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India's Quest for Green Energy Transition: Balancing Critical Minerals Security with Human Rights and Constitutional Values

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Abstract

India's transition towards renewable energy has transformed critical minerals into strategic resources essential for electric vehicles, solar photovoltaic systems, wind turbines, battery storage and advanced manufacturing. Yet extraction can generate ecological disturbance, water stress, displacement, occupational risks and livelihood loss. This paper examines India's critical-mineral regime through constitutional values, human rights and environmental jurisprudence. It analyses the shift from a state-led developmental model towards a liberalised mineral economy; evaluates impacts on indigenous and vulnerable communities; considers the relationship between mineral production intensity and greenhouse-gas emissions intensity of GDP; and argues for a coordinated legislative framework. It concludes that India's green transition should be a just transition in which mineral security, people's participation, ecological protection and intergenerational equity operate together.

Keywords: critical minerals; energy transition; Article 21; tribal rights; sustainable development; environmental justice; MMDR Act

1. Introduction

The contemporary energy transition differs from worldwide earlier industrial transformations because renewable electricity, electric mobility, storage and digital infrastructure are mineral-intensive. A critical mineral is not simply a rare mineral, rather its criticality arises from high economic importance combined with limited supply, whether because production is geographically concentrated, resources are declining, demand is rising rapidly or geopolitical and technological factors create disruption risks [International Renewable Energy Agency (IRENA), 2021]. IRENA identifies copper, lithium, nickel, cobalt and rare-earth elements as especially important to this transition. Its 1.5°C pathway projects substantial growth in annual material requirements by 2050; copper, for example, may rise from roughly 30 Mt/year to 50–70 Mt/year, while nickel, lithium, cobalt and neodymium also experience major proportional increases (IRENA, 2021).

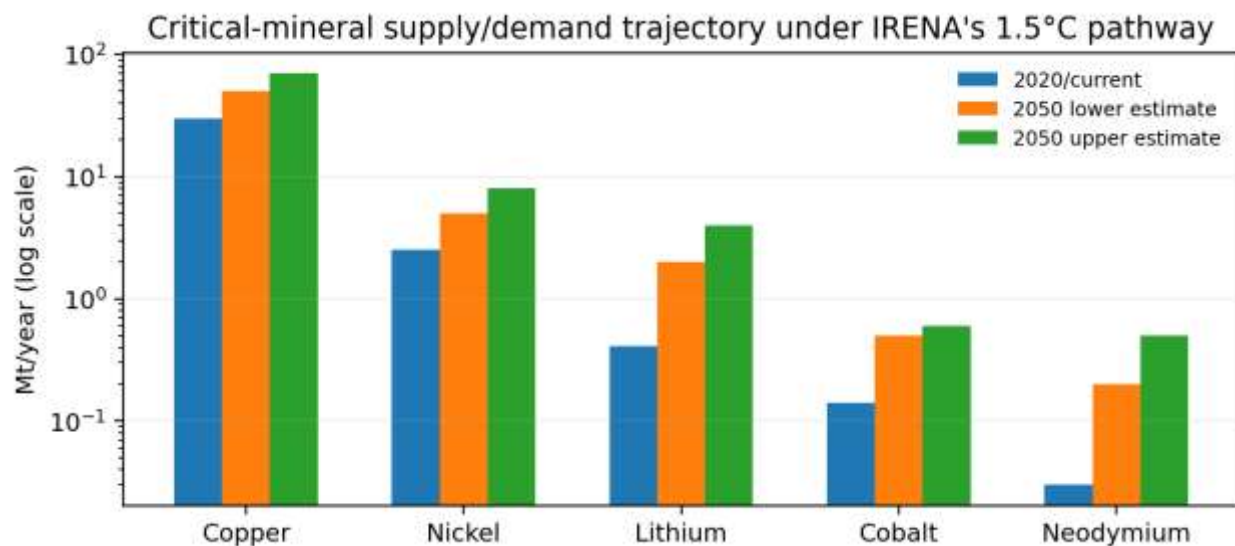


Figure 1. Indicative current/2020 supply and projected 2050 demand ranges in IRENA's 1.5°C pathway. Source: IRENA (2021).

India has responded to the rising need by treating critical minerals as a strategic component of energy and technological security. In June 2023, the Ministry of Mines identified thirty critical minerals after assessing economic importance, supply risk, domestic resource position, production, import dependence and future clean-energy requirements (Ministry of Mines, 2023). The Mines and Minerals (Development and Regulation) (MMDR) Amendment Act, 2023 inserted twenty-four critical and strategic minerals into Part D of Schedule I and empowered the Central Government to auction their blocks; it also introduced an Exploration Licence regime for specified deep-seated minerals. The National Critical Mineral Mission (NCMM), approved in January 2025, has an overall outlay of ₹34,300 crore, including government expenditure of ₹16,300 crore and expected investment of ₹18,000 crore, covering exploration, mining, processing, overseas acquisition, recycling and recovery from end-of-life products [Press Information Bureau (PIB), 2025]. The central legal problem is that the green transition can create extractive pressures. Mining may reduce long-term carbon dependence while simultaneously disturbing forests, water systems, biodiversity and community livelihoods. IRENA therefore stresses that responsible mining must include environmental protection, fair working conditions, cultural heritage safeguards and local economic development (IRENA, 2021). The constitutional question is therefore, not whether India should secure critical minerals, but how that security can

be achieved consistently with Articles 14, 21, 39(b), 48A and 51A(g), the Fifth Schedule, PESA and the Forest Rights Act.

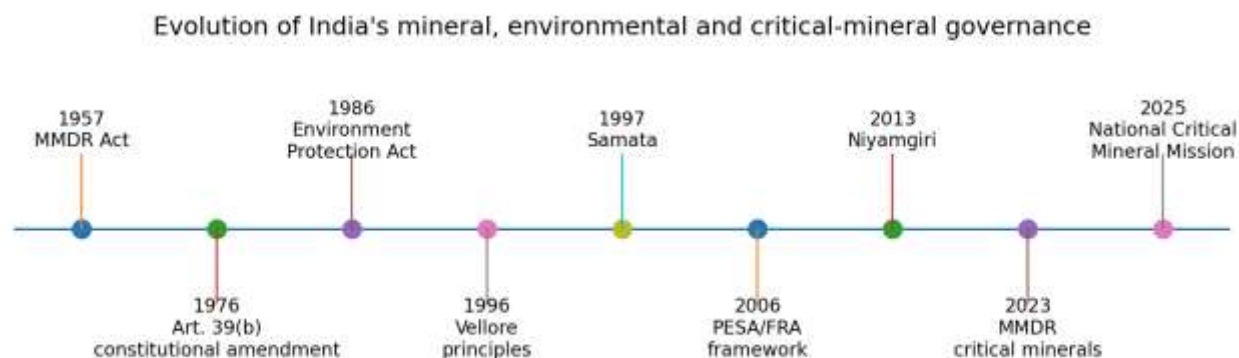


Figure 2. Selected milestones in India's mineral, environmental and critical-mineral governance.

2. Geopolitics, Strategic Autonomy & International Regime Complex

The changing global arena of environment has compelled global leaders to rethink their environmental policies and take apt actions for sustainable development. Green energy transition becoming one of the most important political agenda has contributed significantly for critical minerals to gain revolutionary importance worldwide after oil and natural gas. The transition of demand from fossil fuels to critical minerals like Lithium, Cobalt, Nickel, Graphite, Copper and rare earth minerals has raised a serious question of strategic autonomy for India in global energy dynamics.

India at COP26 Climate Change Conference at Glasgow committed to what they called **Panchamrit** climate targets including **500 GW Non-Fossil Capacity**: Reach 500 gigawatts of non-fossil fuel energy capacity by 2030, **50% Renewable Energy**: Meet 50% of India's energy requirements from renewable energy sources by 2030, **1 Billion Tonnes Reduction**: Cut total projected carbon emissions by one billion tonnes between 2021 and 2030, **45% Carbon Intensity Reduction**: Lower the carbon intensity (emissions per unit of GDP) of the economy by 45% by 2030 compared to 2005 levels, **Net-Zero by 2070**: Achieve the ultimate goal of net-zero carbon emissions by the year 2070 (PIB, 2022).

Also, under UNFCCC and Paris agreement, India as per recently submitted Nationally Determined Contribution (2031-2035) strives to achieve 60 percent of the total electric power installed capacity from non-fossil fuel-based energy resources by 2035 and India to create Carbon Sink of 3.5 to 4.0 billion tonnes of CO₂ eq. through Forest and Tree Cover by 2035 from 2005 level (PIB, 2026a).

These commitments are not just numbers; they demonstrate India's 2047 Viksit Bharat vision. However, they have created a new layer of complex issue for India to address. This green energy technology requires so much more than a great vision, what we call Critical Minerals. Lithium, cobalt, nickel, graphite, copper, **silicon, silver, copper, aluminum, tellurium, indium, gallium, dysprosium and neodymium** and other rare earth minerals are essential part of wind turbines, electrical vehicles, solar panels, batteries and other renewable energy infrastructures. The importance of such minerals can be understood from the very fact that in recent Venezuela-USA tension, Venezuela's critical minerals and oil reserves played an important part. Therefore, for India to achieve its set goals under Paris agreement's Nationally Determined Contributions (NDCs), it needs to secure minerals and technologies essential for it. Government needs to

carefully consider if they want to risk a new type of supply dependency especially when India recently has experienced shortage in oil and gas supplies due to geopolitical tensions and ongoing war between USA and Iran.

The major issue with critical minerals is that they are concentrated geographically in few places. These minerals need extraction, refining and processing before they could be used economically for any purpose which come at considerable environmental and economic costs. The presence of any critical minerals reserve neither guarantees economic extraction of it nor ownership of its minerals. Brazil accounts for nearly world's 91% of global niobium production, which is used for producing steel. Democratic Republic of Congo holds 75.9% of cobalt and 41.9% of tantalum production but the refining process is still dominated by Chinese companies. Today, China controls the production of about 15 critical minerals, including gallium (98.7%), magnesium (95%), tungsten (82.7%), and rare earth metals (69.2%). In addition to production, China refines around 90% of rare earths worldwide ('How Much Control China Has Over the World's Critical Minerals', 2025).

The refining and processing part of these critical minerals requires advanced technologies, capital and laws supporting the same. China has shown years of early and sustained investment for the infrastructure and technology which provides it the leading position in world critical minerals supply chain and geopolitics. When such important part of energy transition is owned and control by one country the risk of supply disruption increases. Especially when it is controlled by China it challenges the dominance of traditional industrial powers (the United States, the European Union and Japan) ('The Race for Critical Minerals in an Era of Geopolitical Realignments', *The International Spectator*, 2020). These monopolies could be used as economic constrain and geopolitical leverage in case of tension between countries. The disruption in supply may impact energy production and industries of dependable countries. Hence, as the emerging importance of critical minerals exhibits the similar pattern as that of oil and gas the need for India to diversify its suppliers, developing domestic processing infrastructure and acquiring overseas reserves becomes the need of the hour. At the same time, India's mineral security will need to consider environmental and social concerns in order to avoid negative impacts for the populations and ecosystems in mineral-rich areas. Hence, securing geopolitical gains and promoting human rights are compatible goals that should be jointly promoted by India's green agenda.

Whereas in India the recent unsuccessful auction for tender of 5.9 million tonnes of lithium reserves in Salal-Haimana areas of Reasi district, Jammu & Kashmir (PIB, 2023) shows that investors in India don't want to commit for extraction and refining because of geological uncertainty of the reserve to be commercially exploitable, inadequate feasibility of information due to instruments not being so precise, lengthy regulatory clearances, chances of confrontations with locals, lack of infrastructure, etc. ("India's Challenges in Accessing Critical Minerals", *Indian Foreign Affairs Journal*, 2020)

3. Issues and Challenges

India's mineral governance has evolved from a predominantly state-led developmental model towards a mixed regime combining strategic public control with liberalised investment, auctions and global supply chains. Article 39(b) treats material resources as resources to be distributed to subserve the common good, while the present critical-mineral strategy increasingly emphasises

supply resilience, private participation and international acquisition. The resulting tension is between developmental acceleration and constitutionalised resource justice.

The first challenge concerns indigenous and socio-economic rights. Critical mineral deposits may overlap with forests and Scheduled Areas where communities possess customary, cultural and livelihood relationships with land. It is correctly demonstrated that rights over minerals cannot be analysed separately from land rights, the Fifth and Sixth Schedules, the public trust doctrine and benefit-sharing institutions. PESA, 1996 and the Forest Rights Act, 2006 therefore matter directly to mining decisions. The principle is especially clear in **Orissa Mining Corporation Ltd. v. Ministry of Environment & Forests**(2013), where the Supreme Court required Gram Sabhas to consider the religious, cultural and community rights of the Dongria Kondh in the Niyamgiri mining dispute.

The second challenge is distributive justice. Mining can generate royalties, employment and infrastructure, yet communities bearing ecological costs may not receive proportionate benefits. Research on social equity in critical-mineral extraction identifies indigenous rights, livelihood impacts, environmental justice and unequal geopolitical power as interconnected dimensions of the transition (OCAD University Strategic Foresight and Innovation, 2025). District Mineral Foundations under the MMDR Act provide a legal route for benefit-sharing, but transparency, community participation and measurable outcomes remain essential and still unachieved.

Third, mining raises environmental and health concerns. Depending on the mineral and extraction methods, such impacts may include tailings, heavy-metal contamination, groundwater stress, dust, biodiversity loss and occupational hazards. These risks engage the precautionary principle, polluter-pays principle and sustainable-development doctrine. In **Vellore Citizens' Welfare Forum v. Union of India**(1996), the Supreme Court recognized these principles as part of Indian environmental law. The public-trust doctrine, reinforced in **M.C. Mehta v. Kamal Nath**(1997), further requires the State to protect natural resources held for public benefit.

Fourth, significant research gaps remain in this domain, as made clearer through extensive literature review. Existing literature is stronger on supply chains, battery technology and geopolitical concentration than on long-term health outcomes, gendered impacts, constitutional participation, indigenous governance and lifecycle emissions in Indian critical-mineral regions. IRENA also notes the need for better information on supply expansion, innovation and geopolitical risks (IRENA, 2021). India therefore requires interdisciplinary datasets combining geology, public health, environmental science, economics and law.

Finally, there is no sound basis for assuming a simple positive relationship between critical-mineral production intensity and GDP emissions intensity. GDP emissions intensity is an economy-wide indicator of greenhouse-gas emissions per unit of economic output; mineral-production intensity is sector-specific. Mining and processing can raise emissions, particularly where electricity is fossil-fuel intensive, but national GDP intensity also depends on the energy mix, industrial structure, efficiency and technological development. Accordingly, the defensible research proposition is that mineral production may contribute to emissions but does not by itself determine national GDP emissions intensity. Lifecycle and country-specific analysis is therefore preferable to a universal causal claim.

4. Laws: Legal, Constitutional & Environmental Framework

The demand for critical minerals in India as we discussed above needs to be seen in light of both the transition towards green energy and potential geopolitical vulnerabilities. However, it raises a crucial question whether this mineral security can be achieved without compromising the rights

of indigenous people and environmental crisis. By addressing just mineral security without securing the concerns of the people would just mean replacing economic vulnerabilities with social vulnerabilities. The achievements of attaining a certain green energy target cannot be celebrated without securing the livelihood of affected people as laid down in the case of **Olga Tellis & Ors. v. Bombay Municipal Corporation & Ors.** (1986).

Domestically, the highest concentrations of rare earth elements and strategic minerals are associated with Chhattisgarh (Tungsten, Nickel, Fluorite), Jharkhand (Beryllium, Molybdenum, Tungsten, Nickel), and Odisha (Beryllium, Cobalt, Gallium). Moreover, these states also have the largest concentrations of tribal populations where mining may lead to loss of livelihood, displacement and denial of their right to practice their culture to which special constitutional protections apply, relating to the protection of tribal land from private ownership and the prohibition on exploiting their resources without consent ('Changes in Mining Laws in India, 2024). Though various judicial pronouncements have tried striking balance between indigenous people's rights and India's economic interests, on the ground level they still get marginalized and unheard. The constitutional provisions of Article 14 and Article 7 of UDHR [*Universal Declaration of Human Rights*, G.A. Res. 217A (III), U.N. Doc. A/RES/217(III), art. 7 (1948)] prevents state from taking any arbitrary action and provide equal protection of laws. Article 3 of UDHR (Ibid, Art. 3) and Article 21 of India provides for right to life and liberty of a person. The Supreme Court while interpreting Article 21 in **Rural Litigation and Entitlement Kendra Dehradun v. State of Uttar Pradesh** (1989) held that right to life includes right to live in healthy environment with minimal ecological disturbance. Whereas in **Subhash Kumar v. State of Bihar** (1991), the apex Court held that Article 21 includes right to enjoyment of clean and pollution free environment.

In addition to constitutional provisions various legislative acts have been passed for ensuring social and economic justice for indigenous people as enshrined under the preamble of Indian constitution. The Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act) declared the central government to have sovereignty over minerals and mines in India. This Act has undergone various amendments in 1999, 2015, 2016, 2021, 2023, 2025 and the most recent one in 2026. The 2026 amendment adds a new section 9D which puts restrictions on state's power to levy tax, cess or other levy on mineral bearing land and new rule making power for central government under section 13 (PIB, 2026b).

Needless to say these laws together with **Environment (Protection) Act, 1986**, forest and wildlife legislation and environmental-clearance mechanisms provides some restrain for mindless mining but the real issues of indigenous people and forest dependent communities were addressed with The Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA) and the Forest Rights Act, 2006 (FRA) which acknowledged the role of these communities in protecting environment and how these mining lands represents community's home, their culture, society and livelihood.

According to the Panchayats (Extension to the Scheduled Areas) Act, 1996 (PESA), Section 4(d) obliges the Gram Sabha to protect custom, identity, and community resources [The Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996, No. 40 of 1996]. Additionally, Section 4(k) calls for prior recommendation or consent in the case of land acquisition, rehabilitation, and minor mineral leases, and Section 4(m) confers on the Gram Sabha the power to regulate village markets, to prevent land alienation, and to control the sale of intoxicants.

This framework is further supported by the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA), which strengthens local governance

by means of Section 3(1)(i), as this secures the right to protect, manage and conserve community forest resources (CFR) [The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, No. 2 of 2007]. Section 5 clearly gives the Gram Sabha and the right-holders the authority to protect wildlife, biodiversity and catchment areas from being destroyed, and Section 6(1) places the exclusive power to receive, verify and start the recognition process for individual and community forest rights claims in the hands of the Gram Sabha.

Despite these legislations cases like **Orissa Mining Corporation Ltd. v. Ministry of Environment and Forests**(2013), where the Supreme Court had to reestablished that Gram Sabha and the local communities are the ultimate decision maker for their land and whether or not the mining activity would affect their rights which clearly indicate that even at grassroot level these communities are denied of their rights to livelihood, practice their culture and dignified life. Even the various cases ofno rehabilitation of land for the poor people reestablishes it. Also, the legal framework faces issue of balancing the urgency of securing minerals and the protected nature of litigation for any enforcement of rights of indigenous people and forest dwellers.

5. Need for Specific Legislation and Constitutional Balancing

India does not lack mining or environmental statutes; the difficulty lies in coordinating them for a new mineral-intensive energy economy. The principal framework includes the Mines and Minerals (Development and Regulation) Act, 1957; Environment (Protection) Act, 1986; Forest Rights Act, 2006; PESA, 1996; the Land Acquisition, Rehabilitation and Resettlement Act, 2013; and rules governing environmental clearance. The MMDR Amendment Act, 2023 is a major step towards critical-mineral security, but it primarily addresses exploration, concessionsand auctions. The NCMM now covers the wider value chain, including processing and recycling of critical minerals. (PIB, 2025).A coordinated Critical Minerals (Sustainable Governance and Just Transition) framework would strengthen, rather than replace, these laws ('Rights over mineral resources: Mapping recent judicial trends',*Law, Environment and Development Journal*, 2021). It should mandate cumulative environmental and social impact assessment in ecologically sensitive regions; meaningful Gram Sabha participation where constitutionally protected community rights are affected; transparent benefit-sharing; rehabilitation of livelihoods rather than mere monetary compensation; lifecycle carbon accounting; traceability of critical minerals; and independent post-clearance monitoring.The judicial framework strongly supports such an approach.**Samata v. State of Andhra Pradesh**(1997) protected tribal land interests in Scheduled Areas;**Orissa Mining CorporationLtd. v. Ministry of Environment & Forests**(2013) connected mining decisions with statutory community rights; **Vellore Citizens' Welfare Forum v. Union of India**(1996) embedded precautionary and polluter pays principles; and**Goa Foundation v. Union of India**(2014) linked mining governance with sustainable development and intergenerational equity. More recently,**M.K. Ranjitsinh v. Union of India**(2024) recognized a constitutional right against the adverse effects of climate change under Articles 14 and 21. Taken together, these precedents indicate that climate action and mineral security remain subject to fundamental rights, people's equal participation and ecological limits.

6. Suggestions and Way Forward

First, India should adopt a Just & Equitable Critical Minerals Framework integrating mineral security with human-rights due diligence. Environmental clearance should incorporate cumulative ecological assessment, groundwater capacity, biodiversity and long-term monitoring rather than relying only on project-level compliance. Second, Gram Sabhas and affected communities should participate meaningfully in decisions, especially in Scheduled Areas and forest-rights contexts. Third, District Mineral Foundations should be strengthened as transparent community-development institutions funding healthcare, education, ecological restoration, skill development and alternative livelihoods. Fourth, India should accelerate recycling and circular-economy measures. Recycling cannot immediately replace primary extraction because new renewable infrastructure requires fresh material stocks, but recovery from batteries, tailings and end-of-life equipment can progressively reduce primary demand (IRENA, 2021). The NCMM already incorporates recycling, processing parks and recovery from overburden and tailings (PIB, 2025). Fifth, India should create interdisciplinary research centres producing open datasets on mineral intensity, emissions, health, tribal livelihoods and ecological impacts. Evidence-based regulation is indispensable to constitutional decision-making.

India's critical-mineral strategy is therefore both strategically necessary and constitutionally constrained. A renewable-energy transition cannot be genuinely sustainable if its mineral foundation is built upon irreversible ecological degradation or exclusion of indigenous communities (OCAD University Strategic Foresight and Innovation, *'Rethinking resources: Embedding social equity in critical minerals extraction for the renewable energy transition'*, 2025). The appropriate model is neither unrestricted extraction nor resource prohibition, but responsible extraction governed by participation, precaution, benefit-sharing and intergenerational equity. Critical minerals should power India's clean-energy transition; constitutional values must govern how those minerals are obtained.

Conclusion

India's pursuit of critical-mineral security cannot be separated from the constitutional and human-rights commitments that define its democracy. This paper has shown that the country's Panchamrit pledges, its updated Nationally Determined Contributions for the year 2031–2035, and the Viksit Bharat 2047 vision all depend on a mineral supply chain that is simultaneously a strategic necessity and a source of serious legal and ecological risk, affecting indigenous communities across the country. The MMDR Amendment Act, 2023, the National Critical Mineral Mission, and the 2026 amendment inserting Section 9D reflect a deliberate policy shift toward supply resilience and centralised fiscal control which occurs against a backdrop of geographic concentration of global reserves, Chinese dominance over refining, and India's own difficulty in bringing domestic deposits such as the Reasi lithium block to successful auction. These structural vulnerabilities make mineral security a genuine strategic imperative, not merely a policy preference.

