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THAKUR RAMNARAYAN COLLEGE OF ARTS & COMMERCE

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Research & Development Cell

Organises

शोध समीक्षा

"A Platform for Innovation & Knowledge"

ONE DAY MULTIDISCIPLINARY INTERNATIONAL CONFERENCE

THEME

VISION VIKSIT BHARAT 2047: EMPOWERING YOUTH, DRIVING INNOVATION AND ENSURING SUSTAINABILITY

DATE OF CONFERENCE

07TH FEBRUARY 2026

CONFERENCE MODE AND LOCATION

Thakur Ramnarayan Educational Campus, S.V. Road, Dahisar (East), Mumbai-400068.

Website Facebook Instagram Linkedin

ABOUT UNIVERSITY OF MUMBAI :

The University of Mumbai, formerly known as the University of Bombay, is one of India's oldest and most prestigious universities. Established in 1857 following "Wood's Education Dispatch," it is among the first three universities founded in India. Following the renaming of the city from Bombay to Mumbai, the university's name was officially changed to the University of Mumbai, as per a notification by the Government of Maharashtra published in the Government Gazette on September 4, 1996. The University received a 5-star rating from the National Assessment and Accreditation Council (NAAC) in 2001 and was awarded an 'A++ grade in April 2017.

ABOUT THAKUR TRUST:

Thakur Educational Trust was established by the Thakur family to fulfill their responsibility of repaying social debt. Registered as a Public Trust in 1990, its mission was to support societal welfare and reform the education system. In 1990, the trust took its first step into education and has since grown into a conglomerate of premier educational institutions led by the Thakur family. The trust encompasses top-tier educational institutes, university accredited professional courses, and autonomous programs. All institutions under the trust are ISO certified, reflecting their ability to meet global educational needs with professionalism.

ABOUT TRCAC:

Thakur Ramnarayan College of Arts and Commerce (TRCAC) is a dynamic intellectual center committed to fostering student learning, advancing faculty research, and contributing actively to the broader community. The college emphasizes a holistic educational experience, encouraging students to engage meaningfully with their peers both inside and outside the classroom. At TRCAC, we prioritize collaborative learning, personal intellectual growth and respect for diverse perspectives, which empower our graduates to excel in a rapidly changing world. Accredited by NAAC with a B grade and a CGPA of 2.44, and certified under ISO 21001:2018, TRCAC upholds the highest standards of academic and institutional excellence. Offering undergraduate programs in Arts, Science, Commerce and Self Finance, the college equips students with critical thinking skills, effective communication abilities and a comprehensive knowledge base. This well-rounded education prepares them for professional success and meaningful societal contributions.

ABOUT PRINCIPAL :

Dr. Sumathi Rajkumar has dedicated her career spanning over 17 years in shaping young minds and cultivating an environment that encourages innovation, creativity, and critical thinking. Under her leadership, the institution has made significant strides such as NAAC accreditation, ISO certification. As a passionate advocate for educational reform & academic integrity, Dr. Sumathi Rajkumar brings a wealth of knowledge and vision to the table. Her focus on nurturing a dynamic learning atmosphere aligns perfectly with the goals of this conference

Dr. Sumathi Rajkumar

Principal

Thakur Ramnarayan College of Arts and Commerce (TRCAC)

ABOUT IQAC :

The Internal Quality Assurance Cell (IQAC) is vital in improving the overall quality of education. It serves as an internal monitoring body, consistently evaluating various aspects of the institution's operations. Its core responsibilities include establishing and implementing robust internal assessment systems, promoting faculty development, collecting and analyzing student feedback, and reviewing institutional performance data. By nurturing a culture of continuous enhancement, the IQAC enables the institution to recognize its strengths and address its weaknesses, facilitating proactive measures to achieve excellence in teaching, learning, and research.

ABOUT RDC :

The Research & Development Cell (RDC), established in 2022, aims to promote a strong research culture among faculty members and students of the institute. RDC actively guides and mentors students in their research journey, leading to the initiation of the Students' Research Convention, "Shodh-Anveshan." The cell successfully conducted its first National Conference, "Shodh Samiksha," on 8 February 2025. In addition, RDC encourages and supports the publication of research papers in reputed journals and conference proceedings. Over the years, RDC has also organized various workshops, seminars, and training programmes, with a primary focus on enhancing the quality, originality, and impact of research among faculty members and students.

