] H. Mishra and P. Maheshwari, "Blockchain in Indian Public Distribution System: a conceptual framework to prevent leakage of the supplies and its enablers and disablers," Journal of Global Operations and Strategic Sourcing, vol. 14, no. 2, pp. 312–335, Jun. 2021, doi: 10.1108/jgoss-07-2020-0044.