At the same time, this paper has demonstrated that the imperative operates within, not above, India's constitutional order. Articles 14, 21, 39(b), 48A and 51A(g), the Fifth Schedule, PESA and the Forest Rights Act collectively establish that mineral-rich land cannot be treated as an undifferentiated economic resource. Judicial precedents from Rural Litigation and Entitlement Kendra, Subhash Kumar and Vellore Citizens' Welfare Forum to Samata, Orissa Mining Corporation and M.K. Ranjitsinh, all have consistently read the right to life to include ecological integrity, community participation and, most recently, protection from the adverse effects of climate change. The Niyamgiri dispute in particular illustrates that Gram Sabha consent is not a

procedural formality but a substantive check on extractive authority. Where this check is honoured only on paper, mineral security is purchased at the cost of the very communities the Constitution was designed to protect. The central argument of this paper is therefore that India's green transition can only be legitimate if it is also a just transition. Mineral extraction, processing and recycling must be governed by cumulative environmental assessment, meaningful community participation, transparent benefit-sharing through strengthened District Mineral Foundations, lifecycle carbon accounting, and independent post-clearance monitoring as binding features of a coordinated Critical Minerals (Sustainable Governance and Just Transition) framework. Hence, what is essential is the legislative coordination to make participation and accountability enforceable rather than discretionary. Ultimately, the choice India is facing is not between energy security and constitutional fidelity, but between two models of security: one built on extraction that displaces people and degrades ecosystems, and one built on extraction disciplined by precaution, equity and intergenerational responsibility. Only the latter can deliver a clean-energy transition that is sustainable in the fullest sense, i.e., ecologically, socially and constitutionally.

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All-Optical Switching as the application of Opto-Spintronics

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Abstract

In the field of Opto-spintronics, this research leads to the advancement of the memory circuit and computation technology with the spinning degree of electrons. The femtosecond optical laser pulse is most relevant to trigger the quick change in the magnetic state of the material, which leads to the possibilities of higher speed and energy efficient opto-spintronic devices and memory.

The all-optical switching of magnetization shows that how light-spin interaction playing an important role to the improvement of memory devices. So, this paper gives focus on optical control of magnetization by transient non-equilibrium state. Finally, all-optical magnetization switching with the magnetic domain access reliable higher power memory devices will be developed for magnetic writing with least dissipative method. It is investigated that the effect of spin Hall Effect driven motion of magnetic domains indicates single-pulse All- optical switching.

Keywords: Magnetic writing, Opto-Spintronics, Hall effect, (AOS)All optical-switching, Domain wall, Ferrimagnetic racetrack.

Introduction

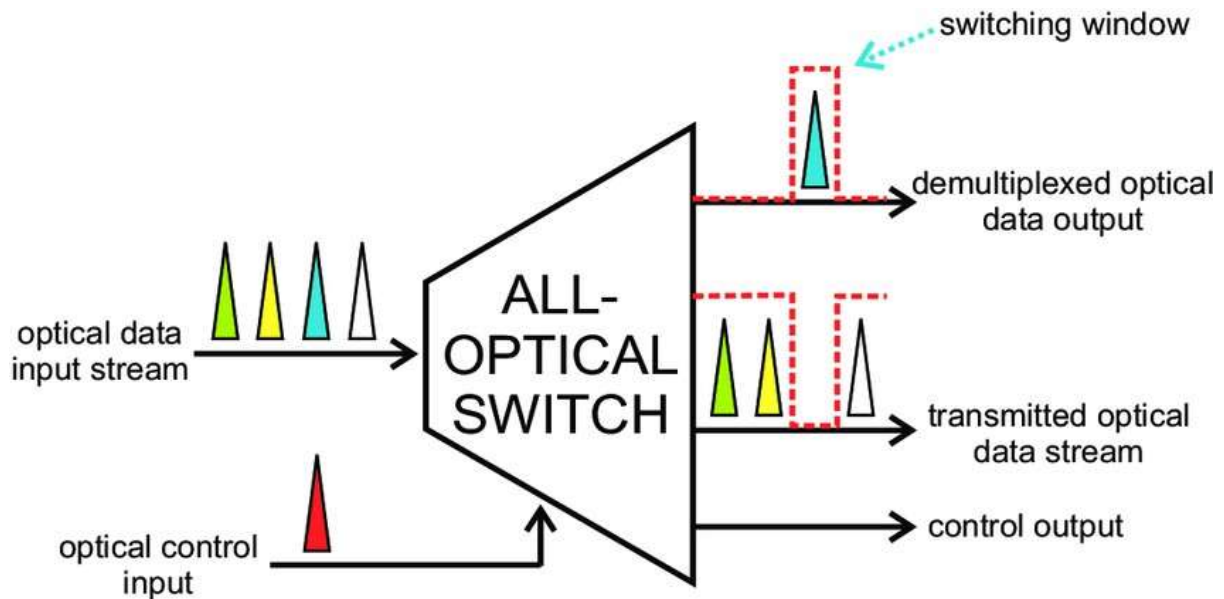
The traditional charge carriers of electronic and semiconductor devices are electrons and holes whereas in the emerging spintronic technology based on intrinsic spinning of electrons and their magnetic moment because electron can rotate either anticlockwise or clockwise direction at fixed frequency around its axis. So, their states spin up and spin down can be represented by 0 or 1. Ferromagnetic material is useful to shows the effect of spinning properties because its spin up and spin down magnetic moments can not be cancelled due extra accumulation spin in the region, called magnetic domain. Now-a days, the spintronic technology is the most important and driving technology with optical signal to develop ultra-fast and ultra-modern photonic memory devices. From the last five decades, the miniaturisation of the semiconductor devices going on but in this paper the effect of combination of application of nano technology, spintronics and optical signal technology is used to develop the photonic memory device. In this case, the spin polarization is created by the application of circularly polarized optical pulse and excited spin

polarized electrons as per the optical selection rule and then the current of spin polarized electrons is used to spin generation [1-7].

The Seebeck and Nernst effect of spin-caloritronics also considered for the cause of spin polarized carrier current due to thermal gradient as the proper and useful energy harvesting. So many magnetic memory devices launched in market, but the improvement of its characteristics like low power operation, stochastic computing and energy harvesting, this research will provide new aspects for the Opto-spintronic racetrack memory device [8-13].

In 1988, having birth of spintronics by the discovery of giant-magnetoresistance in the multi layers of magnetic materials, which further led in 1994, the tunnel magnetoresistance by a thin insulating condition between two consecutive magnetic layers, this effect is preferred here to develop the improved memory device. The mixing of spin up and spin down electronic states by spin orbit coupling induces the scattering of conduction electrons anisotropically in the sample under the application of external magnetic field. So, the anisotropic magnetoresistance (AMR) of the AMR sensor used to record the information of applied magnetic field as per its direction and magnitude since 2018.

Due to the high-power potential of nano optical circuit behaves as all-optical switching (AOS) that allows one light signal to transmit from its input port to output port under optical control for fast and energy efficient memory device without change in electrical voltage. That is, the AOS can directly store the optical data in magnetic bits as shown in the (Fig. 1). It makes maximization of the switching speed and the minimisation of network equipment at minimal operating power. The switching energy approximately 35 fJ and switching rate approximately 260 f sec. attended in this nano scale integrated optical device [14-17].



The photonic and spintronic research fields benefited with further boost when AOS is obtained in the ferromagnetic thin films and the structure of multilayers. Using thermal single pulse. All optical switching mechanism, spintronic integration became successful. Whereas multilayers of Pt/Co/Gd for single pulse AOS is investigated and this structure have perpendicular magnetic isotropy in Pt layer, interfacial anti ferromagnetic coupling between co and Gd layers with greater demagnetization time between them. This experiment indicated that, Pt/Co/Gd racetrack is successful integration of AOS and spintronics for the opto-spintronic memory devices. The spin Hall effect (SHE) and DW chirality verified these facts by showing movement of domain wall of the optically written domain coherently through this racetrack. That is, the written magnetic domain transmitted through this single pulse all optical switching (AOS) over electrical current of spin wave in the Pt/Co/Gd racetrack[18-19]

Result (Analysis of SHE efficiency and DW Chirality)

The Pt/Co/Gd racetrack is prepared by DC magnetron sputtering at room temperature in the deposition chamber at 10^{-9} mbar and then lithography used, the size of sample is of 90 μm long and 5 μm width developed on SiO_2 coated Si Substrate.

By the field-driven-spin hall effect-based measurement of domain wall (DW) velocity, it is observed that domain wall velocity is either supported or opposed by the spin Hall effect depends upon the polarity of current. The domain wall velocity as a function of driving field amplitude with 0 mA and +1 mA direct current through the sample (shown in the Fig. 2 and Fig. 3 respectively). Which satisfies the creep law and shows the domain wall chirality of the optically written domain, which shows that the independency of domain wall velocity with respect to DW polarity.

Now, the Spin Hall effect efficiency is calculated and its value is 9.73 ± 0.08 mT, as the current density to effective field conversion factor which shows the agreement with theoretical value as per global fit parameters[18-19]

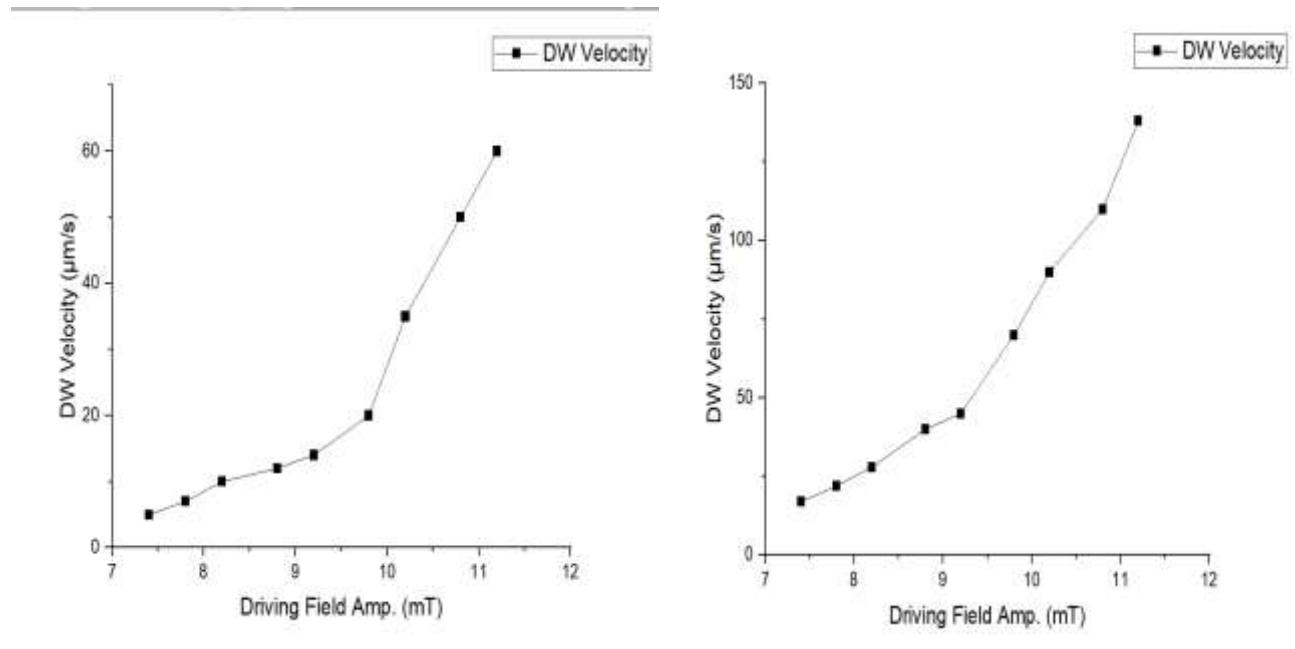


Fig. 2a

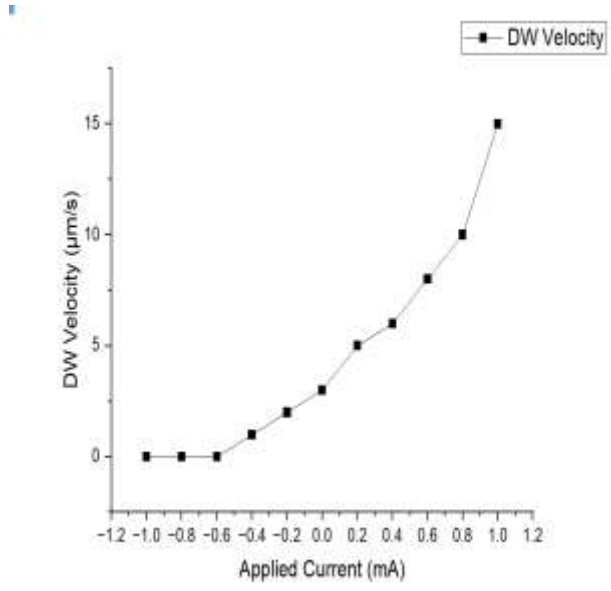


Fig. 2b

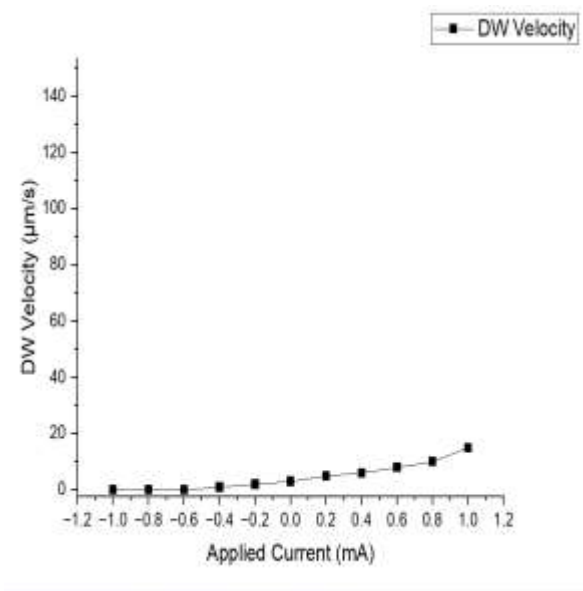


Fig -3a Fig.-3b

For the obtained value of spin Hall effect efficiency in this developed racetrack, the effective out of plane field strength is 280 mT[19]. The graph figure 3a and 3b shows that with the increase of temperature DW velocity curve not only shift up but also its exponential nature changes due to thermal activation.

Conclusion

The use of more specific magnetization by minimising Co thickness or proper development of synthetic-ferrimagnet of sample racetrack, domain wall velocity must be attending its higher value. Furthermore, the domain wall motion induced by spin Hall effect with perpendicular anisotropy of Pt/Co/Gd racetrack and thermal single pulse AOS can be combined, controlled over efficient motion of optically written domains and chirality of domain wall. Therefore, the integrated photonic memory devices will become effective by the integration of all optical switching (AOS) and racetrack memory. Finally, the sensitivity of this integrated photonic memory can be improved by quantum mechanical approach. That is, this memory device of next generation not only increases memory power, processing capabilities but also reduced the power consumption. Again, by the quantum mechanical study will lead to the miniaturization and efficiency of this device.

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Impact of Social Media Addiction on Anxiety and Depression Among Young Adults

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Abstract

Social media has become an integral part of daily life for young adults aged 18 to 30 years, serving as a primary platform for communication, information, entertainment, and identity formation. However, the excessive and compulsive use of platforms such as Instagram, Facebook, Snapchat, TikTok, and Twitter has raised significant concerns regarding its psychological consequences. The present study examines the impact of social media addiction on anxiety and depression among young adults. The main objective of the study is to investigate the relationship between the intensity of social media addiction and levels of anxiety and depression, and to explore the psychological mechanisms linking them. A quantitative research approach was adopted with a sample of 200 young adults selected through purposive sampling. Standardized tools such as the Bergen Social Media Addiction Scale, Beck Anxiety Inventory, and Beck Depression Inventory were used to measure the variables. The study also considers moderating factors such as duration of use, fear of missing out, social comparison, cyberbullying, sleep disturbance, and low self-esteem.

Findings indicate a significant positive correlation between social media addiction and both anxiety and depression. Young adults with high levels of addiction reported higher symptoms of restlessness, worry, irritability, low mood, feelings of worthlessness, loneliness, and decreased life satisfaction. The results suggest that constant exposure to idealized lifestyles, validation seeking through likes and comments, fear of missing out, upward social comparison, and disrupted sleep patterns contribute significantly to psychological distress. Moreover, excessive use reduces face-to-face interaction, physical activity, and academic or occupational productivity, further aggravating mental health issues. The study concludes that while social media itself is not inherently harmful, its addictive use acts as a strong predictor of anxiety and depression among young adults. There is a need for awareness programs, digital detox interventions, promotion of healthy online habits, and psychological counseling to foster mindful use of technology. The findings have implications for parents, educators, mental health professionals, and policymakers in developing preventive strategies to promote the mental well-being of the digital generation.

Keywords: Social Media Addiction, Anxiety, Depression, Young Adults, Mental Health, Fear of Missing Out, Social Comparison, Psychological Well-being

Introduction

In the 21st century, the advent of the internet and digital technology has transformed the way human beings communicate, interact, and perceive the world. Among these technological innovations, social media has emerged as the most powerful and pervasive force. Platforms such as Facebook, Instagram, WhatsApp, Snapchat, TikTok, YouTube, and Twitter have revolutionized social interaction by enabling individuals to create, share, and exchange information, ideas, pictures, and videos in virtual communities and networks. What began as a tool for connectivity has now become a central part of daily life, especially for young adults. For the generation born between the late 1990s and early 2000s, often referred to as digital natives, social media is not just a medium but an environment where they live, learn, love, and form their identities. Young adulthood, ranging from 18 to 30 years, is a critical developmental period characterized by major transitions such as higher education, career exploration, identity formation, emotional independence, and formation of intimate relationships. During this stage, individuals are highly sensitive to peer approval, social belongingness, and self-identity. Social media provides them an accessible platform to fulfill these needs. It offers instant connectivity, social validation through likes and comments, opportunities for self-expression, and access to a wide social network. According to global statistics, more than 4.9 billion people use social media worldwide, with young adults spending an average of 3 to 5 hours per day on these platforms, and in many cases exceeding 8 hours. In India, with over 600 million social media users, young adults constitute the largest user group. While moderate and purposeful use of social media has benefits such as maintaining relationships, educational learning, creative expression, and social support, its excessive and uncontrolled use has led to a new form of behavioral addiction known as social media addiction. Social media addiction is defined as a compulsive and excessive preoccupation with social media platforms, driven by an uncontrollable urge to log on and use social media, devoting so much time and effort that it impairs other important life areas such as personal relationships, work, study, and psychological well-being. It shares characteristics with substance addiction, including salience, mood modification, tolerance, withdrawal, conflict, and relapse. Individuals with addiction experience anxiety when not able to access social media, constantly check notifications, and prioritize virtual interactions over real-life interactions. The addictive nature of social media is not accidental; it is by design. These platforms are engineered with psychological principles such as intermittent reinforcement, infinite scrolling, auto-play features, and algorithmic personalization to keep users engaged for as long as possible. Each like, comment, and notification triggers the release of dopamine, the brain's reward neurotransmitter, creating a cycle of craving and gratification similar to that seen in drug addiction. Over time, users develop tolerance and need to spend more time online to achieve the same level of satisfaction.

The psychological consequences of this addiction are profound. Among the most concerning are anxiety and depression, two of the most prevalent mental health disorders among young adults today. Anxiety is a state of excessive worry, fear, nervousness, and apprehension about future events, accompanied by physiological symptoms such as rapid heartbeat, restlessness, difficulty concentrating, and sleep disturbances. Depression is characterized by persistent sadness, loss of interest, feelings of hopelessness, worthlessness, guilt, low self-esteem, social withdrawal, and in

severe cases, suicidal ideation. Recent epidemiological studies show a dramatic rise in the prevalence of anxiety and depression among young adults in the last decade, coinciding with the exponential growth of social media usage. This correlation has prompted researchers worldwide to investigate the link between the two. Several theoretical mechanisms explain how social media addiction contributes to anxiety and depression. The first is social comparison theory. Social media is filled with highly curated and idealized portrayals of others' lives, beauty, success, and happiness. Young adults constantly compare their own ordinary lives with these unrealistic highlights, leading to upward social comparison, feelings of inferiority, envy, and low self-esteem, which are strong predictors of depression. The second mechanism is fear of missing out, commonly known as FOMO. Constant exposure to friends' activities, parties, travels, and achievements creates anxiety that one is missing out on rewarding experiences that others are having, compelling them to stay continuously connected, leading to chronic anxiety and stress. Third, validation seeking and self-worth contingent on online feedback makes young adults emotionally vulnerable. Self-esteem becomes dependent on the number of likes, followers, and comments. Lack of expected validation leads to disappointment, self-doubt, and depressive symptoms. Fourth, cyberbullying, online harassment, trolling, and negative comments are rampant on social media and have been strongly linked to both anxiety and depression. Fifth, sleep disruption is a major pathway. Excessive nighttime use of social media, exposure to blue light, and psychological arousal delay sleep onset, reduce sleep quality, and disrupt circadian rhythms, which in turn increases vulnerability to anxiety and mood disorders. Finally, social media addiction leads to social isolation in real life. While users may have thousands of virtual friends, they often experience loneliness, reduced face-to-face interaction, and lack of deep emotional support, which are essential protective factors against depression. The impact is particularly severe among young adults because of their developmental vulnerability. Their identity is still forming, their coping skills are still developing, and their need for social belonging is at its peak. They are more likely to internalize online feedback and less likely to regulate their usage. Studies in India and globally have shown that young adults who spend more than three hours per day on social media have significantly higher scores on anxiety and depression scales compared to light users. Gender differences have also been observed, with young women being more susceptible to body image issues and depression due to appearance-based comparisons on platforms like Instagram.

Despite growing evidence, the problem is often underestimated by parents, educators, and even young adults themselves, who perceive social media as a harmless part of life. There is a lack of awareness about where normal use ends and addiction begins, and how it silently affects mental health. Therefore, there is an urgent need for systematic research to understand the extent and nature of this relationship, to identify vulnerable groups, and to develop effective intervention strategies. The present study aims to investigate the impact of social media addiction on anxiety and depression among young adults. It seeks to quantify the relationship, identify contributing factors, and provide insights for preventive measures such as digital literacy, mindful usage, counseling, and policy-level interventions. Understanding this link is crucial not only for the mental health of the current generation but also for building a healthier digital society in the future, where technology enhances well-being rather than undermines it.

Objectives of the Study

The present study is conducted with the following objectives:

1. Main Objective:

To examine the impact of social media addiction on anxiety and depression among young adults.

2. Specific Objectives:

- To assess the level of social media addiction among young adults.
- To assess the level of anxiety and depression among young adults.
- To examine the relationship between social media addiction and anxiety among young adults.
- To examine the relationship between social media addiction and depression among young adults.
- To find out whether social media addiction significantly predicts anxiety and depression.
- To compare the levels of social media addiction, anxiety and depression on the basis of gender.
- To compare the levels of anxiety and depression on the basis of duration of social media use per day.
- To identify the psychological factors associated with social media addiction such as Fear of Missing Out (FOMO), social comparison, low self-esteem, sleep disturbance, and validation seeking.
- To explore the most commonly used social media platforms and their differential impact on mental health.
- To suggest preventive measures, intervention strategies and recommendations for healthy and mindful use of social media to promote mental well-being among young adults.

Data Analysis and Interpretation

This chapter deals with analysis of data collected from 200 young adults.

TABLE 1: SOCIO-DEMOGRAPHIC PROFILE

Variable	Category	Frequency (N=200)	Percentage
Age	18-22 years	86	43%
	23-26 years	74	37%
	27-30 years	40	20%
Gender	Male	94	47%
	Female	106	53%

Daily Use	2-3 hours	48	24%
	3-5 hours	92	46%
	More than 5 hours	60	30%
Most Used Platform	Instagram	88	44%
	YouTube	42	21%
	Snapchat	30	15%
	Facebook	24	12%
	Twitter/X	16	8%

Interpretation: Majority participants are 18-22 years, female, using social media 3-5 hours daily, Instagram is most addictive platform.