RDC
RESEARCH & DEVELOPMENT CELL

ABOUT CONFERENCE THEME :

शोध समीक्षा : A Platform for Innovation & Knowledge is an International Level One-Day Multidisciplinary Conference dedicated to fostering academic excellence, encouraging innovative research, and promoting intellectual collaboration across diverse disciplines. This year's theme, "Vision Viksit Bharat 2047: Empowering Youth, Driving Innovation and Ensuring Sustainability," reflects India's transformative developmental roadmap as the nation approaches the centenary of its independence in 2047. The vision of Viksit Bharat 2047 is centred on four key pillars Yuva (Youth), Garib (Poor), Mahilayen (Women), and Annadata (Farmers) - with a strong emphasis on empowering these groups to drive inclusive economic growth, social progress, technological advancement, environmental sustainability, and India's enhanced global leadership

ESTEEMED GUEST :

Dr. Ruby Ojha

Pro Vice Chancellor
SNDT Women's University, Mumbai

Dr. Ruby Ojha is a senior academic leader and Pro-Vice Chancellor of SNDT Women's University, Mumbai, with over 30 years of experience in teaching, research, and higher education administration. An accomplished scholar in economics and development studies, she has made notable contributions to women's empowerment, inclusive growth, and policy-oriented research. She is a prolific author, researcher, and mentor, actively engaged in advancing quality education and nation-building initiatives

KEYNOTE SPEAKER :

Ms. Shanthi Rajan

Director,
SQA RAK Campus & Head of Academic Development University of Stirling , UAE

Ms. Shanthi Rajan is a senior HR and academic professional with over 34 years of experience, currently serving as Director of SQA Diplomas at the University of Stirling, RAK Campus. She has held key leadership roles in institutional development and quality assurance and has taught across universities in Asia, Africa, and the Middle East. Her work focuses on strategic planning, quality assurance, faculty and student development, and enhancing employability aligned with international standards. Since 2024, she has been engaged in cross-country educational dialogues, collaborating with educators from six countries and co-authoring a UNESCO-linked initiative on holistic education.

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Research Papers

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A STUDY ON EFFECT OF TAX REFORM AND FISCAL INCENTIVES USED FOR SUSTAINABLE BUSINESS

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ABSTRACT
Purpose: *The purpose of the study is to present evidence on government tax reforms and fiscal incentives as important support mechanisms for sustainable businesses in India. The study focuses on policies that promote green manufacturing, reduce financial barriers, encourage investment, support job creation, and contribute to national climate and energy goals.*

Methodology: *Employing a purely secondary data-based approach, the study analyses the effect of tax reforms and fiscal incentives on sustainable businesses by capturing reports from official sources over a 6-year period (FY 2019–26).*

Key Findings: *Key findings provide evidence that tax reforms deliver compounding, long-run advantages including financial resilience, efficiency gains, and emission decline while fiscal incentives drive rapid scaling, investment surge, job growth, and domestic manufacturing boost, together producing a combined effect that addresses market failures and accelerates the low-carbon shift. verifiable insights that offer valuable reference material for future research and policy analysis aimed at advancing sustainable business development in India.*

Keywords: *Tax reforms, fiscal incentives, sustainable businesses, green manufacturing.*

INTRODUCTION
In an era marked by escalating environmental challenges and widening economic disparities, the imperative for sustainable development has never been more pressing. Tax reform and fiscal incentives emerge as pivotal instruments in steering economies toward sustainability while fostering inclusive growth. This research paper delves into the transformative potential of tax policies tailored to incentivize sustainable businesses, examining how strategic reforms can align fiscal strategies with environmental stewardship and social equity. By focusing on mechanisms that reward green practices, such reforms not only mitigate ecological degradation but also stimulate innovation, job creation, and resilient economic structures.

The global discourse on sustainability underscores the role of taxation as a dual-edged tool: one that generates revenue for public goods and another that influences behavioural change among corporations and individuals. In the context of developing economies like India, where rapid industrialization coexists with vulnerabilities to climate change, tax systems such as the Goods and Services Tax (GST) present opportunities for simplification and enhancement.

Tax reforms ranging from lowered corporate tax rates, accelerated depreciation allowances for renewable assets, preferential GST treatment for green products, to targeted deductions and exemptions for environmentally beneficial investments bestow lasting financial relief. By easing the tax load on sustainable expenditures, these measures unlock capital that businesses can redirect toward innovation, capacity expansion, and efficiency enhancements. Over extended horizons, they generate compounding advantages: deepened profitability, fortified operational resilience, progressively shrinking environmental footprints, and stronger alignment with national sustainability imperatives. In essence, they correct market distortions by rewarding positive externalities inherent in low-carbon practices.

Fiscal incentives delivered through direct subsidies, performance-linked rewards via Production-Linked Incentive (PLI) schemes, mission-specific grants (National Green Hydrogen Mission), and concessional financing, provide immediate and decisive capital support. These instruments substantially diminish the prohibitive upfront costs often 30–60% of project outlays for clean technologies thereby lowering risk exposure, especially for small and medium enterprises, and enabling swift deployment of renewables, electric vehicles, and green hydrogen infrastructure. Beyond cost relief, they catalyse domestic manufacturing ecosystems, spawn employment in high-growth green sectors, stimulate technological breakthroughs, and unleash powerful economic multipliers, all while harmonizing private-sector actions with public goals of energy independence, emission abatement, and inclusive development.

Together, these policy instruments forge a supportive ecosystem capable of attracting massive capital inflows, sharpening global competitiveness, and ensuring that economic advancement remains inseparable from ecological well-being. This study delves into these interwoven policy mechanisms within the Indian landscape, illuminating the enduring advantages of tax reforms and the transformative reach of fiscal incentives on sustainable businesses, offering insights vital for nurturing resilient, low-carbon prosperity.

REVIEW OF LITERATURE

Sasanur (2022)

The paper "Impact of Tax Policy Changes on Economic Growth in India: A Conceptual Study" published in the International Journal of Research and Analytical Reviews (IJRAR), gives a simple and broad overview of how changes in India's tax policies affect economic growth. Using secondary sources like articles, journals, and official reports, it explains key ways taxes help the economy: lower corporate taxes and deductions boost investment and savings; reduced personal income taxes and GST unification increase consumer spending; post-2019 lower corporate rates attract more foreign direct investment (FDI); and GST simplification makes doing business easier. The paper also covers other areas like government revenue balance, reducing income inequality through progressive taxes, better tax compliance with technology, links to monetary policy, and long-term factors such as infrastructure, R&D incentives, agriculture reforms, environmental sustainability (including green tax incentives, carbon pricing, and the National Clean Energy Fund), human capital, global trade, demographics, and social security. It highlights how reforms like GST and corporate tax cuts can encourage entrepreneurship, inclusivity, and overall growth, but points out challenges like maintaining fiscal balance and effective implementation. The author suggests flexible, future-focused tax policies for strong, fair, and sustainable development. This work serves as a solid basic reference on tax-growth connections in India, though it is mostly descriptive and does not cover later green-focused GST changes.

Adjetey et al. (2024)

The paper "Analysing the Role of Tax Incentives in Advancing Inclusive and Sustainable Economic Growth Through Integrated Fiscal and Green Transition Approaches", published in the International Journal of Scientific Research and Modern Technology, explore how tax incentives promote fair and eco-friendly economic growth. Drawing from examples in developed, emerging, and developing countries, the authors show how tools like tax holidays, investment credits, accelerated depreciation, grants, cheap loans, and simpler rules push companies to invest in green technologies, cut carbon emissions, and create jobs in clean energy and renewable sectors. These incentives help achieve bigger aims: faster GDP growth, more foreign investment, benefits for poor areas, women, youth, and small businesses, and support for UN Sustainable Development Goals (SDGs). The paper includes global case studies showing how such tools reduce money problems, build skills, and keep government budgets stable without big losses. However, it warns about dangers like poor use of resources if monitoring is weak, companies becoming too dependent, and unfair effects on some groups. For success, incentives need clear rules, strong checks, and links to wider green and social plans. The authors conclude that well-designed tax incentives, part of bigger strategies, can create stronger, fairer, and greener economies, and call for more real-world studies on results and best practices worldwide. This recent work gives useful ideas that connect to India's current steps, like lower GST on EVs and renewables, plus programs such as PLI schemes and the National Green Hydrogen Mission.

Objective

1. To analyse the long-term benefits of tax reforms on sustainable businesses
2. To examine the impact of fiscal incentives on sustainable businesses

RESEARCH METHODOLOGY

Method of data collection

This research employs a **purely secondary data-based approach** to evaluate the effects of tax reforms and fiscal incentives on sustainable businesses in India. The methodology relies exclusively on existing published sources, avoiding primary data collection such as surveys or interviews. This design is descriptive, exploratory, and analytical, drawing on quantitative metrics (e.g., investment inflows, capacity additions, job creation, emission reductions) and qualitative insights (e.g., policy evaluations, thematic trends) from credible secondary sources.

Variable

Examining compounding effects through metrics like ROI growth, cost efficiencies, emission intensity reductions, and economic resilience, Assessing immediate and scaling effects (e.g., manufacturing growth,

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innovation) via indicators such as investment realization, job generation, and domestic value addition, as detailed in the paper.