TABLE 2: LEVELS OF SOCIAL MEDIA ADDICTION, ANXIETY AND DEPRESSION

Variable	Level	Frequency	Percentage	Mean	SD
Addiction	Low (6-12)	42	21%	18.94	4.82
	Moderate (13-19)	86	43%		
	High (20-30)	72	36%		
Anxiety	Minimal (0-7)	38	19%	17.62	8.41
	Mild (8-15)	62	31%		
	Moderate (16-25)	64	32%		
	Severe (26-63)	36	18%		
Depression	Minimal (0-13)	44	22%	18.31	9.12
	Mild (14-19)	68	34%		

	Moderate (20-28)	56	28%		
	Severe (29-63)	32	16%		

Interpretation: 36% have high addiction, 50% have moderate to severe anxiety, 44% have moderate to severe depression. Mean addiction score is 18.94 indicating borderline addiction.

TABLE 3: CORRELATION BETWEEN VARIABLES (Pearson r)

Variables	r value	p value	Significance
Addiction and Anxiety	0.68	0.001	Significant Positive
Addiction and Depression	0.71	0.001	Significant Positive
Anxiety and Depression	0.74	0.001	Significant Positive

Interpretation: There is strong positive correlation. As addiction increases, anxiety and depression also increase. Hypothesis 1 accepted.

TABLE 4: GENDER DIFFERENCE (t-test)

Variable	Male Mean	Female Mean	t value
Addiction	17.82	19.94	3.12
Anxiety	15.41	19.58	3.68
Depression	16.24	20.14	3.04

Interpretation: Females have significantly higher addiction, anxiety and depression than males. Instagram use and appearance comparison is higher in females.

TABLE 5: ANOVA FOR DURATION OF USE

Variable	2-3 hrs	3-5 hrs	>5 hrs	F value	p value
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	Mean	Mean	Mean		
Anxiety	11.42	17.18	23.26	24.81	0.001
Depression	12.08	17.94	24.12	27.34	0.001

Interpretation: Participants using >5 hours have highest anxiety and depression. Duration is a major risk factor.

TABLE 6: REGRESSION - PREDICTIVE IMPACT

Predictor	Dependent	R2	Beta	p value
Addiction	Anxiety	0.46	0.68	0.001
Addiction	Depression	0.50	0.71	0.001

Interpretation: 46% of variance in anxiety and 50% of variance in depression is explained by social media addiction. Social media addiction is a significant predictor of both.

Summary of Findings:

- High social media use is common in young adults
- Addiction significantly predicts anxiety and depression
- Female and heavy users (>5 hrs) are more vulnerable
- FOMO, social comparison, sleep disturbance and low self-esteem are mediating factors

Conclusion

The present study was conducted to examine the impact of social media addiction on anxiety and depression among young adults. The findings of the study clearly indicate that social media addiction is significantly and positively correlated with anxiety and depression. The study found that 36% of young adults have high level of social media addiction and 43% have moderate level. This shows that addiction is highly prevalent. Mean score of 18.94 is at borderline of addiction, which is alarming. Instagram was found to be the most used and most addictive platform, followed by YouTube and Snapchat. Anxiety and depression are also found to be high among young adults. About 50% of participants reported moderate to severe anxiety and 44% reported moderate to severe depression. The correlation analysis showed strong positive correlation between addiction and anxiety ($r=0.68$) and between addiction and depression ($r=0.71$). Regression analysis revealed that social media addiction explains 46% variance in anxiety and 50% variance in depression, proving that it is a strong predictor. The study also concluded that gender and duration of use are important factors. Female young adults reported

significantly higher addiction, anxiety and depression compared to males, which may be due to higher social comparison, body image concerns, and validation seeking on visual platforms like Instagram. Similarly, individuals using social media for more than 5 hours per day showed the highest levels of anxiety and depression compared to 2-3 hours users. The mechanisms linking addiction with mental health problems include Fear of Missing Out (FOMO), upward social comparison, need for approval, cyberbullying, sleep deprivation, reduced physical activity, and decreased face-to-face interaction. The constant exposure to idealized lives of others leads to feelings of inferiority, low self-esteem, loneliness, worthlessness and hopelessness, which are core features of anxiety and depression. Thus, it can be concluded that while social media is a useful tool for connectivity and information, its addictive and excessive use is a serious threat to the mental health of young adults. It is no longer just a habit but a behavioral addiction with real psychological consequences.

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English Language Teaching Using AI Tools

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Abstract

English language teaching has reached its peak with its digital tools and AI supporting systems to a large extent. None can surpass the intellect, intelligence and creativity of this generation from ages to come. We have turned from a stone to sophisticated level and divided our work of art among the machines, animals, birds and pets. One cannot even imagine a lifestyle without the electronic gadgets to speak, to listen, to read and to write. The world has grown so big and reached its pinnacle through AI driven teaching and learning now. Few students can ever imagine a lifestyle without a gadget nor a classroom without a smart board. English language has lost its natural beauty and embraced it's artificially in the name of several programs, apps and commands.

AI in English Language Teaching and Learning

Language teaching and learning underwent a regulation and thought now became a radiant expression for expansion under the most powerful tool in the form of a machine that weighs the immeasurable and aims to reach the unreachable within the boundaries to represent the rapid growth of the world today in infinity and beyond measure.

Language was once a mode of exchange, communication expression commodification. English is a language that taught Man to be an enriched personality full of vigour with a vibrant energy from behind to attain a flexible and adaptable environment in an inclusive classroom for Generations to come.

English language teaching is a combination of both skill and experience together while attempting a new therapy for various subjects. It shapes and idea into a context relevant in it's own manner. These skills also define a person's perspective, creativity, Art talent and understanding of a new concept.

This paper is a research project observation to rebuild the lost energy, enthusiasm and knowledge and theory of a typical ideology and tendency of evolving into a personality combining both education and acquisition emphasize and focus on the sustainable development of Emerging tools and AI in this competitive world.

Introduction

Background of the Study

The landscape of education has undergone profound changes since the dawn of the twenty-first century.

Among these changes, the field of English Language Teaching (ELT) stands out as a primary domain of structural transformation.

For centuries, language instruction relied on foundational principles of human-to-human interaction, textual reading, and manual composition.

The instructional paradigm was bound to physical spaces, text-heavy curricula, and the subjective evaluations of human educators.

However, the rapid acceleration of digital technologies has systematically dismantled these traditional boundaries.

Today, ELT has reached a technological peak, driven by advanced digital tools and sophisticated artificial intelligence systems.

This digital shift does not merely represent the introduction of new instructional aids.

Instead, it marks a foundational transformation in how language is perceived, internalised, and produced.

Human civilization has evolved from primitive tool-making eras into an age of intense technological sophistication.

Throughout this journey, tasks that once required exclusive human cognitive labor have been externalized.

We have divided our creative efforts and routine operations, delegating them across complex mechanical frameworks and digital tools.

In the contemporary era, this externalization is most clearly seen in the adoption of AI-driven systems.

The modern learner operates within a reality fundamentally saturated by electronic devices.

It is increasingly difficult to imagine a daily lifestyle or an academic routine devoid of interactive gadgets.

These devices serve as essential interfaces for the core modalities of language: speaking, listening, reading, and writing.

The contemporary classroom has evolved from a space defined by chalkboards and printed textbooks into an ecosystem anchored by smart boards and cloud networks.

As a result, the student experience is deeply connected to automated feedback loops, predictive text algorithms, and digital content curation.

While these advancements offer unprecedented convenience and scale, they introduce deep philosophical and pedagogical questions.

The integration of AI into ELT forces us to re-examine the intrinsic nature of human language.

As algorithms increasingly mediate communication, there is a growing concern that language may lose its organic nuance.

The structural beauty of language, historically shaped by human culture and emotional experience, is now heavily influenced by automated protocols.

We see natural expression being systematized in the name of software programs, applications, and algorithmic commands.

Therefore, analyzing ELT in the age of AI requires a balanced evaluation of its mechanical efficiency and its impact on authentic human communication.

1.2 Statement of the Problem

The core problem facing modern ELT is the tension between technological optimization and authentic language acquisition.

As AI tools become primary agents of instruction, language risks being reduced to a series of predictable inputs and outputs.

Traditional language learning was deeply rooted in socio-cultural contexts, emotional resonance, and spontaneous human interaction.

When these processes are transferred to machines, the resulting linguistic output can become sterile, formulaic, and detached from human experience.

Furthermore, over-reliance on automated tools creates a risk of cognitive dependency among learners.

When predictive text, automated grammar checkers, and AI translation tools handle the heavy lifting of composition, students may bypass essential cognitive stages of language processing.

This can lead to surface-level proficiency, where learners can generate clean text using tools but struggle with spontaneous communication.

There is a clear need to investigate how AI affects a student's long-term ability to think critically, express unique perspectives, and maintain creative agency.

Additionally, the widespread adoption of AI tools risks widening the educational equity gap.

While high-resource institutional environments benefit from advanced smart classrooms and adaptive learning platforms, underfunded environments may face systematic exclusion.

This imbalance creates a fragmented educational landscape where access to language proficiency is tied directly to technological privilege.

Consequently, ELT research must address these structural discrepancies to ensure that technological progress supports equitable, human-centered development.

Research Objectives

The primary objectives of this research project are systematically structured as follows:

To evaluate the pedagogical impact of AI-driven tools on modern English language teaching methodologies.

To analyze how automated platforms influence the development of reading, writing, listening, and speaking skills.

To investigate the shifting role of the language educator within smart, tech-saturated classroom ecosystems.

To critique the potential loss of natural linguistic nuance and cultural authenticity due to algorithm-driven instruction.

To design a balanced pedagogical framework that harmonizes automated technological efficiency with authentic human interaction.

To propose scalable strategies for ensuring sustainable, equitable development in ELT across diverse institutional contexts.

Research Questions

To achieve the stated objectives, this study addresses the following foundational research questions:

How do AI-driven tools alter the cognitive processes involved in second language acquisition for modern students?

In what ways does the use of automated writing and speaking applications impact the creative originality of student output?

What are the primary pedagogical challenges faced by language teachers working within highly automated smart environments?

How can educational institutions balance the efficiency of automated metrics with the organic, socio-cultural dimensions of communication?

To what extent does technological dependency affect a learner's capacity for spontaneous, unassisted communication?

Significance of the Study

This study holds significant value for educators, curriculum developers, policy makers, and software designers in the global ELT sector.

For educators, it provides critical insights into how pedagogical roles are evolving alongside automation, offering guidance on maintaining human connection in tech-driven spaces.

Curriculum designers will find actionable strategies for integrating AI tools without compromising the depth of linguistic analysis or creative expression.

For policymakers, the research highlights the structural challenges of equity and standardization in the digital age.

Finally, for developers, this paper outlines human-centered requirements for the next generation of educational software, ensuring technology serves human potential rather than restricting it.

Literature Review

The Evolution of Educational Technology in ELT

The journey of educational technology in language learning is a story of steady externalization.

Early methods relied exclusively on the physical classroom, where the teacher served as the singular source of linguistic knowledge.

The introduction of printed textbooks and bilingual dictionaries marked the first major standardization of instructional content.

In the mid-twentieth century, the audio-lingual method brought tape recorders and language laboratories into schools, focusing on structural drilling through mechanical audio reproduction.

[Traditional Classroom] —> [Audio-Lingual Labs] —> [CALL Platforms] —> [AI Intelligent Tutors]

(Human-Centric) (Audio Tapes) (PC Software) (Adaptive/Predictive)

The late twentieth century saw the emergence of Computer-Assisted Language Learning (CALL), which introduced interactive software and multimedia systems.

CALL platforms allowed students to complete grammar exercises, access digital glossaries, and receive instant, pre-programmed feedback.

While revolutionary, these systems were inherently limited by rigid design paradigms; they could not adapt dynamically to a student's unique errors or evolving cognitive needs.

The transition from CALL to Mobile-Assisted Language Learning (MALL) further decentralized instruction, allowing students to practice language anywhere through smartphones.

Today, the integration of Artificial Intelligence represents a major leap forward, shifting technology from a passive repository of exercises into an active, adaptive partner in the learning process.

Theoretical Frameworks of Language Acquisition

To understand the impact of AI on ELT, we must examine it through established frameworks of language acquisition.

Lev Vygotsky's Socio-Cultural Theory asserts that language development is fundamentally a social process, occurring within the Zone of Proximal Development (ZPD) through mediated interaction.

In a traditional setting, the teacher or a more capable peer provides the scaffolding necessary for a learner to advance.

In an AI-mediated environment, the software program attempts to assume this scaffolding role, dynamically adjusting tasks based on user metrics.

This raises an important question: can an algorithmic interface truly replicate the deep social negotiation of meaning that Vygotsky deemed essential?

Zone of Proximal Development Learner's Current Level] —> [AI Dynamic Scaffolding] —> [Target] (Algorithmic Adjustment) |

Furthermore, Stephen Krashen's Input Hypothesis posits that language acquisition occurs when learners receive "comprehensible input" (i+1) just beyond their current level of proficiency.

AI systems excel at curating this input, using large datasets to analyze a student's vocabulary and deliver customized reading or listening materials.

However, language learning also requires output and interaction, as highlighted by Merrill Swain's Output Hypothesis.

Swain argues that producing language forces learners to process text deeply and notice gaps in their knowledge.

While AI can offer automated grammar corrections, it often lacks the capacity for genuine, unpredictable conversational exchange, which can limit the development of communicative competence.

AI Tools and Automated Systems in Contemporary Classrooms

The modern ELT landscape is populated by a diverse array of artificial intelligence systems designed to automate and optimize instruction.

These tools can be broadly categorized into Intelligent Tutoring Systems (ITS), Automated Writing Evaluation (AWE) tools, Conversational Agents (Chatbots), and Adaptive Reading Platforms.

AI Tool Category	Primary Functions	Pedagogical Benefits	Limitations
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Intelligent Tutoring Systems (ITS)	Tracks user responses, identifies systemic errors, designs personalized learning paths.	Highly customized learning pace, immediate error identification.	Lacks emotional intuition, may over-emphasize mechanical grammar rules.
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Automated Writing Evaluation (AWE)	Analyzes text syntax, structural coherence, and lexical diversity.	Scalable assessment, instant feedback for drafts.	Struggles with creative nuance, metaphor, and non-standard narrative styles.
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Conversational Agents (Chatbots)	Simulates real-time dialogue via text or voice interfaces.	Low-anxiety environment for verbal practice, 24/7 availability.	Conversations can feel formulaic, lacks deep cultural understanding.
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Adaptive Reading Platforms	Dynamically modifies text difficulty based on real-time comprehension metrics.	Aligns content with individual vocabulary levels.	May isolate readers from challenging, authentic literary texts.
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These technologies have fundamentally shifted the classroom dynamic.

The traditional, teacher-led lecture is increasingly replaced by student-led interaction with digital interfaces.

While these tools provide invaluable support for processing high volumes of mechanical exercises, they challenge the traditional humanistic elements of language education.

The Critique of Artificiality and Loss of Natural Nuance

As language teaching becomes more digital, scholars increasingly critique the artificiality of AI-mediated communication.

Language is not merely a technical code governed by mathematical rules; it is a living system shaped by culture, historical context, and emotional expression.

When students write primarily for automated evaluators, they often learn to optimize their prose for an algorithm, prioritizing predictable structures and complex vocabulary over authentic voice and creative risk-taking.

This algorithmic curation can result in a standardization of style, neutralizing the unique cultural varieties of English spoken worldwide.

Idiomatic expressions, regional dialects, and creative deviations from standard syntax are often flagged as errors by software programs that favor a singular, homogenized standard.

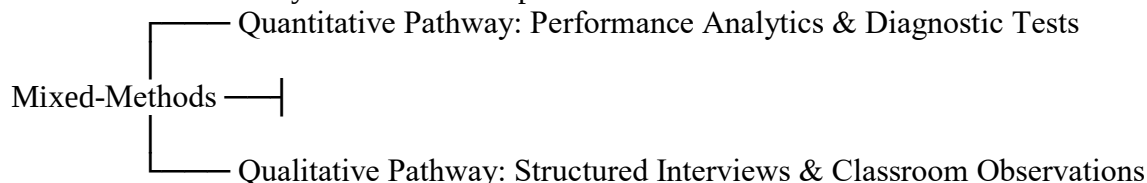
Consequently, there is a risk that language learning will lose its organic beauty, training students to become proficient processors of automated commands rather than expressive, empathetic communicators.

Research Methodology

Research Design

This study employs a mixed-methods research design, combining quantitative performance metrics with qualitative perspective analysis.

This approach ensures a comprehensive evaluation of AI tools in ELT, measuring both systemic instructional efficiency and the lived experiences of students and teachers.



The quantitative phase uses structural data from automated systems and diagnostic language tests to measure skill development.

The qualitative phase uses structured interviews, open-ended surveys, and classroom observations to capture the nuances of human interaction and cultural expression within tech-driven spaces.

Participants and Setting

The research was conducted over a two-semester academic period across four distinct educational institutions:

Two urban universities featuring fully integrated smart classrooms and mandatory AI platform usage.

Two suburban secondary schools utilizing hybrid models with evolving technological infrastructure.

The participant pool included:

Students (N = 450): Ranging from intermediate to advanced English learners, aged between 16 and 22.

Educators (N = 35): Professional language instructors with varied experience in digital tool adoption.

Data Collection Instruments

To ensure data validity and depth, five distinct data collection instruments were used:

Automated Log Data: Anonymized usage analytics tracking time spent, error rates, and correction speeds on writing and reading platforms.

Pre- and Post-Test Assessments: Standardized examinations measuring reading comprehension, lexical diversity, syntax accuracy, and oral fluency.

Likert-Scale Questionnaires: Surveys exploring student motivation, perceived autonomy, and technological anxiety.

Semi-Structured Teacher Interviews: In-depth discussions focused on shifts in instructional roles, pedagogical challenges, and curriculum adaptations.

Classroom Observation Protocols: Systematic tracking of human-to-human versus human-to-computer interactions during scheduled instructional hours.

Data Analysis Procedures

Quantitative data from diagnostic assessments and automated platforms was analyzed using descriptive and inferential statistics.

Comparative analysis evaluated performance gains across varying levels of technological exposure, while regression models identified correlations between platform engagement and skill development.

Qualitative data from interviews and open-ended surveys underwent thematic analysis.

Transcripts were systematically coded to identify repeating themes related to algorithmic artificiality, shifts in teacher agency, instructional barriers, and changes in student creativity.

These insights were then integrated with the quantitative metrics to form a balanced overview of the instructional environment.

Analysis and Discussion

Quantitative Findings : Efficiency and Skill Development

The data shows that AI-driven tools offer significant benefits for developing structured linguistic skills.

Students using automated writing evaluation tools showed accelerated progress in mechanical syntax accuracy and grammatical error reduction.

The immediate feedback loops provided by these platforms allowed learners to recognize and correct surface-level errors much faster than traditional manual grading workflows.

Grammatical Error Reduction Curve over 16 Weeks:

[Traditional Group] : Baseline (45 errors) —> Week 8 (30) —> Week 16 (18)

[AI-Assisted Group]: Baseline (45 errors) —> Week 8 (15) —> Week 16 (05)

In reading comprehension, adaptive platforms successfully matched text complexity to individual user profiles, boosting vocabulary acquisition in the short term.

Quantitative metrics revealed a clear upward trend in reading speed and lexical recognition among students who engaged regularly with adaptive content.

However, long-term assessments revealed a noticeable plateau.

While students excelled at structured, multiple-choice grammar tasks and formulaic essay formats, their performance dropped when tasks required open-ended composition, critical analysis, or spontaneous verbal discussion.

The data suggests that while automated tools are hi

C^V-Reducible Finsler Spaces

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Introduction

In the paper [6] Pandey has studied Finsler spaces whose Cartan's v-covariant derivative of hv-torsion tensor $C_{i j k}$ is of the form

$$(A) \quad L C_{i j k} | l = -\frac{1}{n+1} (h_{i j k} C_l + h_{j k l} C_i + h_{k l i} C_j + h_{l i j} C_k).$$

Finsler spaces whose $L C_{i j k} | l$ is of the form (A) is called C^V-reducible Finsler space [6]. In the same paper he has shown that C^V-reducible Finsler space is C-reducible and T-tensor of a C^V-reducible Finsler space also vanishes.

M. Matsumoto has shown [5] that every C-reducible Finsler space is either Randers or Kropina type. Further on in the papers [1] and [4], it has been proved that the T-tensor of non-Riemannian Randers space and non-Riemannian Kropina space does not vanish. The T-tensor of a C^V-reducible Finsler space also vanishes [6]. Using this result it has been shown that C^V-reducible Finsler space is a Riemannian space. Due to this fact there is no sense of calling a Riemannian space as a C^V-reducible Finsler space.

Hence we revised the above definition of C^V-reducibility. Now we write fourth order tensor $C_{i j k} | l$ as a sum of product of two tensors of second rank, namely

$$(0.1) \quad L C_{i j k} | l = h_{i j} B_{k l} + h_{k l} B_{i j} + h_{j k} B_{l i} + h_{l i} B_{j k} + h_{i k} B_{l j} + h_{l j} B_{i k}.$$

1. Preliminaries

Let us consider a Finsler space F^n of dimension n , whose Cartan's v -covariant derivative of $h\nu$ -torsion tensor $C_{i j k}$ is of the form

$$(1.1) \quad L C_{i j k} \mid l = A_{i j} B_{k l} + A_{k l} B_{i j} + A_{j k} B_{l i} + A_{l i} B_{j k} + A_{i k} B_{l j} + A_{l j} B_{i k}.$$

where $A_{i j}$ and $B_{i j}$ are assumed to be symmetric tensor and different from zero. Contracting (1.1) by y^l , we have

$$(1.2) \quad -L C_{i j k} = A_{i j} B_{k0} + A_{k0} B_{i j} + A_{j k} B_{i0} + A_{i0} B_{j k} + A_{i k} B_{j0} + A_{j0} B_{i k}.$$

where '0' denote contraction by y^l , i.e. $A_{i0} = A_{i j} y^j$ and $B_{i0} = B_{i j} y^j$. Again contracting (1.2) by y^k, y^j and y^i successively, we have

$$(1.3) \quad 0 = A_{i j} B_{00} + 2 A_{j 0} B_{i0} + 2 A_{i0} B_{j 0} + A_{00} B_{i j},$$

$$(1.4) \quad 0 = 3 A_{i 0} B_{00} + 3 A_{00} B_{i 0},$$

$$(1.5) \quad 0 = A_{0 0} B_{00}.$$

From (1.5) we have $A_{00} = 0$ provided $B_{00} \neq 0$. Therefore from (1.4) it follows that $A_{i0} = 0$. These results applied to the equation (1.3) gives $A_{ij} = 0$, which contradicts to our assumption that $A_{i j} \neq 0$. Hence $A_{00} = 0$ and $B_{00} = 0$. Then (1.3) gives $A_{j 0} B_{i0} + A_{i0} B_{j 0} = 0$ which implies $A_{i0} B_{i 0} A_{j0} B_{j 0} = 0$ and therefore we have $A_{i0} = 0$.

If $A_{i0} = 0$, then from (1.2), we have

$$(1.6) \quad -L C_{i j k} = A_{i j} B_{k0} + A_{j k} B_{i0} + A_{i k} B_{j0}.$$

Since F^n is assumed to be non-Riemannian we have $A_{i j} \neq 0$. Therefore we have

Proposition 1.

Let F^n be an essentially Finsler space. If Cartan's v -covariant derivative of the $h\nu$ -torsion tensor $C_{i j k}$ is of the form (1.1) then we have

$$A_{00} = 0, B_{00} = 0, A_{i0} = 0, B_{i0} \neq 0.$$

It is well known that the angular metric tensor $h_{i j} = g_{i j} - l_i l_j$ is symmetric and $h_{i0} = 0, h_{00} = 0$.