Sources of Data

Secondary data is drawn exclusively from reliable, publicly available sources, prioritized for recency (2019–2026), relevance to Indian contexts, and credibility:

a) **Government and Official Reports**: Ministry of New and Renewable Energy (MNRE), Press Information Bureau (PIB), Invest India, National Green Hydrogen Mission (NGHM) portal, Union Budget documents (e.g., 2025-26), and scheme-specific progress reports (e.g., PLI dashboards, PM E-DRIVE/FAME-II updates).

b) **Policy and Economic Analyses**: Reports from EY India, IEEFA, Deloitte, KPMG, World Economic Forum, Climate Action Tracker, and academic/policy institutions (e.g., NIPFP, Brookings-inspired analyses).

c) **Empirical and Sectoral Studies**: Journal articles, working papers, and databases covering tax reforms (e.g., GST rationalization, corporate tax reductions to 15–22%), PLI schemes (e.g., solar PV, ACC batteries), FAME/PM E-DRIVE subsidies, and NGHM incentives (e.g., SIGHT program outlays of ₹17,490 crore).

d) **Quantitative Databases**: Metrics from CMIE, RBI Handbook of Statistics on Indian States, MNRE portals (e.g., 48 GW solar capacity targets, 8.62 lakh tonnes green hydrogen awards), and economic indicators (e.g., FDI inflows US$728B cumulative, exports US$824.9B in FY 2024-25).

Period of study

Analyse the effect of tax reforms and fiscal incentives on sustainable businesses by capturing reports from official sources over a 6 years period (FY 2019–26)

LIMITATIONS

a) Reliance on secondary data may introduce publication bias or data gaps (e.g., incomplete real-time scheme outcomes).

b) This is mitigated by cross-verification across diverse sources and focus on peer-reviewed/official reports.

c) No primary human subjects are involved, so ethical concerns are limited to accurate citation and avoidance of misrepresentation.

d) The study period covers data up to early 2026 for currency.

e) This secondary-only methodology provides reliable, evidence-based insights into how Indian tax reforms and fiscal incentives foster sustainable business growth, directly informing the analytical tables and contributing to policy discourse on green transitions.

Benefits of Tax Reform on sustainable businesses in long Run

The analysis synthesizes evidence from Indian policy evaluations, empirical studies, and government reports to demonstrate how tax reforms—such as Goods and Services Tax (GST) adjustments, corporate tax rate reductions, Production Linked Incentive (PLI) schemes, accelerated depreciation for renewables, and targeted incentives for green technologies—deliver compounding advantages over 6 years.

In India, tax reforms address external environment factors like low-carbon activities, incentivizing clean technology adoption, and enabling reinvestment of savings. While short-term challenges like compliance costs or inverted duty structures may arise, long-run net benefits emerge through cost reductions, competitiveness, and alignment with national goals such as Net Zero by 2070

1. Financial & Cash Flow Stability

Reduced tax burdens free up capital for green investments, improving cash flow, fiscal sustainability, and reinvestment potential.

Key examples

a) Corporate tax reduced to 22% (effective ~25.17% incl. surcharge/cess) for domestic companies since 2019.

b) New manufacturing companies eligible for 15% rate.

c) PLI schemes provide incentives/rebates for solar, EV, and battery manufacturing → lowers effective liabilities while expanding tax base.

Time horizon & impact
6 years, enables higher reinvestment, gradual tax-to-GDP improvement, compounded growth from saved capital.

2. Operational Efficiencies & Cost Reductions
Incentives promote energy/resource efficiency and reduce input/project costs for sustainable operations.

Key examples
a) GST on renewable energy devices/parts (solar panels, wind equipment, biogas) rationalized to 5% (from 12%).

b) Resolution of inverted duty structure in EVs and components → frees up working capital.

Time horizon & impact
Long-term cumulative savings; typical 5–10% reduction in capital costs; break-even/positive ROI in 5–8 years for green projects.

3. Innovation & Technological Adoption
Tax credits, PLI schemes, and accelerated depreciation lower barriers to R&D and domestic clean-tech manufacturing.

Key examples
a) PLI for high-efficiency solar PV modules drives upstream integration and large-scale investment.

b) Accelerated depreciation up to 40% (WDV basis) for renewable assets encourages faster technology upgrades.

Time horizon & impact
Sustained innovation cycles over 10+ years; strong progress toward 75–80% domestic value addition in key sectors by late 2020s; significant annual import substitution (billions in solar/components)

4. Emission Reductions & Environmental Performance
Preferential GST rates, excise treatments, and incentives accelerate shift to low-carbon technologies and fuels.

Key examples
a) PLI + FAME schemes for EVs and renewables reduce fossil fuel dependence.

b) Emission intensity of GDP already reduced by 36% (2005–2020 levels).

c) Alignment with Net Zero 2070 and updated NDC targets (45% intensity reduction by 2030 from 2005 baseline).

Time horizon & impact
Decades-long cumulative reductions; potential for 26–47% further cuts via aligned policies (including carbon pricing elements); strong contribution to SDGs.

5. Economic Growth & Competitiveness
Revenue-neutral reforms + targeted incentives boost productivity, job creation, investor confidence, and global positioning.

Key examples
a) Corporate tax cuts improve attractiveness for FDI and MNCs.

b) Solar PLI has generated >₹48,000 crore investment + 38,500+ direct jobs (mid-2025 figures); major production surge in modules.

c) GST unification creates single national market.

Time horizon & impact
Mild-to-moderate positive GDP multiplier over medium term; improved export competitiveness, stock market sentiment, supply-chain resilience; supports 500 GW non-fossil capacity target by 2030.

6. Broader Societal & Market Spillovers
Higher revenue collections fund infrastructure; green incentives attract FDI, strengthen energy security, supply chains, and inclusive growth.

Key examples
a) PLI reduces import dependence (solar cells, batteries, EV components) → enhances energy security.

b) GST exemptions/rationalization on biogas supports green mobility and agriculture linkages.

c) Boosts SMEs and startups in the clean-tech ecosystem.

Time horizon & impact
Compounding benefits over decades; greater economic resilience, job creation (especially manufacturing), and equity/inclusive growth.

Effect of fiscal incentives on sustainable businesses
The analysis draws from Indian policy evaluations, empirical evidence, and government reports to demonstrate how fiscal incentives—such as subsidies under FAME-II, Production-Linked Incentive (PLI) schemes for solar PV modules and EVs, capital subsidies, grants for green hydrogen and battery storage, accelerated depreciation for renewables, and reduced GST rates—deliver immediate and sustained advantages to businesses in sectors like renewable energy, electric vehicles (EVs), and sustainable manufacturing.

In India, fiscal incentives address high upfront costs and market barriers by providing direct financial support, lowering operational risks, and accelerating adoption of clean technologies. These tools stimulate innovation, job creation, domestic manufacturing, and emission reductions while aligning with national goals like Net Zero by 2070, 500 GW non-fossil capacity by 2030, and energy security. Short-term effects include cost offsets and rapid scaling; long-term benefits emerge through economies of scale, competitiveness, and ecosystem development.

1. Cost Reduction & Financial Stability

Description & Mechanism
Subsidies, tax rebates, and concessional loans offset capital/operational expenses, improving cash flow and enabling green investments.

Latest Indian Examples & Evidence (2025-2026)
PLI schemes (e.g., solar PV, ACC batteries) offer 4-6% incentives on incremental sales; PM E-DRIVE provides ₹2,500/kWh battery subsidies for EVs (reduced from ₹5,000/kWh in 2025-26 phase); NGHM incentives (₹17,490 crore outlay) for electrolysers/green hydrogen production.

Impact on Business Growth
Short-term: 5-10%+ cost cuts, faster break-even. Long-term: Compounded ROI, reduced liabilities, expanded tax base for profitability.

Key Metrics & Sources
₹1.76 lakh crore+ PLI investments realized overall; 100% profit deduction for startups under Section 80-IAC extended to 2030. (PLI progress reports, MNRE, Budget 2025-26).

2. Manufacturing & Supply Chain Localization

Description & Mechanism: Performance-linked incentives boost domestic capacity, reduce imports, and build resilient supply chains.

Latest Indian Examples & Evidence (2025-2026): PLI for High-Efficiency Solar PV (Tranche-II: significant awards leading to capacity build-up); ACC Battery PLI (₹18,100 crore allocation, though progress slower at ~1.4 GWh commissioned by late 2025 vs. 50 GWh target); electrolyser manufacturing incentives (3,000 MW capacity awarded to 15 companies, ₹4,440 crore total incentives).

Impact on Business Growth: Short-term: Sales surge and import substitution. Long-term: 75-80% domestic value addition by 2028-29, export growth, reduced global dependency.

Key Metrics & Sources: Solar module capacity targets advancing (e.g., towards 48-65 GW under PLI); 862,000 tonnes/annum green hydrogen production awarded. (MNRE, PIB, IEEFA reports).