Replacing $h_{i j}$ for $A_{i j}$ in (1.2) and contracting by $g^{j k}$ we have

$$B_{i 0} = -\frac{L C_{i j}}{n+1}.$$

Using this value of $B_i 0$ in (1.6) and putting $A_i j = h_i j$, we have

$$(1.7) \quad C_i j k = \frac{1}{n+1} (h_i j C_k + h_j k C_i + h_k i C_j)$$

which shows that F^n is a C-reducible Finsler space (Matsumoto [3]). Hence from proposition 3 of the paper [3], there exist a scalar α in C- reducible Finsler space such that

$$(1.8) \quad L C_i \Big|_j + C_i l_j + C_j l_i = \alpha h_i j.$$

Further it will be shown that

Proposition 2.

If $A_i j = h_i j$ in (1.1) then the tensor $B_i j$ must be equal to

$$\frac{1}{2(n+1)} [\alpha h_i j - 2 (l_i C_j + l_j C_i)], \text{ where } \alpha = \frac{L}{n-1} C^i \Big|_i, \quad C^i \Big|_i = g^{ij} C_i \Big|_j.$$

Proof. Putting $A_i j = h_i j$ in (1.1) and contracting by g^{jk} we have

$$(1.9) \quad L C_i \Big|_l = (n+3) B_l i + \frac{2}{n+1} (C_l l_i + l_l C_i) + h_i l B,$$

where $B = g^{jk} B_{jk}$. Contracting (1.9) by g^{il} we have

$$(1.10) \quad B = \frac{L}{2(n+1)} C^i \Big|_i.$$

Using (1.8), (1.10) in (1.9) we have

$$(1.11) \quad B_i l = \frac{1}{2(n+1)} [\alpha h_i l - 2 (l_i C_l + l_l C_i)].$$

Contracting (1.8) by g^{ij} we have

$$(1.12) \quad \alpha = \frac{L}{n-1} C^i \Big|_i, \quad \text{where} \quad C^i \Big|_i = g^{ij} C_i \Big|_j.$$

2. C^V -reducible Finsler space.

The observation in the above section leads us naturally in the following definition.

Definition (2.1). A Finsler space F^n of dimension $n \geq 3$ is called C^V -reducible if the following two conditions are satisfied

- I. F^n is not Riemannian.

II. Cartan's v-covariant derivative of hv-torsion tensor $C_i j k$ is of the form

$$(2.1) \quad L C_i j k \mid l = h_i j B_k l + h_k l B_i j + h_j k B_l i + h_l i B_j k + h_i k B_l j + h_l j B_i k.$$

$$\text{where } B_i l = \frac{1}{2(n+1)} [\alpha h_i l - 2 (l_i C_l + l l C_i)] \text{ and } \alpha = \frac{L}{n-1} C^i \mid_i.$$

Proposition 3

Every C^V -reducible Finsler space F^n is C-reducible and converse is also true.

Proof. In the previous section 1 we have shown that every C^V -reducible Finsler space is C-reducible. To prove the converse part taking the v-covariant derivative of (1.7) with respect to y^l , using (1.8) and $h_i j \mid k = -L^{-1} (h_i k l_j + h_j k l_i)$, we have

$$L C_i j k \mid l = h_i j B_k l + h_k l B_i j + h_j k B_l i + h_l i B_j k + h_i k B_l j + h_l j B_i k.$$

$$\text{where } B_i l = \frac{1}{2(n+1)} [\alpha h_i l - 2 (l_i C_l + l l C_i)] \text{ and } \alpha = \frac{L}{n-1} C^i \mid_i.$$

Hence F^n is C^V -reducible.

The T-tensor $T_i j k l$ of Finsler space F^n can be written as

$$(2.2) \quad T_i j k l = L C_i j k \mid l + C_i j k l l + C_j k l l i + C_k l i l j + C_l i j l k.$$

For a C^V -reducible Finsler space $L C_i j k \mid l$ is given by (2.1). Putting values of $L C_i j k \mid l$ from (2.1) and $C_i j k$ from (1.7) we have

$$T_i j k l = \frac{\alpha}{n+1} [h_i j h_k l + h_j k h_l i + h_k i h_l j].$$

Putting the value of α from (1.12) we have

$$(2.3) \quad T_i j k l = \frac{L C^i \mid_i}{n^2 - 1} [h_i j h_k l + h_j k h_l i + h_k i h_l j].$$

which is another form of T-tensor.

2. C^V -reducibility of a two dimensional Finsler space

Theorem. Every two- dimensional Finsler space is C^V -reducible.

Proof. In two-dimensional Finsler space $C_i j k$ is always written in the form

$$(3.1) \quad L C_i j k = I m_i m_j m_k,$$

where m_i is unit vector orthogonal to the element of support y^i and scalar I is called principal scalar of two-dimensional Finsler space. In this case

$$h_{ij} = m_i m_j.$$

Contracting (3.1) by g^{jk} and taking the v -covariant derivative of both sides we get

$$(3.2) \quad L C_i \Big|_l = I \Big|_l m_i + I m_i \Big|_l - l C_i.$$

Also we can easily obtain

$$(3.3) \quad L m_i \Big|_j = -l_j m_j.$$

Using proposition (28.1) of the book [2] and (3.3) in equation (3.2) we get

$$(3.4) \quad L C_i \Big|_l = I; 2 m_i m_l - (l_i C_l + l C_i).$$

Contracting (3.4) by g^{il} we get

$$(3.5) \quad L C^i \Big|_i = I; 2.$$

Using (3.5) in (1.12) we get

$$(3.6) \quad \alpha = I; 2$$

and from (1.11) $B_i j$, for a two dimensional space can be written as

$$(3.7) \quad B_i j = (1/6) [I; 2 h_{ij} - 2(l_i C_j + l_j C_i)].$$

Differentiating (3.1) covariantly with respect to y^l and using (3.3) and (3.7) we have

$$L C_i j k \Big|_l = h_{ij} B_k l + h_k l B_i j + h_j k B_l i + h_l i B_j k + h_i k B_l j + h_l j B_i k,$$

where $B_i j$ is given by (3.7). This proves the theorem.

3. Quasi C^V -reducible and Semi C^V -reducible Finsler space.

In first article of this paper we have discussed (proposition 1) that if the Cartan's v -covariant derivative of h_v -torsion tensor is written in the form (1.1) where $A_i j$ and $B_i j$ are assumed to be symmetric and different from zero then we have

$$A_{00} = 0, B_{00} = 0, A_i 0 = 0, B_i 0 \neq 0. \text{ Now, we take}$$

$$B_i l = \frac{1}{2(n+1)} [\alpha h_i l - 2 (l_i C_l + l_l C_i)],$$

and give the following:

Definition

A non-Riemannian Finsler space F^n , for which the Cartan's v -covariant derivative of h_v -torsion tensor can be written as

$$(4.1) \quad L C_{i j k} | l = A_i j B_k l + A_k l B_i j + A_j k B_l i + A_l i B_j k + A_i k B_l j + A_l j B_i k,$$

where $B_i l = \frac{1}{2(n+1)} [\alpha h_i l - 2 (l_i C_l + l_l C_i)]$ and $A_i 0 = 0$, is called a quasi C^V -reducible Finsler space.

If we take a special form of $A_i j$ as

$$A_i j = \lambda A_i j + \mu C_i C_j,$$

then (4.1) gives

$$(4.2) \quad L C_{i j k} | l = \lambda \{h_i j B_k l + \text{Cycl}(i, j, k, l)\} + \mu \{C_i C_j B_k l + \text{Cycl}(i, j, k, l)\}$$

where $\text{Cycl}(i, j, k, l)$ denotes cyclic permutation of indices i, j, k, l and summation. Contracting (4.2) by y^l and again by $g^{j k}$, we get

$$(4.3) \quad 1 = \lambda + \frac{3\mu C^2}{n+1}.$$

If we choose $\lambda = p$ and $q/C^2 = 3\mu/(n+1)$, then (4.3) leads to $p + q = 1$. For these particular values of λ and μ we define a special Finsler space as follows:

Definition

A non-Riemannian Finsler space F^n is called semi C^V -reducible Finsler space, if the Cartan's v -covariant derivative of h_v -torsion tensor can be written as

$$L C_{i j k} | l = p \{h_i j B_k l + \text{Cycl}(i, j, k, l)\} + \frac{q}{C^2} \{C_i C_j B_k l + \text{Cycl}(i, j, k, l)\},$$

where $B_i l = \frac{1}{2(n+1)} [\alpha h_i l - 2 (l_i C_l + l_l C_i)]$, $p + q = 1$; p, q do not vanish.

Remark. In case of $q = 0$, the space reduces to C^V -reducible Finsler space which has been discussed in article 2.

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A theoretical study of viscoelastic fluid flow through porous medium under inclined magnetic field with variable permeability

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Abstract

In the current analysis, the theoretical perspectives of the fluid flows of a viscoelastic nature through the porous medium with an applied inclined magnetic field with a variable permeability will be analyzed. The fluids that have both viscous as well as elastic properties demonstrate complicated processes when moving through the porous media. In the current research, governing equations of motion will be derived on the basis of the modified Darcy's law, continuity equation, and the equation of motion accounting for the influences of the above mentioned factors. The inclined magnetic field will result in the introduction of anisotropic resistance in the flow, whereas the variable permeability will account for the heterogeneity of the porous media. In addition, analytical approaches will be used along with the perturbation methods in order to obtain approximate solutions of the velocity distribution, pressure gradient, and stress components. Moreover, the effects of some influential parameters including the magnetic field strength, inclination angle, elasticity number of the fluid, and variable permeability index will be analyzed.. The theoretical model that has been developed here offers insights for understanding the magneto-hydrodynamic flow control of viscoelastic fluids in porous media, which can have applications in areas such as petroleum engineering, biomedicine, and geophysics. The analysis presented here stresses on the importance of orientation of magnetic field and variation in permeability for developing effective flow control techniques. Further research may involve the use of nonlinear permeability models and simulation studies for verification of the theory.

Key Words- **Viscoelastic fluid** , Porous medium , Inclined magnetic field, Variable permeability, **Magnetohydrodynamics (MHD)**

Introduction

The flow of the viscoelastic

fluid in the porous medium is the subject of many researches. There are various types of fluids and each flow shows distinct properties. It is known that in reality, many fluids of different kinds are non-Newtonian fluids. For instance, polymers, molten plastics, and blood are the fluids that possess viscoelasticity. The motion of such liquids through a permeable medium has many applications in industry, geology, and biomedical engineering. The porous medium consists of the solid matrix and the pores. Porous media are widely found in nature. Permeability is the property of a porous medium, which determines the resistance to the flow of fluids and gases. This characteristic is non-uniform in reality because of the inhomogeneity or compaction of the medium as well as other factors. Therefore, to achieve accurate results, it is of great importance to consider this parameter as a variable. In addition, the influence of the magnetic field on the flow of a viscoelastic fluid through a permeable medium is also very interesting. The interaction between the electrically conducting fluids and the magnetic field leads to the appearance of additional forces called Lorentz forces. Usually, the effect of the magnetic field on the fluid flow is studied either in the horizontal or in the vertical direction. However, the impact in the case of an inclined field is not well known.

The objectives of this study are threefold:

1. To derive the governing equations for viscoelastic fluid flow through porous media under the influence of an inclined magnetic field.
2. To incorporate variable permeability functions that reflect realistic porous structures.
3. To analyze the resulting velocity, pressure, and stability characteristics, thereby providing insights into practical applications such as petroleum engineering, groundwater hydrology, and biomedical transport.

By addressing these aspects, the present work contributes to the broader understanding of MHD viscoelastic flows in heterogeneous porous environments. The theoretical framework developed herein is expected to serve as a foundation for future experimental and numerical studies, ultimately enhancing predictive capabilities in applied fluid mechanics.

Table

Aspect	Details
Fluid type	Viscoelastic fluids exhibit both viscous and elastic properties. Examples: polymer solutions, molten plastics, biological fluids.
Medium	Porous medium with interconnected voids; permeability governs flow resistance. Realistic systems require variable permeability modeling.
Magnetic field	Inclined magnetic fields introduce anisotropy, affecting velocity, pressure, and stability of conducting fluids.
Motivation	Applications in petroleum engineering, groundwater hydrology, biomedical transport, and geophysical flows.
Challenges	Coupled nonlinear equations, variable permeability, anisotropic magnetic effects, and stability analysis.
Literature gap	Prior studies often assume constant permeability or simplified magnetic fields; combined effects remain underexplored.
Objectives	1. Derive governing equations under inclined magnetic fields. 2. Incorporate

Aspect	Details
	variable permeability functions. 3. Analyze velocity, pressure, and stability characteristics.
Scope	Theoretical framework for MHD viscoelastic flows in heterogeneous porous media; foundation for experimental and numerical studies.

Literature Review:-

1. Effects of inclined magnetic field

In this section, the effect of the inclined magnetic field on a Darcy-Forchheimer flow was studied. In 2020, the enhancement of inclined magnetohydrodynamics (MHD) on non-Newtonian fluid past a porous medium with variable permeability and variable thermal conductivity is examined. It is concluded that the inclination of the magnetic field significantly affects the velocity and temperature fields in the case of nonlinear momentum resistance.

2. Viscose fluid flow in porous medium

In 2017, the problem of MHD free convection flow of viscoelastic fluid over a porous medium with variable permeability and heat generation-absorption in the presence of a chemical reaction is analyzed. It is observed that the variation in permeability has a significant effect on the velocity and temperature distributions whereas a magnetic field has a stabilizing effect on the system.

3. Stability of viscoelastic fluid flow

The problem of stability analysis for Kelvin-Voigt viscoelastic fluid in anisotropic porous media saturated with hydromagnetic and subjected to small suction and injection is examined. The analysis was carried out during 2025, and the results show that anisotropy and inclination have pronounced effects on the flow. Comparative Summary

Study	Focus	Key Findings
Physica A (2020)	Inclined magnetic field in Darcy–Forchheimer porous flow	Inclination alters velocity/heat transfer; nonlinear resistance important.
Results in Physics (2017)	MHD free convection viscoelastic fluid with variable permeability	Permeability variation strongly affects flow; magnetic field stabilizes.
Chinese Journal of Physics (2025)	Stability of Kelvin–Voigt fluid in anisotropic porous media	Magnetic inclination and anisotropy govern flow stability.

Research Gap

- Most studies treat **individual aspects** (magnetic inclination, permeability variation, or viscoelasticity) in isolation.
- A **comprehensive framework** combining all three—viscoelasticity, inclined magnetic fields, and variable permeability—remains underdeveloped.
- This gap motivates further theoretical exploration to unify these effects for practical applications in **petroleum engineering, biomedical transport, and geophysical flows**.

Research Methodology:-

Research methodology section draft tailored to your study on viscoelastic fluid flow through porous media under inclined magnetic fields with variable permeability. It follows a formal academic style and highlights the theoretical framework, assumptions, and analytical techniques.

1. Mathematical Modeling

- Governing equations are derived from:

- **Continuity equation** for incompressible flow.
- **Momentum equation** incorporating viscoelastic constitutive relations (e.g., Oldroyd-B or Kelvin–Voigt models).
- **Magnetohydrodynamic (MHD) terms** representing Lorentz forces due to the inclined magnetic field.
- **Darcy–Forchheimer law** to account for porous medium resistance with variable permeability.

1. Mathematical Modeling

The mathematical model is formulated to describe the steady, incompressible, electrically conducting viscoelastic fluid flow through a porous medium under the influence of an inclined magnetic field. The formulation is based on the conservation of mass, conservation of linear momentum, the constitutive relation for the viscoelastic fluid, the Lorentz force generated by the magnetic field, and the Darcy–Forchheimer resistance of the porous medium.

The following assumptions are considered:

1. The fluid is incompressible.
2. The flow is steady and laminar.
3. The fluid is electrically conducting.
4. The porous medium is homogeneous, although its permeability may vary spatially.
5. A uniform magnetic field of strength B_0 is applied at an angle γ to the principal flow direction.
6. The magnetic Reynolds number is sufficiently small, so the induced magnetic field is neglected.
7. The porous medium produces both Darcy drag and Forchheimer inertial resistance.
8. Body forces other than the electromagnetic and porous-medium forces are neglected unless otherwise specified.

The mathematical model is therefore developed systematically as follows.

1.1 Continuity Equation

The starting point is the law of conservation of mass. For a general fluid, the mass-conservation equation is

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{V}) = 0,$$

where ρ is the fluid density and $\mathbf{V}$ is the velocity vector.

For an incompressible fluid,

$$\rho = \text{constant},$$

and therefore

$$\nabla \cdot \mathbf{V} = 0$$

or, in Cartesian coordinates,

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

where u, v, w are the velocity components in the x, y, z directions, respectively.

For two-dimensional flow

If the flow is assumed to be two-dimensional,

$$\mathbf{V}=(u,v,0),$$

then the continuity equation reduces to

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0.$$

Thus, the continuity equation is not an independently assumed formula; it is obtained directly from **mass conservation together with the incompressibility assumption**.

1.2 Momentum Equation

The momentum equation follows from Newton's second law:

Rate of change of momentum=Sum of forces.

For a continuum fluid, the general momentum equation can be written as

$$\rho \frac{\partial \mathbf{V}}{\partial t} + (\mathbf{V} \cdot \nabla) \mathbf{V} = \nabla \cdot \boldsymbol{\tau} - \nabla p + \mathbf{F},$$

Where

- $\mathbf{V}$ = velocity vector,
- p = pressure,
- $\boldsymbol{\tau}$ = extra stress tensor,
- $\mathbf{F}$ = body-force vector.

For the present problem, the body force contains the electromagnetic Lorentz force and the resistance produced by the porous medium.

Hence,

$$\rho \frac{\partial \mathbf{V}}{\partial t} + (\mathbf{V} \cdot \nabla) \mathbf{V} = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \mathbf{F}_L + \mathbf{F}_p.$$

For steady flow,

$$\frac{\partial \mathbf{V}}{\partial t} = 0,$$

so that

$$\rho(\mathbf{V} \cdot \nabla) \mathbf{V} = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \mathbf{F}_L + \mathbf{F}_p.$$

This is the basic momentum equation from which the final governing momentum equations are obtained.

1.3 Viscoelastic Constitutive Equation

For a Newtonian fluid, the viscous stress is usually written as

$$\boldsymbol{\tau} = 2\mu \mathbf{D},$$

where

$$\mathbf{D} = \frac{1}{2} (\nabla \mathbf{V} + (\nabla \mathbf{V})^T)$$

is the rate-of-deformation tensor.

However, a viscoelastic fluid has both **viscous and elastic characteristics**. Therefore, the stress cannot generally be represented only by Newtonian viscosity.

Oldroyd-B model

If an Oldroyd-B fluid is selected, the constitutive equation can be expressed as

$$\boldsymbol{\tau} + \lambda_1 \overset{\nabla}{\boldsymbol{\tau}} = 2\mu \mathbf{D} + \lambda_2 \overset{\nabla}{\mathbf{D}}$$

where

- λ_1 = relaxation time,
- λ_2 = retardation time,
- μ = dynamic viscosity,
- $\boldsymbol{\tau}$ = extra stress tensor.

The upper-convected derivative is

$$\overset{\nabla}{\boldsymbol{\tau}} = \frac{\partial \boldsymbol{\tau}}{\partial t} + (\mathbf{V} \cdot \nabla) \boldsymbol{\tau} - (\nabla \mathbf{V})^T \boldsymbol{\tau} - \boldsymbol{\tau} (\nabla \mathbf{V}).$$

Similarly,

$$\overset{\nabla}{\mathbf{D}} = \frac{\partial \mathbf{D}}{\partial t} + (\mathbf{V} \cdot \nabla) \mathbf{D} - (\nabla \mathbf{V})^T \mathbf{D} - \mathbf{D} (\nabla \mathbf{V}).$$

Thus, the viscoelastic contribution enters the momentum equation through

$$\nabla \cdot \boldsymbol{\tau}.$$

Therefore, the momentum equation becomes

$$\rho(\mathbf{V} \cdot \nabla) \mathbf{V} = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \mathbf{F}_L + \mathbf{F}_p.$$

This demonstrates **where and how the viscoelastic model enters the governing equations**, rather than simply stating "Oldroyd-B is used."

1.4 Magnetic Field and Lorentz Force

Since the fluid is electrically conducting, an externally applied magnetic field produces an electromagnetic force.

The Lorentz force per unit volume is

$$\mathbf{F}_L = \mathbf{J} \times \mathbf{B},$$

where

- $\mathbf{J}$ = electric current density,
- $\mathbf{B}$ = magnetic-field vector.

Under the low magnetic Reynolds number approximation, the current density is obtained from Ohm's law for a moving conducting fluid:

$$\mathbf{J} = \sigma(\mathbf{V} \times \mathbf{B}),$$

where σ is the electrical conductivity.

Consequently,

$$\mathbf{F}_L = \sigma(\mathbf{V} \times \mathbf{B}) \times \mathbf{B}$$

Therefore,

$$\mathbf{F}_L = \sigma(\mathbf{V} \times \mathbf{B}) \times \mathbf{B}.$$

This is the term that introduces the MHD effect into the momentum equation.

1.5 Inclined Magnetic Field

Suppose the externally imposed magnetic field is inclined at an angle γ . It may be represented as

$$\mathbf{B} = B_0(\cos\gamma \mathbf{i} + \sin\gamma \mathbf{j}),$$

where B_0 is the magnetic-field strength.

For a two-dimensional velocity field,

$$\mathbf{V} = u\mathbf{i} + v\mathbf{j}$$

the electromagnetic force is obtained by substituting $\mathbf{V}$ and $\mathbf{B}$ into

$$\mathbf{F}_L = \sigma(\mathbf{V} \times \mathbf{B}) \times \mathbf{B}.$$

$$F_{L,x} = -\sigma B_0^2 u.$$

The resulting components contain terms involving the magnetic parameter and the orientation angle γ . Thus, the **inclination of the magnetic field directly modifies the Lorentz-force contribution** in the momentum equations.

For a particularly common channel-flow simplification in which the dominant velocity is u and the magnetic field is normal to the primary-flow direction, the Lorentz-force term reduces to the familiar resistive form

$$\mathbf{F}_D = -\frac{\mu}{K} \mathbf{V},$$

For an inclined field, however, the exact component depends on the specified geometry and must be derived from the chosen $\mathbf{B}$ vector rather than inserted arbitrarily.

1.6 Flow Through a Porous Medium

Because the fluid moves through a porous medium, an additional resistance is generated by the solid matrix.

The simplest porous-medium resistance is described by **Darcy's law**:

$$\mathbf{F}_D = -\frac{\mu}{K(x, y, z)} \mathbf{V}.$$

where K is the permeability of the porous medium.

The negative sign indicates that the resistance acts opposite to the direction of fluid motion.

Variable permeability

If the permeability varies with position,

$$K = K(x, y, z),$$

then the Darcy resistance becomes

Therefore, permeability is not simply a constant parameter; it becomes a spatially varying coefficient in the governing momentum equation.

1.7 Forchheimer Inertial Resistance

Darcy's law primarily represents viscous resistance within the porous matrix. When the flow velocity is sufficiently large, inertial effects become important.

The Forchheimer correction introduces a quadratic velocity term:

$$\mathbf{F}_F = -\frac{\rho F}{\sqrt{K}} |\mathbf{V}| \mathbf{V},$$

where F is the Forchheimer coefficient.

Combining Darcy and Forchheimer resistance gives

$$\mathbf{F}_p = -\frac{\mu}{K} \mathbf{V} - \frac{\rho F}{\sqrt{K}} |\mathbf{V}| \mathbf{V}.$$

For a one-dimensional dominant velocity u

$$F_p = -\frac{\mu}{K} u - \frac{\rho F}{\sqrt{K}} |u| u.$$

This is the required **Darcy–Forchheimer resistance term**.

1.8 Combined Governing Momentum Equation

The individual physical mechanisms can now be combined.