3. Innovation & Technological Advancement

Description & Mechanism: Grants and incentives fund R&D, pilots, and advanced tech adoption in clean energy.

Latest Indian Examples & Evidence (2025-2026): NGHM pilots (e.g., ₹455 crore for low-carbon steel, ₹496 crore for mobility applications); PLI for advanced auto components; tax incentives for R&D in EVs/green hydrogen; ongoing Budget 2026 discussions for recalibrated PLI and enhanced R&D tax breaks.

Impact on Business Growth: Short-term: Faster prototyping and pilots. Long-term: New products/markets, innovation-driven revenue, tech leadership.

Key Metrics & Sources: 15 companies awarded electrolyser capacity; promotion of nonlinear green innovation. (MNRE NGHM updates, Deloitte analyses).

4. Market Expansion & Competitiveness

Description & Mechanism: Incentives enhance global positioning, attract FDI, and support exports in green sectors.

Latest Indian Examples & Evidence (2025-2026): PLI across 14 sectors (₹1.97 trillion total allocation); GST concessions (5% on EVs/renewables); extended incentives for clean mobility and manufacturing.

Impact on Business Growth: Short-term: Increased sales/exports. Long-term: FDI inflows, "China Plus One" advantages, sustainable market share.

Key Metrics & Sources: Cumulative FDI ~US$728B; exports US$824.9B in FY 2024-25; EV market share growth to ~7.5%. (India Briefing, Invest India).

5. Job Creation & Economic Multipliers

Description & Mechanism: Incentives stimulate employment in green ecosystems and ancillary sectors.

Latest Indian Examples & Evidence (2025-2026): PLI generates substantial jobs; solar PLI adds tens of thousands; EV/renewable schemes create direct/indirect roles in manufacturing and services.

Impact on Business Growth: Short-term: Immediate hiring. Long-term: Inclusive growth, workforce upskilling, economic diversification.

Key Metrics & Sources: Over 1.1 million jobs projected/achieved across PLI; solar PLI: ~38,500–44,400 jobs + ₹48,000–52,900 crore investment (as of mid-to-late 2025); auto PLI: ~44,987 jobs. (PIB, MNRE).

6. Environmental & Reputation Benefits

Description & Mechanism: Incentives for emission reductions improve ESG performance and attract investors/consumers.

Latest Indian Examples & Evidence (2025-2026): NGHM demand creation for green hydrogen/ammonia; tax incentives for net-zero adoption; Budget 2025-26/2026 focus on ESG-linked benefits.

Impact on Business Growth: Short-term: Compliance savings. Long-term: Enhanced brand value, green finance access, alignment with SDGs.

Key Metrics & Sources: Emission intensity drop of 36% (from 2005 baseline); positioning as global green hydrogen hub. (EY, Budget analyses, MNRE).

7. Policy & Regulatory Alignment

Description & Mechanism: Incentives provide long-term certainty, reducing risks for planning and investment.

Latest Indian Examples & Evidence (2025-2026): Extended PLI timelines; PM E-DRIVE (₹10,900 crore till March 2026, with adjustments like reduced subsidies and phase-outs for certain categories); NGHM ecosystem support; Budget 2026 expectations for EV PLI recalibration and renewables push.

Impact on Business Growth: Short-term: Easier compliance. Long-term: Adaptive growth in sustainable markets and energy security.

Key Metrics & Sources: 500 GW non-fossil capacity target by 2030; green hydrogen production capacity aiming for 5 MMT/annum. (MNRE, Deloitte).

Findings of the Study

This study, based on secondary data from official Indian government sources (MNRE, PIB, Invest India) and credible analyses (IEEFA, EY), evaluates the effects of tax reforms and fiscal incentives on sustainable businesses in India. The findings are structured around the two research objectives, drawing directly from the compiled tables and updated metrics as of early 2026.

1. **Financial and Cash Flow Stability**: Lower corporate tax rates (15% for new manufacturing under Section 115BAB) and deductions have improved cash flows, enabling reinvestment in green assets. This has

supported sustained profitability and fiscal resilience, with tax-to-GDP improvements post-reforms contributing to broader economic stability.

2. **Operational Efficiencies and Cost Reductions**: Preferential GST rates and accelerated depreciation have reduced project costs by 5–10%, accelerating break-even for green infrastructure (typically 5–8 years). Reforms have lowered operating expenses in renewables and EVs, enhancing long-term competitiveness.

3. **Emission Reductions and Environmental Performance**: Tax incentives have supported a progressive decline in emission intensity (36% reduction from 2005 levels as per official BUR-4 data). New emission intensity targets under the Carbon Credit Trading Scheme (CCTS) for 2025–26 and 2026–27 (e.g., 2.71–6.5% weighted average reductions across sectors) reinforce behavioural shifts toward low-carbon operations.

4. **Economic Growth and Competitiveness**: Reforms have boosted investor confidence, with concessional rates attracting FDI and expanding the tax base. Long-term spillovers include stronger domestic manufacturing and alignment with Net Zero 2070, though impacts vary by sector (stronger for manufacturing and renewables).

5. **Immediate Cost Reduction and Adoption Boost**: PM E-DRIVE (₹10,900 crore outlay, October 2024–March 2026) has accelerated EV uptake, with subsidies (e.g., ₹2,500/kWh in later phases) leading to rapid exhaustion of funds for e-3W (L5 category ₹857 crore depleted early). This has boosted market share and demand in public/commercial transport.

6. **Manufacturing and Supply Chain Development**: PLI schemes have attracted massive investments (₹48,120–52,900 crore for solar PV as of 2025, with additional capacities reaching 17 GW modules, 6 GW cells, and 2 GW ingot-wafer). Tranche-II allocations (39,600 MW) target 75–80% domestic value addition by 2028–29, reducing import dependence.

7. **Job Creation and Economic Multipliers**: PLI has generated 38,500–44,400 jobs in solar alone, with broader schemes exceeding 1.1 million jobs. Multipliers extend to Tier-2/3 cities and ancillary sectors.

8. **Innovation and Technological Advancement**: NGHM incentives (₹17,490 crore for SIGHT) have awarded 862,000 tonnes green hydrogen production and 3,000 MW electrolyser capacity, funding pilots in steel/mobility and spurring advanced tech adoption.

9. **Emission Reductions and Broader Resilience**: Incentives have supported emission intensity drops and energy security, with solar capacity additions (e.g., 11 GW modules + 5 GW cells in 2025) and green hydrogen progress aligning with 500 GW non-fossil target by 2030.

CONCLUSION

The evidence confirms that India's tax reforms and fiscal incentives have effectively supported sustainable businesses, addressed market failures and accelerated the shift to low-carbon models. Tax reforms provide deferred, compounding benefits for long-term resilience, while fiscal incentives deliver rapid scaling and multipliers (e.g., investments, jobs, capacities). Together, they position sustainable enterprises for enduring success, contributing to economic growth, energy independence, and environmental goals. Implementation refinements (e.g., gradual tapering, upstream focus) will further enhance outcomes in the path to Net Zero by 2070.

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A STUDY ON THE ROLE OF YOUTH IN VIKSIT BHARAT MISSION 2047

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ABSTRACT
India is home to the world's largest youth population, with over 65% of its citizens under the age of 35. The youth are not just future leaders—they are the drivers of change today. From technology to social reform, entrepreneurship to governance, the contribution of young Indians is vital for transforming India into a developed nation. According to a report by PIB the year 2025 has been a defining year for India's growth. India with a GDP of USD 4.18 trillion dollars has overtaken Japan to become the world's 4th largest economy. The RBI has revised India's GDP growth from 6.8% to 7.3% for FY 2025-26. India is gaining momentum over the years with a consistently declining unemployment rate. In this scenario Youth has a very important role to play. The role of youth is vital for India to achieve its goal of a developed country by 2047.This paper explores the mindset of the youth in terms of their perception, preferences and outlook towards the idea of a Viksit Bharat and how they would contribute in this critical mission. The success of the mission depends on how clear the perception of the youth is about the mission, their role, the confidence in the efforts of the government and last but not the least what benefit they will get out of it. The paper analyzes the responses collected with the help of a Primary Survey done amongst the youth population to identify the desired outcomes.

Keywords: *Youth, Viksit Bharat mission 2047, India, growth, contribution*

INTRODUCTION
VIKSIT BHARAT 2047 is a dream project of Government of India to transform India as a developed country by the year 2047.To achieve this goal NITI AAYOG has made a blue print VISION INDIA@2047.