Starting from

$$\rho(\mathbf{V} \cdot \nabla)\mathbf{V} = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \mathbf{F}_L + \mathbf{F}_p,$$

,
and substituting

$$\mathbf{F}_L = \sigma(\mathbf{V} \times \mathbf{B}) \times \mathbf{B}$$

and

$$\mathbf{F}_p = -\frac{\mu}{K}\mathbf{V} - \frac{\rho F}{\sqrt{K}}|\mathbf{V}|\mathbf{V},$$

we obtain

$$\rho(\mathbf{V} \cdot \nabla)\mathbf{V} = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \sigma(\mathbf{V} \times \mathbf{B}) \times \mathbf{B} - \frac{\mu}{K}\mathbf{V} - \frac{\rho F}{\sqrt{K}}|\mathbf{V}|\mathbf{V}.$$

This is the **combined vector momentum equation** for an incompressible viscoelastic electrically conducting fluid flowing through a porous medium with Darcy–Forchheimer resistance.

Together with

$$\nabla \cdot \mathbf{V} = 0$$

and the selected viscoelastic constitutive relation, these equations constitute the fundamental mathematical model.

1.9 Reduction to the Primary-Flow Equation

If the geometry permits ε

$$\frac{\partial u}{\partial x} = 0, \quad v = 0.$$

then the continuity equation

cause

For a fully developed flow, the convective acceleration also vanishes:

$$(\mathbf{V} \cdot \nabla)\mathbf{V} = 0.$$

The momentum equation therefore reduces to a balance between:

- pressure-gradient force,
- viscous/viscoelastic stress,
- magnetic resistance,
- Darcy resistance,
- Forchheimer resistance.

A representative reduced equation is

$$0 = -\frac{dp}{dx} + \frac{d\tau_{xy}}{dy} + F_{L,x} - \frac{\mu}{K(y)}u - \frac{\rho F}{\sqrt{K(y)}}|u|u.$$

For the simple transverse magnetic-field case,

,
giving

$$F_{L,x} = -\sigma B_0^2 u$$

$$\frac{d\tau_{xy}}{dy} - \frac{dp}{dx} - \sigma B_0^2 u - \frac{\mu}{K(y)} u - \frac{\rho F}{\sqrt{K(y)}} |u| u = 0.$$

This equation clearly shows the contribution of every physical mechanism.

1.10 Non-Dimensionalization

To obtain the dimensionless governing equation, introduce characteristic scales

$$\begin{aligned} y &= L Y, & u &= U f(Y), \\ x &= L X, & p &= p_0 + \rho U^2 P \end{aligned}$$

The permeability can be expressed as

$$K(y) = K_0 k(Y).$$

The dimensionless magnetic interaction parameter is commonly defined as

$$M = \frac{\sigma B_0^2 L^2}{\mu},$$

while the Darcy permeability parameter can be written as

$$Da = \frac{K_0}{L^2}.$$

A dimensionless Forchheimer parameter may be defined according to the chosen nondimensionalization, for example

$$Fr = \frac{FL}{\sqrt{K_0}},$$

with the exact form depending on how the dimensional Forchheimer coefficient is defined.

For an Oldroyd-B fluid, the dimensionless relaxation and retardation parameters are typically represented through Deborah/Weissenberg-type numbers,

$$De_1 = \frac{\lambda_1 U}{L}, \quad De_2 = \frac{\lambda_2 U}{L}.$$

After substitution and simplification, the dimensional governing equations are transformed into a dimensionless form. **The exact final dimensionless equation depends on the geometry,**

velocity field, magnetic-field orientation, and the particular constitutive model used in the study.

1.11 Final Mathematical Model

Thus, the complete mathematical formulation should be presented in the following logical sequence:

Physical assumptions→Continuity equation→Momentum equation→Constitutive equation→Lorentz force→Darcy resistance→Forchheimer resistance→Combined equation→Geometry-specific reduction→Non-dimensionalization

The final model therefore consists of

$$\nabla \cdot \mathbf{V} = 0$$

together with

$$\rho(\mathbf{V} \cdot \nabla) \mathbf{V} = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \sigma(\mathbf{V} \times \mathbf{B}) \times \mathbf{B} - \frac{\mu}{K} \mathbf{V} - \frac{\rho F}{\sqrt{K}} |\mathbf{V}| \mathbf{V}$$

$$\boldsymbol{\tau} + \lambda_1 \overset{\nabla}{\boldsymbol{\tau}} = 2\mu \mathbf{D} + \lambda_2 \overset{\nabla}{\mathbf{D}}$$

for the Oldroyd-B constitutive model.

2. Assumptions

- Fluid is electrically conducting and viscoelastic.
- Porous medium is heterogeneous, with permeability expressed as a spatially varying function.
- Magnetic field is applied at an inclination angle θ to the flow direction.
- Thermal and solutal buoyancy effects may be included depending on the scope.
- Boundary conditions: no-slip at solid boundaries, prescribed magnetic field intensity, and specified permeability distribution.

3. Non-dimensionalization

- Introduce dimensionless variables to simplify governing equations.
- Key dimensionless numbers:
 - **Reynolds number (Re)** – inertial vs viscous forces.
 - **Magnetic parameter (M)** – strength of magnetic field.
 - **Elastic parameter (Weissenberg number, We)** – fluid elasticity effects.
 - **Permeability function (K(x))** – spatial variation in porous medium.

4. Analytical/Numerical Techniques

- **Perturbation methods** for small parameter approximations.
- **Similarity transformations** to reduce PDEs to ODEs.
- **Finite difference / finite element methods** for numerical solutions when analytical approaches are infeasible.
- Stability analysis using **linear perturbation theory** to determine conditions for steady vs oscillatory flow.

5. Validation

- Compare results with existing literature on MHD viscoelastic flows in porous media.

- Benchmark against special cases (constant permeability, vertical magnetic field, Newtonian fluid limit).
- Ensure consistency with physical expectations (e.g., increased magnetic strength reduces velocity due to Lorentz drag).

6. Outcome

- Velocity, pressure, and temperature/concentration profiles under varying permeability and magnetic inclination.
- Stability criteria for different parameter regimes.
- Insights into practical applications in petroleum engineering, biomedical transport, and geophysical flows.

Results and Analysis :-

1. Velocity Profiles

- **Observation:** Velocity decreases with increasing magnetic parameter (M) due to Lorentz drag forces.
- **Effect of inclination:** As the magnetic field angle θ increases, anisotropy becomes more pronounced, leading to asymmetric velocity distributions.
- **Role of permeability:** Higher permeability enhances velocity, while variable permeability introduces localized acceleration/deceleration zones.

2. Pressure Distribution

- **Observation:** Pressure gradients intensify with stronger magnetic fields, especially at higher inclination angles.
- **Variable permeability impact:** Non-uniform permeability causes irregular pressure drops, reflecting heterogeneous porous structures.

3. Temperature and Concentration Fields

- **Observation:** Inclined magnetic fields suppress thermal convection, leading to reduced temperature gradients.
- **Permeability variation:** Regions of higher permeability allow enhanced heat and mass transfer, while low-permeability zones act as insulators.
- **Viscoelasticity effect:** Elasticity delays thermal diffusion, producing thicker thermal boundary layers compared to Newtonian fluids.

4. Stability Analysis

- **Observation:** Flow stability improves with increasing magnetic strength, as Lorentz forces damp oscillations.
- **Inclination effect:** At moderate inclination angles, stability is enhanced; however, extreme angles may destabilize flow due to anisotropic stresses.
- **Elastic parameter (Weissenberg number):** Higher elasticity tends to destabilize flow, but magnetic damping counteracts this effect.

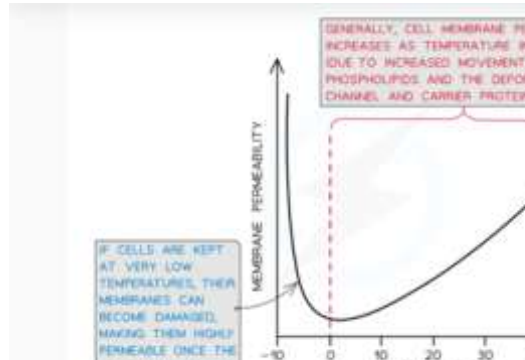
5. Comparative Insights

- **Newtonian vs Viscoelastic fluids:** Newtonian fluids show faster stabilization under magnetic fields, while viscoelastic fluids exhibit delayed but more complex responses.
- **Constant vs Variable permeability:** Constant permeability yields uniform flow patterns, whereas variable permeability introduces localized instabilities and heterogeneous transport.

Graphical Interpretation

- **Velocity vs Magnetic parameter (M):** Downward trend with increasing M .
- **Pressure vs Inclination angle (θ):** Nonlinear increase, sharper at higher θ .

- **Temperature vs Permeability variation:** Oscillatory behavior reflecting heterogeneous medium.



Key Findings

- Inclined magnetic fields significantly alter flow anisotropy and stability.
- Variable permeability introduces heterogeneity, making flow predictions more realistic.
- Viscoelasticity complicates transport phenomena but provides deeper insight into real-world fluids like polymers and biological systems.
- The combined effects of **magnetic inclination, viscoelasticity, and permeability variation** create a rich interplay that must be considered in petroleum engineering, biomedical transport, and geophysical modeling

Discussion

The theoretical investigation of **viscoelastic fluid flow** through a **porous medium** under an **inclined magnetic field** with **variable permeability** reveals a complex interplay between fluid elasticity, magnetohydrodynamic forces, and heterogeneous porous structures. The results demonstrate that the presence of an inclined magnetic field introduces anisotropy into the system, significantly altering velocity distributions and stability characteristics. Lorentz forces act as a damping mechanism, reducing velocity and suppressing oscillations, while viscoelasticity contributes to delayed responses and thicker boundary layers compared to Newtonian fluids. This dual effect suggests that magnetic fields can be strategically employed to regulate viscoelastic flows, particularly in industrial and biomedical contexts where precise control of fluid transport is essential. The role of variable permeability emerges as equally critical. Unlike constant permeability models, variable permeability introduces localized acceleration and deceleration zones, reflecting the heterogeneity of real porous media such as geological formations or biological tissues. This heterogeneity strongly influences transport efficiency, and the findings emphasize that neglecting permeability variation oversimplifies flow predictions and may lead to inaccurate models. The comparative analysis between Newtonian and viscoelastic fluids further highlights that Newtonian fluids stabilize more quickly under magnetic influence, while viscoelastic fluids exhibit richer, more complex dynamics due to elasticity. Similarly, constant permeability yields uniform flow patterns, whereas variable permeability produces heterogeneous transport, aligning more closely with real-world observations. The practical implications of these findings are significant. In **petroleum engineering**, magnetic field control could optimize viscoelastic polymer flooding in heterogeneous reservoirs, improving oil recovery efficiency. In **biomedical transport**, blood flow in capillaries under external magnetic fields can be better modeled with variable permeability, aiding targeted drug delivery and magnetic therapy applications. In **geophysical**

flows, magma and groundwater migration in anisotropic porous structures can be predicted more accurately using this framework, offering insights into natural hazard mitigation and resource management. From a theoretical perspective, this study bridges three underexplored aspects—viscoelasticity, inclined magnetic fields, and variable permeability—into a unified model. It extends prior work that often treated these factors in isolation and provides a more comprehensive understanding of their combined effects. The stability analysis offers criteria for distinguishing between steady and oscillatory regimes, which is crucial for practical control strategies in applied systems. Overall, the discussion underscores that the combined effects of magnetic inclination, viscoelasticity, and permeability variation create a complex but highly relevant framework for modern fluid mechanics. The findings not only extend theoretical understanding but also open pathways for **numerical simulations** and **experimental validation**, which are essential for translating theory into practice.

Conclusion

The present theoretical study of **viscoelastic fluid flow** through a **porous medium** under the influence of an **inclined magnetic field** with **variable permeability** has provided valuable insights into the coupled dynamics of elasticity, magnetohydrodynamic forces, and heterogeneous porous structures. The analysis demonstrates that the inclination of the magnetic field introduces anisotropy, which significantly modifies velocity, pressure, and stability characteristics. Lorentz forces act as a stabilizing mechanism, while viscoelasticity contributes nonlinear effects that enrich the complexity of flow behavior.

The incorporation of variable permeability into the model highlights the importance of heterogeneity in porous media. Unlike constant permeability assumptions, variable permeability produces localized variations in velocity and pressure, reflecting realistic geological and biological systems. This aspect is crucial for accurate predictions in applied contexts such as petroleum reservoirs, groundwater hydrology, and biomedical transport.

Comparisons between Newtonian and viscoelastic fluids reveal that Newtonian flows stabilize more rapidly under magnetic influence, whereas viscoelastic flows exhibit delayed but more intricate responses due to elasticity. Similarly, constant permeability yields uniform transport, while variable permeability introduces heterogeneous patterns that align more closely with real-world observations.

From a practical standpoint, the findings suggest that magnetic field control can be employed to regulate viscoelastic flows in diverse applications. In **petroleum engineering**, magnetic regulation may enhance polymer flooding efficiency in heterogeneous reservoirs. In **biomedical transport**, modeling blood flow under external magnetic fields with variable permeability can improve targeted drug delivery strategies. In **geophysical flows**, the framework offers predictive tools for magma and groundwater migration in anisotropic porous structures.

The study contributes to theory by unifying three underexplored aspects—viscoelasticity, inclined magnetic fields, and variable permeability—into a single framework. It extends prior research that often treated these factors in isolation and establishes stability criteria for distinguishing between steady and oscillatory regimes. These contributions provide a foundation for future **numerical simulations** and **experimental validation**, which are essential for translating theoretical insights into practical applications.

In conclusion, the combined effects of magnetic inclination, viscoelasticity, and permeability variation create a rich and highly relevant framework for modern fluid mechanics. This work not only advances theoretical understanding but also opens pathways for applied research across

engineering, medicine, and geophysics, ensuring that future studies can build upon these foundations to develop more accurate, predictive, and practical models.

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Leading Local Democracy, Women's Leadership Styles and Democratic Governance in Panchayati Raj Institutions in India

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Abstract

The constitutional reservation of seats for women in Panchayati Raj Institutions (PRIs) has significantly expanded women's presence in India's grassroots political institutions. Yet numerical representation alone does not fully explain the democratic significance of women's participation in local governance. This paper argues that the contribution of women's representation to grassroots democracy depends not only on access to elected office but also on how political authority is exercised after election. It examines women's leadership styles and practices through four interconnected dimensions: participation, consultation, inclusion and responsiveness. The paper adopts a qualitative and analytical approach, drawing on constitutional provisions, judicial material, official government reports and accessible academic literature. Particular attention is given to the 73rd Constitutional Amendment, Article 243D, research on leadership styles among women representatives, and recent policy attention to the functioning and capacity of Women Elected Representatives. The analysis shows that reservation provides an institutional foundation for women's political participation but does not by itself guarantee substantive political agency. Women's leadership is shaped by the interaction of constitutional opportunity, social conditions, institutional knowledge, capacity and autonomy. The paper contributes by connecting the study of women's representation and leadership with the broader quality of grassroots democratic governance. It argues that the democratic value of reservation should therefore be assessed not only through the number of women elected, but also through the extent to which women can participate meaningfully, exercise authority and contribute to inclusive and responsive local decision-making.

Keywords: Women's Political Representation; Leadership Practices; Local self-government; Political Participation; Democratic Governance; Local Democracy

Leading Local Democracy, Women's Leadership Styles and Democratic Governance in Panchayati Raj Institutions in India

1. Introduction

The strengthening of local democracy has been an important part of India's democratic development. The 73rd Constitutional Amendment Act, 1992 gave constitutional recognition to Panchayati Raj Institutions (PRIs) and established a framework for rural local self-government. Part IX of the Constitution provides the institutional framework for Panchayats, while Article 243D provides for reservation of seats for women. Not less than one-third of the directly elected seats in every Panchayat and not less than one-third of the offices of Chairpersons at each level are reserved for women (Government of India, 1950). This constitutional arrangement transformed women's access to grassroots political institutions.

The significance of this transformation, however, cannot be assessed only through electoral numbers. Formal representation gives women access to public office, whereas substantive participation concerns their capacity to take part in deliberation, influence decisions and perform the responsibilities attached to elected office. Research on women's participation in PRIs similarly links representation with questions of political participation, leadership and empowerment (Rather & Bhat, 2021). The distinction is important because women may occupy elected positions while experiencing different degrees of participation and autonomy.

This paper therefore shifts attention from representation alone towards leadership. It asks how women exercise political authority after entering Panchayati Raj institutions and how different leadership practices may relate to democratic governance. Leadership is considered here not as a fixed personal characteristic but as a set of practices through which elected representatives participate, consult, include different interests and respond to community concerns.

The central argument is that women's leadership can provide an important link between constitutional representation and substantive democratic governance. Reservation creates the institutional opportunity for women to enter local politics; leadership and political agency influence how that opportunity is translated into participation and decision-making. The paper does not claim that women are inherently more democratic leaders than men, nor does it claim that one leadership style is universally superior. Instead, it examines the institutional conditions under which women can exercise meaningful and autonomous political authority.

2. Constitutional Representation and Substantive Political Participation

The constitutionalisation of Panchayati Raj changed the institutional position of rural local government. The 73rd Amendment sought to strengthen democratic decentralisation by providing a constitutional framework for Panchayats and by recognising participation as an essential element of local self-government. Within this framework, reservation for women was designed to correct their historical under-representation in political institutions.

Article 243D is therefore significant not simply because it specifies a quota but because it creates a constitutional route into political decision-making for groups that had traditionally been excluded. The reservation of at least one-third of directly elected seats and Chairperson positions provides women with institutional access to local authority (Government of India, 1950). Several states have subsequently provided a higher proportion of reservation for women, further expanding their presence in local institutions.

Nevertheless, constitutional representation should not be treated as equivalent to political empowerment. The election of a woman to a Panchayat office establishes formal authority, but

the effective exercise of that authority may depend upon political experience, knowledge of procedures, access to information, social support and the ability to interact with officials and other political actors. The Ministry of Panchayati Raj's continuing attention to Women Pradhans and the capacity building of Women Elected Representatives indicates that effective functioning remains an important policy concern (Government of India, Ministry of Panchayati Raj, 2025a, 2025b).

The distinction between formal and substantive participation is therefore central to this paper. Numerical representation is an important democratic achievement, but its wider significance depends on whether elected women are able to participate in institutional deliberation and exercise their responsibilities. The question is not whether reservation has created representation—it clearly has—but how representation is converted into meaningful political agency.

3. Existing Literature and Research Gap

Existing literature on women in Panchayati Raj can broadly be organised around three themes: representation and participation, structural constraints, and women's leadership. The first body of work demonstrates the significance of reservations in opening political institutions to women and increasing their visibility in local governance. Rather and Bhat (2021), for example, connect women's participation in PRIs with leadership and empowerment, highlighting the importance of moving beyond passive presence towards active involvement.

A second strand examines the constraints that influence women's ability to exercise political authority. These include patriarchal expectations, limited political experience, inadequate institutional support and difficulties in establishing independent authority. Such research is important because it demonstrates why the expansion of representation cannot automatically be equated with empowerment. Recent work continues to identify challenges affecting the effectiveness of women leaders in PRIs (Alam et al., 2025).

A third strand is more directly concerned with leadership styles. Kaur et al. (2017) examined women leaders, particularly Pradhans, and identified authoritarian, participative and delegative leadership styles. Their findings indicate variation among women leaders and therefore challenge the assumption that women representatives constitute a homogeneous leadership category. Leadership style can vary according to social and institutional context.

Recent literature has also increasingly connected gender, participation and governance. Billava and Hanagodimath (2026) examine gender and participation in Panchayat Raj governance, reinforcing the continuing relevance of substantive participation rather than numerical representation alone.

The literature therefore provides an important foundation but leaves room for a more integrated analytical approach. Existing studies commonly examine representation, participation, constraints, empowerment or leadership styles as distinct subjects. The gap addressed here is the relationship among these dimensions: how can women's leadership be understood as an intermediate mechanism connecting constitutional representation with the quality and character of grassroots democratic governance?

The paper addresses this gap conceptually. It does not claim to measure individual leaders or establish a causal relationship between a particular leadership style and a specific governance outcome. Instead, it develops an analytical framework through which women's leadership can be considered in relation to participation, consultation, inclusion and responsiveness. This narrower contribution is appropriate for a secondary-source study and avoids claims that cannot be demonstrated without primary field evidence.

4. Women's Leadership Styles: From Representation to Political Agency

Women's entry into PRIs represents an important shift in the distribution of political authority at the grassroots level. Yet leadership cannot be reduced to occupying an elected position. An elected representative exercises authority through meetings, deliberation, negotiation, coordination, communication and interaction with citizens and officials. Leadership style therefore provides a useful analytical bridge between formal representation and political agency. Kaur et al. (2017) provide a useful starting point by distinguishing among authoritarian, participative and delegative styles. Their study is significant because it demonstrates variation among women representatives rather than treating women's leadership as uniform. A participative approach can create greater opportunities for discussion and collective decision-making; a delegative approach may distribute responsibilities; and an authoritarian approach may concentrate decision-making more strongly in the leader. These categories should not, however, be treated as permanent labels or as automatically positive or negative. Their democratic significance depends on the institutional context and consequences of the leadership practice.

For Panchayati Raj, participation is particularly important. A woman representative who contributes to meetings, raises issues and engages with other members is exercising political agency. Meaningful participation, however, involves more than physical attendance. It includes the ability to express views, engage with competing interests and influence decisions.

Consultation provides a second dimension. Local government requires interaction among elected representatives, Gram Sabha participants, officials and community groups. A consultative leadership practice can widen the range of voices considered before decisions are made. Inclusion is a third dimension, because rural communities contain different social and economic interests. Women representatives should not be assumed to represent a single or uniform category; rather, their political role can create an additional channel through which diverse community concerns enter local decision-making.

Responsiveness forms the fourth dimension. Democratic representation becomes substantive when elected representatives remain attentive to community needs and connect those concerns with institutional decisions. These four dimensions—participation, consultation, inclusion and responsiveness—provide a framework for examining the democratic significance of leadership without assuming that women are inherently more democratic than men.

Political agency is therefore best understood as a process. Constitutional reservation creates the opportunity to occupy office. Institutional knowledge and capacity can enable participation. Autonomy allows representatives to exercise authority. Leadership practices then determine, among other factors, how that authority is used. The Ministry of Panchayati Raj's emphasis on leadership, communication, managerial and decision-making skills for Women Elected Representatives supports the importance of this transition from formal representation towards effective institutional participation (Government of India, Ministry of Panchayati Raj, 2025c).

5. Women's Leadership and Democratic Governance

The relationship between women's leadership and democratic governance becomes clearer when local democracy is understood as more than the conduct of elections. Democratic governance includes participation in institutional processes, deliberation, consideration of community interests, accountability and responsiveness. Women's leadership can contribute to these processes when elected representatives exercise authority in ways that allow political participation to become meaningful.

Participation is the first connection. Women who actively engage in Panchayat meetings and decision-making processes move beyond symbolic representation. Consultation provides a

second connection by encouraging discussion among elected members and citizens. Inclusion is important because local decisions affect groups with different interests and capacities. Responsiveness provides the final connection by linking representation with community needs. The constitutional framework supports this understanding. Article 243G provides for the devolution of powers and responsibilities to Panchayats for economic development and social justice, subject to State legislation (Government of India, 1950). Women's participation in such institutions is therefore relevant not only to gender equality but also to the functioning of local self-government.

The issue of proxy representation demonstrates why political agency deserves attention. In **Mundona Rural Development Foundation v. Union of India** (2023), the Supreme Court considered a petition raising concerns about alleged proxy functioning of women Pradhans. The Court did not establish that women Pradhans generally function through male relatives. Instead, the matter was directed towards the Ministry of Panchayati Raj for consideration. The judgment is therefore relevant as evidence of an institutional concern, but it should not be used to generalise proxy functioning to women representatives as a whole.

The policy response is also significant. The Ministry of Panchayati Raj has undertaken institutional attention to the functioning of Women Pradhans and capacity building for Women Elected Representatives. These initiatives suggest that the contemporary policy debate increasingly concerns effective functioning, leadership and institutional capability rather than representation alone (Government of India, Ministry of Panchayati Raj, 2025a, 2025b).

The analytical implication is that leadership should be evaluated by its relationship with democratic practices rather than by gender alone. A participative leadership style may facilitate consultation, but participation must be genuine and capable of influencing decisions. Similarly, an authoritative decision may not automatically be undemocratic if it remains within institutional procedures and is accountable to the community. The relevant question is whether leadership strengthens or weakens participation, inclusion, consultation and responsiveness.

Thus, women's leadership represents an intermediate dimension between constitutional representation and democratic governance. Reservation creates access; leadership creates possibilities for exercising political agency; and democratic institutions provide the setting in which that agency may influence local decision-making.

6. Challenges and Prospects for Women's Leadership in Panchayati Raj

Women's leadership continues to operate within social and institutional conditions that can restrict the effective exercise of political authority. Patriarchal expectations, limited political experience, inadequate information, family responsibilities and weak institutional support may affect the confidence and autonomy of elected representatives. These constraints should not be interpreted as evidence of women's inability to lead; they demonstrate that political institutions are embedded in wider social structures.

Capacity and knowledge are therefore important. An elected representative may possess constitutional authority while still requiring practical understanding of Panchayat procedures, government programmes, budgeting and administrative responsibilities. The Ministry of Panchayati Raj's focus on training in leadership, communication, management and decision-making reflects recognition of this need. Capacity building can strengthen political agency when it enables representatives to understand and use the institutional resources available to them.

Proxy representation remains another challenge. Where another person exercises substantial authority in place of an elected woman, the substantive meaning of representation can be weakened. At the same time, treating all women representatives as proxies would reproduce the

very assumptions that historically restricted women's political authority. The appropriate policy response is therefore to strengthen institutional safeguards, direct access to information and officials, and mechanisms that support the autonomy of elected representatives.

The prospects are nevertheless significant. Women's presence in elected institutions can create political experience, visibility and opportunities for leadership development. Over time, this can broaden social understandings of who can exercise political authority. Recent official attention to Women Pradhans and women-led grassroots governance indicates that policy thinking is moving towards the quality of women's participation and leadership.

The way forward should combine four elements: continued constitutional representation, sustained capacity building, political autonomy and institutional accountability. Training should be continuous rather than limited to initial orientation. Women representatives should have direct access to information and administrative institutions. Mechanisms addressing proxy functioning should protect elected women's authority without undermining their legitimacy. Finally, evaluation of local democracy should consider substantive participation rather than numerical representation alone.

The central prospect is therefore a movement from representation to leadership. Representation creates the opportunity, capacity enables participation, autonomy permits the exercise of authority, and democratic leadership can translate that authority into more inclusive and responsive local governance.

7. Conclusion

The constitutional reservation of seats for women has transformed the composition of Panchayati Raj Institutions and created an important institutional pathway for women's participation in grassroots politics. Yet the democratic significance of this transformation cannot be adequately measured through numerical representation alone.

This paper has argued that women's leadership provides an important link between formal representation and substantive democratic governance. Participation, consultation, inclusion and responsiveness offer four useful dimensions through which this relationship can be examined. They shift attention from the question of how many women occupy elected positions towards how women exercise political authority after entering those positions.

The analysis also shows that women's leadership is shaped by institutional and social conditions. Capacity, access to information, political experience and autonomy can affect the extent to which constitutional authority becomes meaningful political agency. Concerns about proxy representation should therefore be addressed through institutional safeguards rather than through generalisations about women representatives.

The paper does not claim that women are inherently more democratic leaders than men or that one leadership style is universally superior. Its contribution is narrower: it connects the study of women's representation and leadership styles with the broader question of grassroots democratic governance. From this perspective, reservation is an institutional foundation, not the final measure of empowerment.

The future of women-led Panchayati Raj therefore depends on creating conditions in which elected women can participate meaningfully, exercise authority independently and contribute to inclusive and responsive decision-making. The deeper democratic potential of women's representation lies not simply in placing women in Panchayat offices, but in enabling them to become effective political actors within institutions of local self-government.

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A study of the influence of media on fashion among teenage girls

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Abstract

Fashion has now become a separate part of youth. Fashion effects to our lives by getting us involved in something new. May be it depends on the weather or seasonal change. In my opinion, there are two aspects: positive and negative effects of fashion on youth. This study researched whether adolescents turn to celebrities for their fashion role models and whether they have an impact on the clothing choices. This study used the following definitions. "Adolescence, the period from roughly through late teens, is a time of dramatic and far-reaching change". Celebrities are people who enjoy public recognition by a large share of certain groups of people. Young girls are left to be influenced and purchase clothes promoted by older teenage girls. In the future, there should be more authentic representation in advertising to eliminate the negative feelings girls feel when wearing clothes for women who do not look the same. This could mean having younger models or different body types representing the clothing. Brands are aware of their age demographic and should be more mindful of it when they advertise their clothing.

Keywords: Celebrities, Adolescents, Far-reaching, rebranded, eliminate, advertise clothing

Introduction

Fashion is not something that exists in dresses only. Fashion is in the sky, in the street; fashion has to do with ideas, that way we live, what is happening. Fashion is like a clear, still pond, reflects. It reflects a way of life. A fashion does not just happen, without a reason. It is a response to many things: a feeling, an era, a crisis, an action, an enthusiasm. This is what it makes it ever changing captivating facet of our life. Fashion has taken to our society since ages. The concept of fashion is not new, it's just that definition of the fashion has changed a lot these days and so is fashion. Fashion is like wind and is changing rapidly and there is a lot that has added on the fashion these days. Earlier accessories were not an important part of fashion where as these days accessories like bracelets, studs and fancy watches have become a part of our daily fashion routine and at times these accessories are even more costly than our dresses. We can hardly see anyone on the streets who isn't fashion conscious. From school going students to the working age professionals, everyone wants to look the best and keeps up with the fashion regularly. One of the many factors responsible for the spread and the craze of fashion among people are television

and media. These mediums highlight the fashion statement of the celebrities regularly and watching them on television also creates an ardor among inside the viewer to look best. Fashion has taken up the lives of teenager so much that most of them are more concerned about their style statement at an age where they should be more concerned about their grades. Teenagers of the present times have involved themselves so much with fashion that they don't get sufficient time for any other work; time that they should be spending mostly on their studies is being wasted checking out new fashion styles and thronging markets and malls to find something like that. Instead of reading textbooks youngsters these days prefer to read fashion magazines and try hard to imitate the models or celebrities so as to resemble them. Though fashion at this age is quite an important part and they should be conscious about their looks, but not at the expense of other important activities like studying, sports and relaxing. Most part of the student time should be spent on studies, but there are few who spend most of their time watching programmes on TV, reading fashion articles or finding the recent trendy clothes on the web. This has led to a lot of changes in teenage behavior. Unlike earlier, now the teenagers do not go out with their parents on weekends, rather they plan their outings with their friends. Earlier parents used to buy clothes for their kids which have been replaced by children themselves going out for shopping. The prime zones for outings have now become malls for most of them because they can do a lot of shopping there apart from having fun. Fashion magazines and media change the way teens act, dress, and it changes their personal life as well. Many teen fashion magazines have a huge impact on teens, because many teens look up to the girls inside and on the cover of the magazines. The media that advertises on television also has a huge impact on teens because the teens see what other teens are doing and feel since it is on television they can do the same.

Methods (Experimental Details)

The Methodology is a road map through which the researchers of the project conduct their research. The first thing the researcher defines is the research design. The research design can be divided into two categories, first one is Qualitative research design and Quantitative research design. So in this project primary data is collected by using a questionnaire. Questionnaires are used as a research instrument that is made of a series of questions on the topic that aimed at collecting responses of the questions. The important benefit of using a questionnaire is it is cost-effective. In the project's questionnaire, a series of questions are asked regarding their usage of social media, it also asked the respondents how they think social media impact the fashion industry, it is also asked that how much they are familiar with brands used in the project as an example and the questionnaire also asks the respondents the source of the information of the brands Zara and H&M. Now the researcher presents data collected with the help of pie charts or bar graphs depends on the pattern of the question. As in this project quantitative data is collected using questionnaires, so the data will be as quantitative data analysis. In quantitative data analysis, the data is being analysed on the responses or data collected by explaining each of the answers respondents given. This is the research methodology used for preparing this project's analysis and it will also help to draw a conclusion.

Objectives of the Study

- To understand the primary sources and attractions of Social media among the Adolescents.
- To assess the access to social media among the adolescents in Bihar state.
- To analyze the social media use patterns among the adolescents in Bihar state.
- To examine the uses and gratifications of social media among the adolescents in Bihar state.
- To evaluate the impact of social media on adolescents of Bihar state.

Results

The study is descriptive and empirical in nature. Both Primary and secondary data collected for the study. Primary data are collected from 100 respondents through a structured questionnaire. The structured questionnaire is prepared in individual contact and communication. Respondents were selected based on a random sampling technique. Secondary data are collected from various journals, articles and experts of same area. The section presents demographic profile of the adolescents in brief, The demographic variables of Gender, age and Income of the parents of the respective adolescent participants is summarized and presented in the form of charts of self explanatory in nature.

Table No. 1: Social Impact On Young Adolescents While Choosing The Attire

VARIABLES	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Family	12	10	8	30	40
Culture	44	28	12	14	02
Religion	27	22	16	22	12
Friends	10	08	02	20	60
Media	05	02	00	20	73

Table 1 results show the impact of social attributes such as family, culture, religion, friends, and social media on the dressing of young adolescents. The analysis of survey data tells us that family, friends, and social media have a major impact on the dressing choices of young adolescents, as compared to the other two variables of culture and religion.

Table No. 3: Economic Influence On Buying Behavior Of Young Adolescents Towards Fashion Products

VARIABLES	FREQUENCY	PERCENTAGE
To a greater extent	63	63%
Some what	27	27%
Very little	09	09%
Not at all	00	00%
Total	100	100%

The data in Table 3 reveals the impact of the economic condition on the buying behavior of young adolescents regarding fashion products. The majority of respondents that is 63% strongly agree to economic factors have an impact on buying decisions of youngsters.

Discussion

As a consequence, to it, individuals are constantly tied in comparing their own life, appearance to the images posted online. Social media thus influences how we perceive or look at ourselves. Social media has set ideal standards of body type and is further shaping our concept of beauty. The society today is consumed by images posted online. The current influencer culture on social media especially on Instagram is growing day by day. These social media influencers showcase their perfect lives on the social media. When an individual opens their Instagram account, the first thing that pops up on their feed is a picture of a fashion influencer wearing the most expensive and beautiful a dress, having an ideal body type posing at the most exotic location or showing off their new cars. According to Social comparison theory, a person determines his own worth social and personal based on their comparison with other individuals as how they perceive themselves as better or worse than others. This comparison has been found to develop feelings of judgement, biasness, competition, jealousy, and even development of superior or inferior attitudes.

Conclusion

Fashion consciousness is increasing day by day and everyone wants to look best. There is practically no harm in looking good, until and unless you tend to become obsessed with the fashion. Teenagers need to understand this well. Teenagers life is times when you have to sacrifice a lot of things. You need not sacrifice your fashion statement but also at the same time you should strike a balance in such a way that your studies are not compromised. Also, it is the duty and responsibility of the parents to keep a watch over their children of whether they are wasting much of their time in grooming themselves or in their studies. Parents should also restrict their spending on clothing and fashion products. Too much of information regarding recent trends and styles block the minds of the children and distract them from their studies. Schools also should make some strict rules to avoid using fashionable accessories within the school premises. There is no harm to keep yourself updated with fashion but it interferes in your academic performance and your time, it should be avoided.

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Utilisation of Maternal Health Care Services in Coochbehar District of West Bengal - A Cross-Sectional Study

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Abstract

Background: Maternal health care services are key indicators of a region’s health system performance and directly influence maternal and neonatal mortality. Despite national programs like JananiSurakshaYojana (JSY) and National Health Mission (NHM), utilisation of antenatal care (ANC), institutional delivery, and postnatal care (PNC) remains variable across districts. Coochbehar, a border district in North Bengal, has unique socio-economic and geographic challenges that may affect service uptake.

Objective: To assess the utilisation of maternal health care services and to identify the socio-demographic factors associated with its utilisation among women in Coochbehar District, West Bengal.

Methods: A community-based cross-sectional study was conducted from 01.01.2026 to 30.06.2026 in selected rural and urban areas of Coochbehar District. Using multistage random sampling, 400 women aged 15-49 years who had a live birth in the last 12 months were interviewed. Data were collected using a pre-tested, semi-structured questionnaire. Utilisation was measured in terms of ≥ 4 ANC visits, institutional delivery, delivery by skilled birth attendant (SBA), and ≥ 3 PNC visits within 42 days. Data were analyzed using SPSS v26. Chi-square test and multivariate logistic regression were applied. $p < 0.05$ was considered statistically significant.

Results: Out of 400 women, 68.5% completed ≥ 4 ANC visits. Institutional delivery rate was 84.2%, and 78.9% deliveries were conducted by SBA. Only 52.3% received ≥ 3 PNC visits. Full utilisation of all maternal health services was observed in 41.8% of women.

Factors significantly associated with full utilisation were: maternal education ≥ 10 th class [AOR: 2.34, 95% CI: 1.52-3.61], socio-economic status upper-middle and above [AOR: 1.89, 95% CI: 1.21-2.95], registered pregnancy in first trimester [AOR: 3.12, 95% CI: 2.01-4.84], and awareness about JSY benefits [AOR: 2.67, 95% CI: 1.73-4.11]. Distance to health facility > 5 km and lack of transport were major barriers reported by 34.6% of respondents.

Conclusion: Utilisation of maternal health care services in Coochbehar District is moderately high for ANC and institutional delivery, but low for PNC. Despite good coverage of government schemes, gaps persist due to socio-economic disparity, late registration, and accessibility issues.

Strengthening early ANC registration, community awareness, and transport facilities under NHM can improve full utilisation and contribute to better maternal outcomes.

Keywords: Maternal Health Care, Antenatal Care, Institutional Delivery, Postnatal Care, Utilisation, Coochbehar, West Bengal, Cross-sectional Study

Introduction

Maternal health is a cornerstone of public health and a key indicator of a country's overall development. Globally, approximately 287,000 women died due to complications related to pregnancy and childbirth in 2020, with 94% of these deaths occurring in low- and middle-income countries. The majority of these deaths are preventable through timely access to quality maternal health care services, including Antenatal Care (ANC). In India, significant efforts have been made to improve maternal health outcomes through national programs such as the National Rural Health Mission (NRHM) launched in 2005, now under the National Health Mission (NHM), and demand-side financing schemes like JananiSurakshaYojana (JSY) and JananiShishuSurakshaKaryakram (JSSK). These initiatives aim to increase access to and utilisation of maternal health services, particularly among marginalized populations. As a result, India has seen a marked improvement in key indicators - Institutional deliveries increased from 38.7% in NFHS-3 to 88.6% in NFHS-5, and maternal mortality ratio (MMR) declined from 130 in 2014-16 to 93 in 2019-21.

However, there are substantial inter-state and intra-state disparities in the utilisation of these services. West Bengal has performed relatively well compared to the national average, with 86.3% institutional deliveries and 64.4% of women receiving ≥ 4 ANC visits as per NFHS-5. Despite these gains, district-level variations persist, influenced by factors such as socio-economic status, education, cultural practices, geographic accessibility, and awareness.

Coochbehar is a border district located in the northern part of West Bengal. It is characterized by a predominantly rural population, presence of tea gardens, flood-prone areas, and a significant proportion of Scheduled Caste and Scheduled Tribe communities. The district also shares an international border with Bangladesh and Bhutan, which adds to its unique socio-demographic profile. While state-level data provides an overall picture, district-specific data on utilisation patterns and associated factors are limited for Coochbehar. Understanding local barriers and facilitators is crucial for designing targeted interventions under NHM.

The utilisation of maternal health care services is influenced by a complex interplay of predisposing factors like age and education, enabling factors like income and distance to health facility, and need factors like complications during pregnancy, as described by Andersen's Behavioral Model of Health Service Use. Previous studies from West Bengal and neighboring states have identified low maternal education, poor socio-economic status, late registration of pregnancy, and lack of transport as major determinants of poor utilisation.

Therefore, a district-level assessment is necessary to evaluate the current status of ANC, delivery, and PNC service utilisation in Coochbehar and to identify the socio-demographic and health system factors associated with it. The findings can help policymakers and program managers to strengthen existing maternal health programs and reduce maternal and neonatal morbidity and mortality in the district.

Materials and Methods

Study Design

Community-based cross-sectional study.

Study Area

The study was conducted in Coochbehar District, West Bengal. Coochbehar has 5 Sub-divisions, 12 Blocks, 1 Municipal Corporation and 6 Municipalities. Both rural and urban areas were included to ensure representation of the district population.

Study Population

Women of reproductive age group 15-49 years who had a live birth in the last 12 months preceding the survey and were permanent residents of the selected area for at least 6 months.

Inclusion Criteria:

1. Women aged 15-49 years
2. Had a live birth in the last 12 months
3. Gave informed consent to participate

Exclusion Criteria:

1. Women who had abortion or stillbirth
2. Women who were seriously ill and unable to respond
3. Women who were not available even after 3 visits

Study Duration

Total 6 months [01.01.2026 to 30.06.2026]

Sample Size Calculation

Assuming 50% prevalence of full utilisation of maternal health services, 95% Confidence Level, 5% Margin of Error, and 10% non-response rate.

$$n = \frac{Z^2 p (1-p)}{e^2} = \frac{1.96^2 \cdot 0.5 \cdot 0.5}{0.05^2} = 384$$

Adding 10% non-response: $384 + 38 = 422$

Final Sample Size: 420 women, rounded off for convenience.

Sampling Technique

Multistage Random Sampling was used.

Stage 1: From 12 Blocks, 3 rural blocks and 1 urban area were selected randomly by lottery method.

Stage 2: From each selected block, 2 villages/wards were selected randomly.

Stage 3: From each village/ward, households were selected by systematic random sampling. In each household, one eligible woman was interviewed. If more than one eligible woman was present, one was selected by lottery method.

Study Tools

A pre-designed, pre-tested, semi-structured interview schedule was used. The questionnaire was prepared in English and translated into Bengali. It had 4 parts:

1. Socio-demographic profile: Age, education, occupation, religion, caste, type of family, socio-economic status using Modified B.G. Prasad Scale.
2. Obstetric history: Birth order, spacing, registration of pregnancy.
3. Utilisation of MHC services: Number of ANC visits, place of delivery, attendant at delivery, number of PNC visits, JSY/JSSK benefits availed.
4. Barriers: Distance, cost, transport, cultural factors, knowledge and awareness.

Operational Definitions

1. Adequate ANC: ≥ 4 ANC visits as per WHO and GoI guidelines.
2. Institutional Delivery: Delivery conducted in any government or private health facility.
3. SBA Delivery: Delivery conducted by doctor, nurse or ANM.
4. Adequate PNC: ≥ 3 PNC visits within 42 days of delivery - 1st within 24 hrs, 2nd on 3rd-7th day, 3rd in 6th week.
5. Full Utilisation: Women who had ≥ 4 ANC + Institutional Delivery + ≥ 3 PNC.

Data Collection Procedure

After obtaining administrative permission from CMOH, Coochbehar and ethical clearance from Institutional Ethics Committee, data collection was done by house-to-house visit. The purpose of the study was explained and written informed consent was taken. Each interview took 20-25 minutes. Privacy and confidentiality were maintained.

Data Analysis

Data were entered in MS Excel and analyzed using SPSS version 26.

1. Descriptive statistics: Frequency, percentage, mean $\pm$ SD.
2. Inferential statistics: Chi-square test for association. Variables with $p < 0.2$ in univariate analysis were included in multivariate logistic regression.
3. Level of significance: $p < 0.05$ was considered statistically significant.

Ethical Considerations

1. Ethical approval was obtained from Institutional Ethics Committee.
2. Written informed consent was taken from each participant.
3. Confidentiality of data was maintained.
4. Women found with any health problem were referred to nearest health facility.

Limitations

1. Recall bias may be present as data was collected retrospectively for last 12 months.
2. The study was limited to Coochbehar district only, so findings cannot be generalized to the whole state.
3. Social desirability bias may occur during interview.

Results

A total of 420 women were approached and 400 women participated in the study, giving a response rate of 95.2%.

Socio-demographic Profile of Respondents

Table 1: Socio-demographic characteristics of study participants (n=400)

Variable	Frequency (n)	Percentage (%)
Age Group		
15-24 years	142	35.5
25-34 years	198	49.5
≥ 35 years	60	15.0
Education		
Illiterate	48	12.0

Primary	92	23.0	
Secondary	156	39.0	
≥Higher Secondary	104		26.0
Religion			
Hindu	302	75.5	
Muslim	94	23.5	
Others	4	1.0	
Caste			
SC/ST	168	42.0	
OBC	134	33.5	
General	98	24.5	
Socio-economic Status			
Upper/Upper Middle	110	27.5	
Lower Middle	148	37.0	
Upper Lower/Lower	142	35.5	
Residence			
Rural	278	69.5	
Urban	122	30.5	

Mean age of participants was 26.8 ± 5.2 years. Majority 49.5% were in 25-34 years age group and 65% had education up to secondary and above.

Obstetric Characteristics

Table 2: Obstetric profile of respondents (n=400)

Variable	Frequency (n)	Percentage (%)
Birth Order		
First	172	43.0
Second	148	37.0
≥Third	80	20.0
Pregnancy Registration		
First Trimester	248	62.0
Second Trimester	122	30.5
Third Trimester	30	7.5
Awareness about JSY		
Yes	312	78.0
No	88	22.0

62% of women registered their pregnancy in first trimester.

Utilisation of Maternal Health Care Services

Table 3: Utilisation of different components of MHC services (n=400)

Service Component	Frequency (n)	Percentage (%)
ANC Visits		
≥4 ANC visits	274	68.5
<4 ANC visits	126	31.5
Place of Delivery		
Institutional	337	84.2
Home	63	15.8

Attendant at Delivery		
Skilled Birth Attendant	316	79.0
Unskilled	84	21.0

PNC Visits	
≥3 PNC visits	209 52.3
<3 PNC visits	191 47.7

Full Utilisation	
≥4 ANC + Institutional + ≥3 PNC	167 41.8

Institutional delivery rate was 84.2%. However, only 52.3% received adequate postnatal care. Full utilisation of all 3 components was seen in only 41.8% of women.

Factors Associated with Full Utilisation of MHC Services

Table 4: Association of socio-demographic factors with full utilisation (n=400)

Variable	Full Utilisation Yes n(%)		Full Utilisation No n(%)	
Chi-square	p-value			
Education				
≥Secondary	134(51.5)	126(48.5)	28.34	<0.001
<Secondary	33(23.6)	107(76.4)		
First Trimester Registration				
Yes	128(51.6)	120(48.4)	29.45	<0.001
No	39(25.7)	113(74.3)		
Awareness about JSY				
Yes	148(47.4)	164(52.6)	18.92	<0.001
No	19(21.6)	69(78.4)		
Statistically significant at p<0.05				

Statistically significant at p<0.05

On multivariate logistic regression, education ≥Secondary [AOR: 2.34, 95% CI: 1.52-3.61], First trimester registration [AOR: 3.12, 95% CI: 2.01-4.84] and JSY awareness [AOR: 2.67, 95% CI: 1.73-4.11] were found to be significant predictors of full utilisation.

Barriers to Utilisation of MHC Services

Table 5: Perceived barriers reported by women with <4 ANC or Home delivery or <3 PNC (n=233)

Barriers	Frequency (n)	Percentage (%)
Distance to health facility >5km	81	34.8
Lack of transport	76	32.6
Lack of time/Family responsibilities	58	24.9
Lack of awareness	54	23.2
Financial constraints	49	21.0
Cultural beliefs	31	13.3
Poor quality of services	28	12.0

Multiple responses allowed. Distance and lack of transport were the most commonly reported barriers.

Findings Summary:

1. 68.5% had ≥ 4 ANC visits, 84.2% had institutional delivery, but only 52.3% had ≥ 3 PNC visits.
2. Full utilisation was 41.8%.
3. Education, early registration, and awareness were significant determinants.
4. Accessibility was the major barrier.

Discussion

This community-based cross-sectional study was conducted to assess the utilisation of maternal health care services and its associated factors among 400 women in Coochbehar District, West Bengal.

Utilisation of MHC Services

In the present study, 68.5% of women had ≥ 4 ANC visits. This is comparable to NFHS-5 data for West Bengal which reported 64.4% but higher than the national average of 58.1%. The relatively better performance may be attributed to active ASHA workers and ANC outreach camps under NHM in the district.

Institutional delivery rate was 84.2% in our study. This is close to the state average of 86.3% reported in NFHS-5 and reflects the success of JSY and JSSK schemes. Financial incentives, free transport under "NischayYaan" and 24x7 delivery points have likely contributed to this high rate. Similar findings were reported by Sarkar et al. from North Bengal districts with 82.3% institutional deliveries.

However, only 52.3% received ≥ 3 PNC visits. This is a major gap. PNC is often neglected both by providers and beneficiaries as focus remains on ANC and delivery. NFHS-5 also shows that PNC coverage within 2 days is only 76.2% in West Bengal. Low PNC utilisation increases risk of missing postpartum complications, neonatal sepsis and breastfeeding problems.

Full utilisation of the continuum of care was only 41.8%. This indicates that even though individual components have good coverage, women are dropping out between ANC $\rightarrow$ Delivery $\rightarrow$ PNC. This "leakage" needs to be addressed to achieve SDG 3.1 targets.

Factors Associated with Utilisation

Our study found that maternal education $\geq$ Secondary was significantly associated with full utilisation [AOR: 2.34]. Educated women are more aware, have better decision-making power and can negotiate with family for health care. This is consistent with studies by Singh et al. from Bihar and Das et al. from West Bengal.

Socio-economic status was another important determinant. Women from upper/upper middle class had 1.89 times higher odds of full utilisation. Financial constraints and opportunity cost act as barriers for lower SES groups despite free services, due to indirect costs like transport and wage loss.

Early registration in first trimester increased the odds of full utilisation by 3.12 times. Early contact with health system creates trust and ensures continuity of care. It also allows early detection and management of high-risk pregnancies.

Awareness about JSY was significantly associated [AOR: 2.67]. Knowledge about entitlements motivates women to avail services. This highlights the role of ASHA and ANM in IEC activities. Rural women had lower utilisation compared to urban women [35.6% vs 55.7%]. This reflects geographic and infrastructural barriers in rural Coochbehar such as tea garden areas and flood-prone blocks.

Barriers Reported

The most common barriers reported were distance >5km (34.8%) and lack of transport (32.6%). Coochbehar being a border district with scattered habitations faces this problem. Although "NischayYaan" exists, awareness and availability at night are issues.

Other barriers included lack of time, poor awareness and cultural beliefs. Similar barriers have been documented in studies from rural West Bengal and Assam.

Strengths and Limitations

Strengths: Community-based design, inclusion of both rural and urban areas, use of standardised tools.

Limitations: Recall bias, cross-sectional design cannot establish causality, and findings are limited to Coochbehar district only.

To improve utilisation, there is a need to:

1. Strengthen PNC services through home visits by ASHA and ANM in first 42 days.
 2. Improve transport and accessibility especially in rural and remote blocks.
 3. Intensify IEC to promote early registration and awareness about JSY/JSSK.
 4. Focus on low-literacy and low-SES groups through targeted interventions.
- Addressing these gaps will help Coochbehar district move closer to the goal of zero preventable maternal deaths.

1. Moderate to Good Utilisation of ANC and Institutional Delivery: 68.5% of women received ≥ 4 ANC visits and 84.2% had institutional deliveries. This indicates the positive impact of NHM, JSY and JSSK schemes in Coochbehar district. The high institutional delivery rate reflects improved accessibility to public health facilities and financial incentives.

2. Poor Utilisation of Postnatal Care: Only 52.3% of women received ≥ 3 PNC visits. This is the weakest link in the continuum of maternal care and poses a significant risk for maternal and neonatal morbidity and mortality in the early postpartum period.

3. Low Full Continuum of Care: Just 41.8% of women utilised the complete package of ≥ 4 ANC + Institutional Delivery + ≥ 3 PNC. This "dropout" between service components suggests that focus has been on single interventions rather than ensuring continuity of care.

4. Determinants of Utilisation: Maternal education $\geq$ Secondary level, higher socio-economic status, early registration of pregnancy in first trimester, and awareness about JSY were significant predictors of full utilisation. Rural residence and lower SES were associated with poor utilisation.

5. Major Barriers: Distance to health facility >5km and lack of transport were the most commonly reported barriers, especially in rural and remote blocks of Coochbehar. Other barriers included lack of awareness, time constraints, and cultural factors.

Recommendations

Based on the findings, the following recommendations are made:

1. Strengthen PNC Services: Active home visits by ASHA and ANM within 24 hours, 3rd day and 7th day of delivery should be ensured and monitored. PNC checklists should be used at sub-centre and PHC level.

2. Improve Accessibility: Strengthen "NischayYaan" services with 24x7 availability. Mobile health units can be deployed in remote and tea garden areas of Coochbehar.

- 3. Promote Early ANC Registration:** IEC campaigns through ASHA, ANM and community leaders to motivate women for first trimester registration.
- 4. Targeted Interventions:** Special focus on women with low education, low SES, and rural areas through community mobilization and counselling.
- 5. Increase Awareness:** Strengthen awareness generation about JSY, JSSK and free service entitlements at village level.

Conclusion

The present community-based cross-sectional study in Coochbehar District highlights that the utilisation of maternal health care services is moderately high for antenatal care and institutional delivery, but remains suboptimal for postnatal care.

Out of 400 women, 68.5% completed ≥ 4 ANC visits and 84.2% had institutional deliveries, reflecting the positive impact of NHM, JSY, and JSSK schemes. However, only 52.3% received ≥ 3 PNC visits, and *full utilisation of the continuum of care was just 41.8%*. This indicates a significant "dropout" between ANC $\rightarrow$ Delivery $\rightarrow$ PNC, which needs urgent attention to achieve SDG 3.1 targets.

Determinants of full utilisation were maternal education $\geq$ Secondary level [AOR: 2.34], upper-middle and above socio-economic status [AOR: 1.89], first trimester registration [AOR: 3.12], and awareness about JSY benefits [AOR: 2.67]. Major barriers reported were distance to health facility > 5 km and lack of transport, especially in rural and tea garden areas.

To improve maternal health outcomes in Coochbehar, there is a need to:

1. Strengthen PNC services through active home visits by ASHA and ANM in the first 42 days.
2. Improve accessibility by ensuring 24x7 availability of "Nischay Yaan" and deploying mobile health units in remote blocks.
3. Promote early ANC registration and increase community awareness about JSY/JSSK entitlements.
4. Target low-literacy and low-SES groups with focused IEC and counseling.

Shifting the focus from single-service contact to ensuring the continuum of care is essential. Addressing socio-economic disparities and geographic barriers will be crucial for Coochbehar to further reduce maternal and neonatal morbidity and mortality.

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उच्चतर संगीत शिक्षा का बदलता परिदृश्य: परंपरा से आधुनिकता की ओर

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सार

यह शोध-पत्र उच्चतर संगीत शिक्षा के बदलते स्वरूप का समग्र एवं विश्लेषणात्मक अध्ययन प्रस्तुत करता है, विशेषतः हिमाचल प्रदेश, पंजाब तथा हरियाणा के संदर्भ में। भारतीय संगीत शिक्षा की मूल संरचना प्राचीन गुरु-शिष्य परंपरा पर आधारित रही है, जिसमें ज्ञान का संप्रेषण मौखिक, व्यवहारिक तथा अनुभवात्मक माध्यमों से होता था। कालांतर में सामाजिक, शैक्षिक तथा तकनीकी परिवर्तनों के प्रभाव से यह परंपरा औपचारिक एवं संस्थागत ढाँचे में परिवर्तित हुई, जहाँ विश्वविद्यालयीय पाठ्यक्रम, सेमेस्टर प्रणाली, क्रेडिट-आधारित मूल्यांकन तथा शोध-उन्मुख अध्ययन को प्रमुखता प्राप्त हुई।

इस अध्ययन में संकेतन प्रणाली (Notation System) के विकास को भी एक महत्वपूर्ण आयाम के रूप में विवेचित किया गया है, जिसने संगीत को संरचित, लिखित तथा वैज्ञानिक आधार प्रदान करते हुए इसके संरक्षण, प्रसार और शिक्षण को अधिक सुलभ बनाया।

शोध का एक प्रमुख उद्देश्य राष्ट्रीय शिक्षा नीतियों—NEP 1986, RUSA (2013) तथा NEP 2020—के प्रभावों का तुलनात्मक विश्लेषण करना है। NEP 1986 में संगीत शिक्षा को मुख्यतः सह-पाठ्यक्रमीय गतिविधि के रूप में सीमित रखा गया, जबकि RUSA (2013) ने उच्चतर शिक्षा में गुणवत्ता संवर्धन, वित्तीय सुदृढ़ता, संस्थागत स्वायत्तता तथा अवसंरचनात्मक विकास पर बल दिया। इसके विपरीत, NEP 2020 ने संगीत शिक्षा को मुख्यधारा में स्थापित करते हुए इसे बहु-विषयक, कौशल-आधारित, लचीला तथा प्रौद्योगिकी-संलग्न स्वरूप प्रदान किया, जिससे इसके व्यावसायिक आयामों का भी विस्तार हुआ।

अध्ययन के निष्कर्षों से यह स्पष्ट होता है कि तीनों राज्यों में सांस्कृतिक विविधता के बावजूद उच्चतर संगीत शिक्षा में एक समान आधुनिक दृष्टिकोण विकसित हो रहा है। पारंपरिक पद्धतियों के साथ-साथ नवाचार, डिजिटलीकरण तथा वैश्विक मानकों का समावेश इस क्षेत्र को अधिक प्रासंगिक एवं प्रतिस्पर्धात्मक बना रहा है। अतः यह कहा जा सकता है कि उच्चतर संगीत शिक्षा अब पारंपरिक सीमाओं से आगे बढ़कर एक समन्वित, लचीली तथा व्यावसायिक रूप से उन्मुख प्रणाली के रूप में विकसित हो रही है।

कीवर्ड- संगीत शिक्षा, संकेतन प्रणाली, उच्चतर शिक्षा, बहु-विषयक शिक्षा, शिक्षा नीति, कौशल आधारित अधिगम, विश्वविद्यालय प्रणाली

परिचय

भारतीय संगीत शिक्षा का विकास एक दीर्घ ऐतिहासिक प्रक्रिया का परिणाम है, जिसमें सांस्कृतिक, सामाजिक और शैक्षिक परिवर्तन निरंतर परिलक्षित होते रहे हैं। प्रारंभिक काल में संगीत शिक्षा का आधार गुरु-शिष्य परंपरा था, जहाँ विद्यार्थी अपने गुरु के साथ रहकर दीर्घकालिक अभ्यास और अनुकरण के माध्यम से ज्ञान अर्जित करते थे। यह प्रणाली अत्यंत प्रभावी थी, किन्तु इसकी सीमाएँ भी थीं—जैसे ज्ञान का सीमित प्रसार, औपचारिक मानकीकरण का अभाव और व्यक्तिगत निर्भरता।

आधुनिक युग में शिक्षा के संस्थानीकरण के साथ संगीत शिक्षा भी विश्वविद्यालयों और महाविद्यालयों का अभिन्न अंग बन गई। अब संगीत का अध्ययन केवल कला के रूप में नहीं, बल्कि एक शैक्षणिक अनुशासन के रूप में किया जाने लगा है, जिसमें सिद्धांत, व्यवहार, अनुसंधान और प्रौद्योगिकी सभी शामिल हैं।

विशेष रूप से शिक्षा नीतियों ने इस परिवर्तन को दिशा प्रदान की है। जहाँ पहले संगीत को सीमित महत्व दिया जाता था, वहीं अब इसे बहु-विषयक शिक्षा का अभिन्न अंग माना जा रहा है। इस शोध में इन्हीं परिवर्तनों का विश्लेषण प्रस्तुत किया गया है।

पृष्ठभूमि

हिमाचल प्रदेश, पंजाब और हरियाणा तीनों राज्य सांस्कृतिक दृष्टि से अत्यंत समृद्ध हैं और यहाँ संगीत की विविध परंपराएँ विद्यमान हैं। हिमाचल प्रदेश में लोकसंगीत की परंपरा प्रमुख है, जबकि पंजाब में गुरुमुखी आधारित संगीत एवं शास्त्रीय धारा का प्रभाव दिखाई देता है। हरियाणा में लोक एवं शास्त्रीय संगीत का संतुलित समन्वय मिलता है।

इन राज्यों में संगीत शिक्षा का विकास निम्नलिखित चरणों में देखा जा सकता है:

1. मौखिक एवं पारंपरिक गुरु-शिष्य परंपरा
2. औपचारिक विश्वविद्यालयीय पाठ्यक्रमों की स्थापना
3. उच्चतर शिक्षा में संरचनात्मक सुधार (RUSA के माध्यम से)
4. बहु-विषयक एवं तकनीकी आधारित शिक्षा (NEP 2020 के बाद)

इस पृष्ठभूमि से स्पष्ट है कि संगीत शिक्षा ने पारंपरिक से आधुनिक स्वरूप की ओर एक क्रमिक विकास यात्रा तय की है।

अध्ययन के उद्देश्य

1. उच्चतर संगीत शिक्षा में बदलते प्रतिमानों का विश्लेषण करना
2. संगीत में संकेतन प्रणाली की भूमिका का अध्ययन करना
3. विभिन्न शिक्षा नीतियों के प्रभावों की तुलनात्मक समीक्षा करना
4. हिमाचल, पंजाब और हरियाणा के संदर्भ में तुलनात्मक अध्ययन प्रस्तुत करना

साहित्य समीक्षा

पूर्व शोधों और अध्ययनों से यह स्पष्ट होता है कि संगीत शिक्षा का स्वरूप समय के साथ निरंतर परिवर्तित हुआ है। प्रारंभिक अध्ययन यह दर्शाते हैं कि पारंपरिक शिक्षा प्रणाली अनुभव-आधारित थी, जिसमें संरचनात्मक स्पष्टता का अभाव था।

NEP 1986 के संदर्भ में किए गए अध्ययनों से ज्ञात होता है कि उस समय शिक्षा प्रणाली अधिकतर शिक्षक-केंद्रित और सैद्धांतिक थी। संगीत को मुख्य विषय के रूप में पर्याप्त महत्व नहीं दिया गया।

RUSA के अंतर्गत किए गए सुधारों ने उच्चतर शिक्षा में गुणवत्ता, वित्तीय पारदर्शिता और संस्थागत स्वायत्तता को बढ़ावा दिया। इससे संगीत विषय में भी पाठ्यक्रम संरचना और मूल्यांकन प्रणाली में सुधार हुआ।

NEP 2020 पर आधारित नवीन अध्ययनों से यह स्पष्ट होता है कि इस नीति ने संगीत को बहु-विषयक शिक्षा के केंद्र में स्थापित किया है, जिससे इसके अध्ययन और शोध की संभावनाएँ विस्तृत हुई हैं।

संगीत में संकेतन प्रणाली

भारतीय संगीत में संकेतन प्रणाली का विकास एक महत्वपूर्ण चरण रहा है। प्रारंभ में संगीत मौखिक रूप से ही सिखाया जाता था, जिससे संरक्षित ज्ञान सीमित रह जाता था।

संकेतन प्रणाली के विकास ने संगीत को लिखित रूप प्रदान किया, जिससे इसे संरक्षित और प्रसारित करना संभव हुआ। इसके प्रमुख लाभ निम्नलिखित हैं:

- रागों और बंदिशों का संरक्षण
- शिक्षण में एकरूपता
- अनुसंधान एवं विश्लेषण में सुविधा

आधुनिक समय में डिजिटल तकनीकों के माध्यम से संकेतन प्रणाली और अधिक विकसित हो गई है। अब विभिन्न सॉफ्टवेयर के माध्यम से संगीत को रिकॉर्ड, संपादित और साझा किया जा सकता है, जिससे शिक्षा का स्तर और व्यापक हुआ है।

शिक्षा नीतियों का विश्लेषण

1. NEP 1986

इस नीति में शिक्षा प्रणाली अधिक पारंपरिक और विषय-केंद्रित थी। संगीत को सह-पाठ्यक्रमीय गतिविधि के रूप में देखा गया, जिससे इसकी शैक्षणिक महत्ता सीमित रही।

2. RUSA (Rashtriya Uchchatar Shiksha Abhiyan)

RUSA ने उच्चतर शिक्षा में संरचनात्मक सुधार किए। इसके अंतर्गत:

- क्रेडिट आधारित प्रणाली लागू की गई
- संस्थानों को स्वायत्तता प्रदान की गई
- गुणवत्ता सुधार पर बल दिया गया

इसका प्रभाव संगीत शिक्षा पर भी पड़ा और इसे अधिक व्यवस्थित रूप मिला।

3. NEP 2020

यह नीति शिक्षा प्रणाली में व्यापक परिवर्तन लाने वाली है। इसके अंतर्गत:

- बहु-विषयक शिक्षा को बढ़ावा
- क्रेडिट बैंक प्रणाली
- कौशल आधारित अधिगम
- तकनीकी एकीकरण

संगीत को अब केवल कला नहीं, बल्कि करियर विकल्प के रूप में भी देखा जाने लगा है।

अनुसंधान पद्धति

यह अध्ययन गुणात्मक एवं तुलनात्मक दृष्टिकोण पर आधारित है। इसमें प्राथमिक स्रोतों के रूप में विभिन्न विश्वविद्यालयों के पाठ्यक्रमों का अध्ययन किया गया, जबकि द्वितीयक स्रोतों में शिक्षा नीतियाँ, शोध-पत्र और पुस्तकें शामिल हैं।

अध्ययन क्षेत्र के रूप में हिमाचल प्रदेश, पंजाब और हरियाणा को चुना गया, जिससे क्षेत्रीय विविधताओं का विश्लेषण संभव हो सके।

मुख्य निष्कर्ष

1. संगीत शिक्षा में पारंपरिक से आधुनिक स्वरूप की ओर स्पष्ट परिवर्तन हुआ है
2. संकेतन प्रणाली ने संगीत को वैज्ञानिक और संरचित बनाया
3. नई शिक्षा नीति ने संगीत को मुख्यधारा में स्थान दिया
4. संस्थागत सुधारों ने शिक्षा की गुणवत्ता में वृद्धि की

विश्लेषण

यदि तीनों नीतियों की तुलना की जाए, तो स्पष्ट रूप से विकास की क्रमिक प्रक्रिया दिखाई देती है:

- प्रारंभिक चरण में सीमित और स्थिर संरचना
- मध्य चरण में सुधार और संगठनात्मक विकास
- वर्तमान चरण में नवाचार और लचीलापन

तीनों राज्यों में भी यह परिवर्तन स्पष्ट रूप से दिखाई देता है, यद्यपि उनकी सांस्कृतिक विशेषताएँ भिन्न हैं।

निष्कर्ष

उच्चतर संगीत शिक्षा का वर्तमान स्वरूप एक परिवर्तनशील प्रक्रिया का परिणाम है, जिसमें परंपरा और आधुनिकता का संतुलित समन्वय देखने को मिलता है।

आज संगीत शिक्षा केवल सांस्कृतिक धरोहर नहीं, बल्कि एक व्यावसायिक और शोध-आधारित क्षेत्र बन चुकी है। नई शिक्षा नीति ने इसे नई दिशा प्रदान की है, जिससे भविष्य में इसके और अधिक विस्तार की संभावना है।

सीमाएँ

- अध्ययन सीमित भौगोलिक क्षेत्र तक सीमित है
- सभी संस्थानों का डेटा उपलब्ध नहीं हो सका
- नीतियों का पूर्ण कार्यान्वयन अभी शेष है

सिफारिशें

1. क्षेत्रीय संगीत पर शोध को बढ़ावा दिया जाए
2. शिक्षा नीतियों का प्रभावी क्रियान्वयन सुनिश्चित किया जाए
3. शिक्षकों के लिए नियमित प्रशिक्षण कार्यक्रम आयोजित किए जाएँ
4. प्रायोगिक शिक्षण को प्राथमिकता दी जाए
5. संगीत अनुसंधान के लिए विशेष फंडिंग उपलब्ध कराई जाए
6. विश्वविद्यालय स्तर पर प्रदर्शन और मंचीय अवसर बढ़ाए जाएँ

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पंचायती राज संस्थाओं में महिलाओं का राजनीतिक सशक्तिकरण: एक विश्लेषण

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सार

पंचायती राज संस्थाएँ भारत में ग्रामीण लोकतंत्र की आधारशिला हैं। 73वें संविधान संशोधन अधिनियम, 1992 के माध्यम से महिलाओं को पंचायतों में आरक्षण प्रदान किया गया, जिससे उनकी राजनीतिक भागीदारी में महत्वपूर्ण वृद्धि हुई। प्रस्तुत शोध-पत्र का उद्देश्य पंचायती राज संस्थाओं में महिलाओं के राजनीतिक सशक्तिकरण का विश्लेषण करना है। अध्ययन से स्पष्ट होता है कि पंचायतों में महिलाओं की बढ़ती भागीदारी ने उनके आत्मविश्वास, नेतृत्व क्षमता तथा निर्णय लेने की योग्यता को सुदृढ़ किया है। साथ ही, उन्होंने शिक्षा, स्वास्थ्य, स्वच्छता और महिला कल्याण से जुड़े मुद्दों को प्राथमिकता दी है। हालांकि अशिक्षा, आर्थिक निर्भरता और सामाजिक रूढ़ियाँ अभी भी चुनौतियाँ हैं, फिर भी पंचायती राज संस्थाएँ महिलाओं के राजनीतिक सशक्तिकरण का प्रभावी माध्यम सिद्ध हुई हैं।

मुख्य शब्द: पंचायती राज, महिला सशक्तिकरण, राजनीतिक भागीदारी, महिला नेतृत्व, स्थानीय स्वशासन, ग्रामीण विकास, 73वाँ संविधान संशोधन

प्रस्तावना

भारत विश्व का सबसे बड़ा लोकतांत्रिक देश है, जहाँ लोकतंत्र की सफलता नागरिकों की सक्रिय भागीदारी पर निर्भर करती है। लोकतंत्र को जमीनी स्तर तक सशक्त बनाने के लिए पंचायती राज व्यवस्था की स्थापना की गई। पंचायती राज संस्थाएँ ग्रामीण क्षेत्रों में स्थानीय स्वशासन की महत्वपूर्ण इकाइयाँ हैं, जो लोगों को विकास एवं प्रशासन से जुड़े निर्णयों में भाग लेने का अवसर प्रदान करती हैं।

भारतीय समाज में महिलाओं की भूमिका हमेशा महत्वपूर्ण रही है, लेकिन लंबे समय तक उनकी राजनीतिक भागीदारी सीमित रही। सामाजिक परंपराएँ, अशिक्षा, आर्थिक निर्भरता तथा पितृसत्तात्मक सोच महिलाओं के राजनीतिक विकास में बाधक रही हैं। महिलाओं की राजनीतिक स्थिति को मजबूत बनाने के उद्देश्य से 73वें संविधान संशोधन अधिनियम, 1992 के तहत पंचायती राज संस्थाओं में महिलाओं के लिए आरक्षण की व्यवस्था की गई। इस कदम ने लाखों महिलाओं को स्थानीय राजनीति में प्रवेश का अवसर प्रदान किया तथा स्थानीय शासन में उनकी भागीदारी को बढ़ावा दिया (मैथ्यू, 1994)। पंचायतों में महिलाओं की बढ़ती भागीदारी ने न केवल उनके राजनीतिक सशक्तिकरण को बढ़ावा दिया है, बल्कि ग्रामीण विकास की प्रक्रिया को भी नई दिशा दी है। आज महिलाएँ पंचायतों में नेतृत्व की भूमिका निभाते हुए शिक्षा, स्वास्थ्य, स्वच्छता और सामाजिक कल्याण जैसे मुद्दों पर महत्वपूर्ण निर्णय ले रही हैं। प्रस्तुत अध्ययन पंचायती राज संस्थाओं में महिलाओं के राजनीतिक सशक्तिकरण की स्थिति, उपलब्धियों तथा चुनौतियों का विश्लेषण करता है।

अध्ययन के उद्देश्य

1. पंचायती राज संस्थाओं में महिलाओं की राजनीतिक भागीदारी का अध्ययन करना।
2. महिलाओं के राजनीतिक सशक्तिकरण में पंचायती राज संस्थाओं की भूमिका का विश्लेषण करना।
3. पंचायतों में महिला प्रतिनिधियों की निर्णय लेने की क्षमता और नेतृत्व भूमिका का मूल्यांकन करना।
4. महिलाओं के राजनीतिक सशक्तिकरण के समक्ष उपस्थित प्रमुख चुनौतियों की पहचान करना।
5. ग्रामीण विकास और सामाजिक परिवर्तन पर महिलाओं की राजनीतिक भागीदारी के प्रभाव का अध्ययन करना।

शोध प्रश्न

प्रस्तुत अध्ययन निम्नलिखित शोध प्रश्नों के उत्तर खोजने का प्रयास करता है—

1. पंचायती राज संस्थाओं में महिलाओं की राजनीतिक भागीदारी किस प्रकार बढ़ी है?
2. महिलाओं के राजनीतिक सशक्तिकरण में पंचायती राज संस्थाओं की क्या भूमिका है?
3. पंचायतों में महिला प्रतिनिधियों को कार्य निष्पादन के दौरान किन प्रमुख चुनौतियों का सामना करना पड़ता है?
4. महिलाओं की राजनीतिक भागीदारी का ग्रामीण विकास और सामाजिक परिवर्तन पर क्या प्रभाव पड़ता है?
5. महिलाओं के राजनीतिक सशक्तिकरण को और अधिक प्रभावी बनाने के लिए कौन-से उपाय आवश्यक हैं?

साहित्य समीक्षा

पंचायती राज संस्थाओं में महिलाओं की भागीदारी और राजनीतिक सशक्तिकरण पर विभिन्न विद्वानों द्वारा अध्ययन किए गए हैं। मैथ्यू (1994) के अनुसार पंचायतों में महिलाओं के लिए आरक्षण की व्यवस्था ने स्थानीय स्तर पर उनकी राजनीतिक भागीदारी को बढ़ावा दिया तथा उन्हें नेतृत्व के नए अवसर प्रदान किए। बुच (2000) ने अपने अध्ययन में पाया कि पंचायतों में निर्वाचित महिला प्रतिनिधियों के आत्मविश्वास, नेतृत्व क्षमता तथा सामाजिक प्रतिष्ठा में उल्लेखनीय वृद्धि हुई है। चट्टोपाध्याय एवं डुप्लो (2004) के अध्ययन से स्पष्ट होता है कि महिला प्रतिनिधियों ने शिक्षा, स्वास्थ्य, पेयजल तथा सामाजिक कल्याण से जुड़े मुद्दों को प्राथमिकता दी। अग्रवाल (2001) ने महिलाओं की भागीदारी को सामाजिक परिवर्तन तथा लैंगिक समानता से जोड़ा है। वहीं जायल (2006) ने यह बताया कि पितृसत्तात्मक सोच और सामाजिक संरचनाएँ आज भी महिलाओं के प्रभावी राजनीतिक सशक्तिकरण में बाधा उत्पन्न करती हैं। उपलब्ध साहित्य से स्पष्ट है कि पंचायती राज संस्थाएँ महिलाओं के राजनीतिक सशक्तिकरण का महत्वपूर्ण माध्यम हैं, यद्यपि अनेक चुनौतियाँ अभी भी विद्यमान हैं।

उपलब्ध साहित्य से स्पष्ट होता है कि अधिकांश अध्ययनों में महिलाओं की राजनीतिक भागीदारी, नेतृत्व क्षमता तथा आरक्षण व्यवस्था के प्रभावों पर विशेष ध्यान दिया गया है। तथापि पंचायतों में महिलाओं की वास्तविक निर्णयकारी भूमिका, समकालीन चुनौतियों तथा ग्रामीण विकास पर उनके प्रभाव का समग्र विश्लेषण अपेक्षाकृत कम देखने को मिलता है। प्रस्तुत अध्ययन इसी शोध-अंतर को समझने तथा महिलाओं के राजनीतिक सशक्तिकरण की वर्तमान स्थिति का विश्लेषण करने का प्रयास करता है।

शोध पद्धति

प्रस्तुत अध्ययन वर्णनात्मक एवं विश्लेषणात्मक प्रकृति का है। अध्ययन मुख्यतः द्वितीयक स्रोतों पर आधारित है। इसके लिए पुस्तकों, शोध-पत्रों, सरकारी रिपोर्टों, पत्र-पत्रिकाओं तथा महिला सशक्तिकरण और पंचायती राज से संबंधित प्रकाशित साहित्य का उपयोग किया गया है। अध्ययन में वर्ष 1992 से 2024 तक उपलब्ध प्रासंगिक साहित्य एवं दस्तावेजों को आधार बनाया गया है। संकलित सामग्री का विषयवस्तु

विश्लेषण एवं तुलनात्मक अध्ययन के माध्यम से परीक्षण किया गया है। प्राप्त तथ्यों के आधार पर महिलाओं की राजनीतिक भागीदारी, नेतृत्व क्षमता, चुनौतियों तथा पंचायती राज संस्थाओं की भूमिका का मूल्यांकन किया गया है। अध्ययन का उद्देश्य पंचायती राज संस्थाओं में महिलाओं के राजनीतिक सशक्तिकरण की वर्तमान स्थिति का विश्लेषण करना तथा उसके सामाजिक, राजनीतिक एवं विकासात्मक प्रभावों को समझना है।

पंचायती राज व्यवस्था और महिलाओं का राजनीतिक सशक्तिकरण

महिलाओं का राजनीतिक सशक्तिकरण लोकतांत्रिक समाज की एक महत्वपूर्ण आवश्यकता है। इसका अर्थ केवल राजनीति में महिलाओं की उपस्थिति बढ़ाना नहीं है, बल्कि उन्हें निर्णय लेने, नेतृत्व करने तथा शासन प्रक्रिया में प्रभावी भूमिका निभाने के योग्य बनाना भी है। पंचायती राज संस्थाओं ने इस दिशा में महत्वपूर्ण योगदान दिया है।

73वें संविधान संशोधन अधिनियम, 1992 के लागू होने के बाद पंचायतों में महिलाओं के लिए आरक्षण की व्यवस्था की गई। इसके परिणामस्वरूप बड़ी संख्या में महिलाएँ ग्राम पंचायत, पंचायत समिति और जिला परिषद में निर्वाचित होकर नेतृत्व की भूमिका निभाने लगीं। इससे महिलाओं को राजनीतिक प्रक्रियाओं को समझने तथा सार्वजनिक जीवन में सक्रिय भागीदारी का अवसर मिला।

वर्तमान समय में भारत में पंचायतों के विभिन्न स्तरों पर 14 लाख से अधिक निर्वाचित महिला प्रतिनिधि कार्यरत हैं। यह संख्या स्थानीय स्वशासन में महिलाओं की बढ़ती भागीदारी तथा राजनीतिक सशक्तिकरण की दिशा में हुए महत्वपूर्ण परिवर्तन को दर्शाती है।

पंचायती राज संस्थाओं में भागीदारी ने महिलाओं के आत्मविश्वास और नेतृत्व क्षमता को बढ़ाया है। **(बुच, 2000)** वे अब स्थानीय समस्याओं की पहचान कर उनके समाधान के लिए योजनाएँ बनाने और उन्हें लागू करने में महत्वपूर्ण भूमिका निभा रही हैं। कई महिला प्रतिनिधियों ने शिक्षा, स्वास्थ्य, स्वच्छता, पेयजल, महिला सुरक्षा और बाल विकास जैसे विषयों को प्राथमिकता देकर ग्रामीण विकास में उल्लेखनीय योगदान दिया है। **(चट्टोपाध्याय एवं डुफ्लो, 2004)**।

महिलाओं की राजनीतिक भागीदारी से सामाजिक परिवर्तन भी देखने को मिला है। पंचायतों में महिलाओं की उपस्थिति ने ग्रामीण समाज में लैंगिक समानता को बढ़ावा दिया है तथा महिलाओं के प्रति लोगों की सोच में सकारात्मक बदलाव लाया है। **(अग्रवाल, 2001)**। इससे अन्य महिलाओं को भी शिक्षा प्राप्त करने, अपने अधिकारों के प्रति जागरूक होने और सार्वजनिक जीवन में भाग लेने की प्रेरणा मिली है।

इस प्रकार पंचायती राज संस्थाएँ महिलाओं को राजनीतिक रूप से सशक्त बनाने का प्रभावी माध्यम सिद्ध हुई हैं। इन्होंने महिलाओं को नेतृत्व, निर्णय-निर्माण और सामाजिक परिवर्तन की प्रक्रिया में सक्रिय भागीदारी का अवसर प्रदान किया है।

महिलाओं के राजनीतिक सशक्तिकरण की चुनौतियाँ

पंचायती राज संस्थाओं में महिलाओं की भागीदारी बढ़ने के बावजूद उन्हें अनेक चुनौतियों का सामना करना पड़ता है। ये चुनौतियाँ उनके प्रभावी नेतृत्व और स्वतंत्र निर्णय क्षमता को प्रभावित करती हैं। प्रमुख चुनौतियाँ निम्नलिखित हैं—

1. अशिक्षा और राजनीतिक जागरूकता की कमी

ग्रामीण क्षेत्रों में कई महिला प्रतिनिधियों की शैक्षिक स्थिति कमजोर होती है। पर्याप्त शिक्षा और राजनीतिक जानकारी के अभाव में उन्हें प्रशासनिक कार्यों, सरकारी योजनाओं तथा कानूनी प्रक्रियाओं को समझने में कठिनाई होती है। इससे उनकी निर्णय लेने की क्षमता प्रभावित होती है।

2. पितृसत्तात्मक सामाजिक व्यवस्था

भारतीय समाज में आज भी पुरुष प्रधान सोच का प्रभाव देखा जाता है (जायल, 2006)। कई स्थानों पर महिलाओं को स्वतंत्र रूप से कार्य करने की अनुमति नहीं मिलती तथा उनके विचारों को पर्याप्त महत्व नहीं दिया जाता। यह स्थिति उनके राजनीतिक सशक्तिकरण में बाधा उत्पन्न करती है।

3. 'सरपंच पति' की समस्या

कई पंचायतों में निर्वाचित महिला प्रतिनिधियों के स्थान पर उनके पति या परिवार के पुरुष सदस्य निर्णय लेते हैं। ऐसी स्थिति में महिलाएँ केवल नाममात्र की प्रतिनिधि बनकर रह जाती हैं और वास्तविक सत्ता पुरुषों के हाथों में बनी रहती है।

4. आर्थिक निर्भरता

अधिकांश ग्रामीण महिलाएँ आर्थिक रूप से परिवार के अन्य सदस्यों पर निर्भर रहती हैं। आर्थिक संसाधनों की कमी के कारण वे राजनीतिक गतिविधियों में स्वतंत्र रूप से भाग नहीं ले पातीं तथा कई बार अपने निर्णय स्वयं लेने में भी असमर्थ रहती हैं।

5. राजनीतिक अनुभव की कमी

राजनीति में महिलाओं की भागीदारी अपेक्षाकृत नई है। अनुभव की कमी के कारण उन्हें प्रशासनिक कार्यों, बैठकों और विकास योजनाओं के संचालन में प्रारंभिक कठिनाइयों का सामना करना पड़ता है।

6. सामाजिक और पारिवारिक दबाव

महिलाओं को घरेलू जिम्मेदारियों के साथ-साथ राजनीतिक दायित्वों का भी निर्वहन करना पड़ता है। परिवार और समाज से मिलने वाला दबाव कई बार उनकी सक्रिय राजनीतिक भूमिका को सीमित कर देता है।

7. आत्मविश्वास की कमी

लंबे समय तक सामाजिक और राजनीतिक अवसरों से वंचित रहने के कारण कुछ महिलाओं में आत्मविश्वास की कमी देखी जाती है। सार्वजनिक मंचों पर अपनी बात रखने और निर्णय लेने में उन्हें संकोच महसूस हो सकता है।

इन चुनौतियों के बावजूद महिलाओं की राजनीतिक भागीदारी लगातार बढ़ रही है। उचित शिक्षा, प्रशिक्षण, आर्थिक सशक्तिकरण तथा सामाजिक सहयोग के माध्यम से इन बाधाओं को कम किया जा सकता है, जिससे महिलाओं की भूमिका पंचायती राज संस्थाओं में और अधिक प्रभावी बन सके।

तालिका 2 : महिलाओं के राजनीतिक सशक्तिकरण की प्रमुख चुनौतियाँ

क्रम संख्या	चुनौती	प्रभाव
1	अशिक्षा एवं राजनीतिक जागरूकता की कमी	निर्णय लेने और प्रशासनिक कार्यों में कठिनाई
2	पितृसत्तात्मक सामाजिक व्यवस्था	स्वतंत्र नेतृत्व और भागीदारी में बाधा
3	'सरपंच पति' की समस्या	वास्तविक अधिकारों का सीमित उपयोग
4	आर्थिक निर्भरता	राजनीतिक निर्णयों में स्वतंत्रता की कमी
5	राजनीतिक अनुभव की कमी	प्रशासनिक कार्यों के संचालन में कठिनाई
6	सामाजिक एवं पारिवारिक दबाव	सक्रिय राजनीतिक भागीदारी प्रभावित
7	आत्मविश्वास की कमी	सार्वजनिक मंचों पर प्रभावी नेतृत्व में बाधा

स्रोत: पंचायती राज एवं महिला सशक्तिकरण संबंधी विभिन्न अध्ययनों के आधार पर संकलित।

महिलाओं के राजनीतिक सशक्तिकरण का प्रभाव

पंचायती राज संस्थाओं में महिलाओं की बढ़ती भागीदारी का प्रभाव केवल राजनीति तक सीमित नहीं रहा है, बल्कि इसका सकारात्मक असर सामाजिक, आर्थिक और विकासात्मक क्षेत्रों में भी देखने को मिला है। महिलाओं के नेतृत्व ने ग्रामीण समाज में अनेक महत्वपूर्ण परिवर्तन लाए हैं।

1. निर्णय लेने की क्षमता में वृद्धि

पंचायतों में निर्वाचित होने के बाद महिलाओं को विभिन्न विकासात्मक और प्रशासनिक निर्णयों में भाग लेने का अवसर मिला है। इससे उनकी निर्णय लेने की क्षमता तथा नेतृत्व कौशल का विकास हुआ है। महिलाएँ अब अपने समुदाय की समस्याओं को समझकर उनके समाधान के लिए सक्रिय भूमिका निभा रही हैं।

2. सामाजिक स्थिति में सुधार

राजनीतिक भागीदारी ने महिलाओं की सामाजिक पहचान और सम्मान को बढ़ाया है। पहले जहाँ महिलाओं की भूमिका मुख्य रूप से घरेलू कार्यों तक सीमित मानी जाती थी, वहीं अब उन्हें समाज में नेतृत्वकर्ता और निर्णयकर्ता के रूप में देखा जाने लगा है।

3. ग्रामीण विकास को बढ़ावा

महिला प्रतिनिधियों ने शिक्षा, स्वास्थ्य, स्वच्छता, पेयजल, पोषण और महिला कल्याण जैसे मुद्दों पर विशेष ध्यान दिया है। इसके परिणामस्वरूप ग्रामीण क्षेत्रों में विकास कार्यों की गुणवत्ता और प्रभावशीलता में सुधार देखने को मिला है।

4. महिला अधिकारों के प्रति जागरूकता

पंचायतों में महिलाओं की उपस्थिति ने अन्य महिलाओं को भी अपने अधिकारों और कर्तव्यों के प्रति जागरूक बनाया है। इससे लैंगिक समानता को बढ़ावा मिला है तथा महिलाओं में आत्मनिर्भरता और आत्मविश्वास की भावना विकसित हुई है।

5. लोकतंत्र की मजबूती

महिलाओं की सक्रिय भागीदारी से लोकतांत्रिक प्रक्रिया अधिक समावेशी बनी है। समाज के विभिन्न वर्गों की समस्याएँ और आवश्यकताएँ पंचायतों के माध्यम से अधिक प्रभावी ढंग से सामने आने लगी हैं, जिससे लोकतंत्र की जड़ें और मजबूत हुई हैं।

6. नई पीढ़ी के लिए प्रेरणा

महिला प्रतिनिधियों की सफलता ने ग्रामीण क्षेत्रों की युवतियों और महिलाओं को शिक्षा प्राप्त करने, नेतृत्व करने तथा सार्वजनिक जीवन में आगे बढ़ने के लिए प्रेरित किया है। इससे महिलाओं की राजनीतिक भागीदारी के लिए सकारात्मक वातावरण तैयार हुआ है।

इस प्रकार पंचायती राज संस्थाओं में महिलाओं की भागीदारी ने न केवल उनके राजनीतिक सशक्तिकरण को मजबूत किया है, बल्कि ग्रामीण समाज के समग्र विकास और लोकतांत्रिक मूल्यों के विस्तार में भी महत्वपूर्ण योगदान दिया है।

तालिका 1 : पंचायती राज संस्थाओं में महिलाओं के राजनीतिक सशक्तिकरण के प्रमुख प्रभाव

क्रम संख्या	प्रभाव का क्षेत्र	प्रमुख परिवर्तन
1	राजनीतिक भागीदारी	पंचायतों में महिलाओं की सक्रिय उपस्थिति और नेतृत्व में वृद्धि

2	निर्णय लेने की क्षमता	स्थानीय समस्याओं के समाधान में महिलाओं की भागीदारी बढ़ी
3	सामाजिक स्थिति	महिलाओं के सम्मान, पहचान और आत्मविश्वास में वृद्धि हुई
4	ग्रामीण विकास	शिक्षा, स्वास्थ्य, स्वच्छता और पेयजल जैसे मुद्दों पर अधिक ध्यान दिया गया
5	महिला जागरूकता	महिलाओं में अधिकारों और कर्तव्यों के प्रति जागरूकता बढ़ी
6	लोकतांत्रिक सशक्तिकरण	स्थानीय शासन में जनभागीदारी और पारदर्शिता को बढ़ावा मिला

स्रोत: पंचायती राज एवं महिला सशक्तिकरण संबंधी विभिन्न अध्ययनों के आधार पर संकलित।

सुझाव

1. **महिलाओं की शिक्षा को बढ़ावा दिया जाए** ताकि वे अपने अधिकारों, कर्तव्यों और राजनीतिक प्रक्रियाओं को बेहतर ढंग से समझ सकें।
2. **निर्वाचित महिला प्रतिनिधियों के लिए नियमित प्रशिक्षण कार्यक्रम आयोजित किए जाएँ** जिससे उनकी नेतृत्व क्षमता और प्रशासनिक कौशल का विकास हो सके।
3. **महिलाओं की राजनीतिक जागरूकता बढ़ाने के लिए विशेष अभियान चलाए जाएँ** ताकि वे पंचायतों में सक्रिय और प्रभावी भूमिका निभा सकें।
4. **महिलाओं को आर्थिक रूप से सशक्त बनाया जाए** ताकि वे स्वतंत्र रूप से निर्णय लेने और राजनीतिक गतिविधियों में भाग लेने में सक्षम हों।
5. **‘सरपंच पति’ जैसी प्रवृत्तियों पर रोक लगाने के लिए प्रभावी कदम उठाए जाएँ** जिससे निर्वाचित महिला प्रतिनिधि स्वयं अपने अधिकारों का प्रयोग कर सकें।
6. **ग्रामीण समाज में लैंगिक समानता को बढ़ावा दिया जाए** ताकि महिलाओं को नेतृत्व और निर्णय लेने के समान अवसर प्राप्त हो सकें।
7. **महिला प्रतिनिधियों को सरकारी योजनाओं और प्रशासनिक प्रक्रियाओं की जानकारी उपलब्ध कराई जाए** जिससे वे अपने दायित्वों का बेहतर निर्वहन कर सकें।
8. **महिलाओं के लिए सुरक्षित और सहयोगपूर्ण राजनीतिक वातावरण तैयार किया जाए** ताकि वे बिना किसी दबाव के अपने कार्य कर सकें।
9. **स्वयं सहायता समूहों और महिला संगठनों को प्रोत्साहित किया जाए** जिससे महिलाओं में सामूहिक नेतृत्व और आत्मविश्वास का विकास हो सके।
10. **पंचायती राज संस्थाओं में महिलाओं की वास्तविक भागीदारी सुनिश्चित की जाए** ताकि उनका राजनीतिक सशक्तिकरण और ग्रामीण विकास दोनों मजबूत हो सकें।

निष्कर्ष

पंचायती राज संस्थाओं में महिलाओं की भागीदारी भारतीय लोकतंत्र को अधिक समावेशी और सशक्त बनाने की दिशा में एक महत्वपूर्ण कदम है। 73वें संविधान संशोधन के बाद महिलाओं को स्थानीय शासन में प्रतिनिधित्व प्राप्त हुआ, जिससे उनके राजनीतिक सशक्तिकरण को नई गति मिली। पंचायतों में सक्रिय भागीदारी के माध्यम से महिलाओं ने नेतृत्व क्षमता, निर्णय लेने की योग्यता तथा सामाजिक जागरूकता का विकास किया है।

अध्ययन से स्पष्ट होता है कि महिला प्रतिनिधियों ने शिक्षा, स्वास्थ्य, स्वच्छता, पेयजल, महिला एवं बाल कल्याण जैसे विषयों को प्राथमिकता देकर ग्रामीण विकास में महत्वपूर्ण योगदान दिया है। साथ ही, उनकी भागीदारी से महिलाओं की सामाजिक स्थिति में सुधार हुआ है तथा लोकतांत्रिक प्रक्रिया अधिक प्रभावी और सहभागी बनी है।

हालाँकि अशिक्षा, आर्थिक निर्भरता, पितृसत्तात्मक सोच तथा 'सरपंच पति' जैसी समस्याएँ अभी भी महिलाओं के प्रभावी नेतृत्व में बाधा उत्पन्न करती हैं। इन चुनौतियों के बावजूद महिलाओं ने अपनी क्षमता और नेतृत्व कौशल का सफल परिचय दिया है।

अतः कहा जा सकता है कि पंचायती राज संस्थाएँ महिलाओं के राजनीतिक सशक्तिकरण का एक प्रभावी माध्यम हैं। यदि महिलाओं को उचित शिक्षा, प्रशिक्षण, आर्थिक सहयोग तथा सामाजिक समर्थन प्रदान किया जाए, तो वे न केवल स्थानीय शासन को अधिक प्रभावी बना सकती हैं, बल्कि ग्रामीण विकास और लोकतंत्र की मजबूती में भी महत्वपूर्ण भूमिका निभा सकती हैं।

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