India's growth story in recent years is marked by the development in technology, infrastructure, industrial growth and fast track efficient services for the people. However, this journey was full of challenges. The way India faced COVID-19 crisis is an example for the whole world. The Make in India movement, Digital India and the government push for the UPI helped the country to set the journey on a fast pace.UPI is an example for the entire world that how a country with the largest population in the world can aspire for complete digitalization of financial transactions and could achieve it to a large extent. This was the boldest step ever in any part of the world to move towards the cashless economy. As India moves to the next phase of its development the youth of India has a critical role to play. India is one of the youngest nations and is the fourth largest economy in the world in terms of GDP. It is imperative to understand what youth perceives about the VIKSIT BHARAT mission and how they would play the role assigned to them. Do they really understand their role? What is their awareness and preferences towards factors critical for VIKSIT BHARAT? Do they know and appreciate the efforts of the Government towards the Viksit Bharat mission? What is their perception about how they would contribute or would like to contribute towards Viksit Bharat Mission? The research paper raises these questions to the youth and try to understand their mindset.

OBJECTIVES
1. To understand the awareness and preferences of the youth towards factors critical for the Viksit Bharat Mission.
2. To analyze the feelings of the youth towards the efforts made by the Government towards Viksit Bharat mission.
3. To explore the opinion of the youth towards how they want to realise Viksit Bharat Mission.

RESEARCH METHODOLOGY
Sampling Method-Convenience Sampling

Sample Size- 102Data Collection Method- Questionnaire survey

Data Analysis tool- SPSS Version 29 and 31

Mode of Distribution-Online Google Form

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DATA ANALYSIS

Table 1.1

Reliability Statistics

Cronbach's Alpha	N of Items
.904	16

Descriptive statistics

Demographic factors

Table 1.2

EDUCATION LEVEL

	N	%
SSC	15	14.6%
HSC	43	41.7%
GRADUATE	25	24.3%
POST GRADUATE	17	16.5%
Ph.D	2	1.9%
Missing System	1	1.0%

Table 1.3

GENDER DISTRIBUTION

	N	%
MALE	62	60.2%
FEMALE	40	38.8%
Missing System	1	1.0%

Table 1.4

OCCUPATION DIST.

	N	%
STUDENT	69	67.0%
EMPLOYED	25	24.3%
SELF-EMPLOYED	7	6.8%
NOT EMPLOYED	1	1.0%
Missing System	1	1.0%

Descriptive Statistics (Key factors)

Analysis construct (Likert Scale): 1-Strongly Disagree,2-Disagree,3-Neutral,4-Agree,5-Strongly Agree

❖ **Analysis -Ego centric Life Patterns**

Table 1.5

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I always keep the interest of my country first while taking career decisions?	102	1.00	5.00	3.6667	1.11988
I am aware of the political scenario of the countr and its is important for me	102	1.00	5.00	4.0000	1.01474
I am actively engaged in community activities through my school / college and i find it appealing	102	1.00	5.00	3.6373	1.07895
I cherish diversity of indian culture and would love to preserve it	102	1.00	5.00	4.5294	.88671
Valid N (listwise)	102				

Table 1.5.1

I always keep the interest of my country first while taking career decisions?

	N	%
STRONGLY DISAGREE	8	7.8%
DISAGREE	3	2.9%
NEUTRAL	29	28.2%
AGREE	37	35.9%
STRONGLY AGREE	25	24.3%
Missing System	1	1.0%

Table 1.5.2

I am aware of the political scenario of the countr and its is important for me

	N	%
STRONGLY DISAGREE	5	4.9%
DISAGREE	1	1.0%
NEUTRAL	19	18.4%
AGREE	41	39.8%
STRONGLY AGREE	36	35.0%
Missing System	1	1.0%

Table 1.5.3

I am actively engaged in community activities through my school / college and i find it appealing

	N	%
STRONGLY DISAGREE	6	5.8%
DISAGREE	7	6.8%
NEUTRAL	27	26.2%
AGREE	40	38.8%
STRONGLY AGREE	22	21.4%
Missing System	1	1.0%

Table 1.5.4

I cherish diversity of indian culture and would love to preserve it	N	%
STRONGLY DISAGREE	4	3.9%
NEUTRAL	3	2.9%
AGREE	26	25.2%
STRONGLY AGREE	69	67.0%
Missing System	1	1.0%

❖ **Analysis-Factors related to perception of the youth towards Government efforts**

Table 1.6

	Factor 1	Factor 2	Factor 3
Mean	4.2157	4.1078	4.0882

Table 1.6.1(F1)

I appreciate that gender gap is closing, and women participation is increasing in India's growth	N	%
STRONGLY DISAGREE	4	3.9%
DISAGREE	2	1.9%
NEUTRAL	9	8.7%
AGREE	40	38.8%
STRONGLY AGREE	47	45.6%
Missing System	1	1.0%

Table 1.6.2 (F2)

Skill Development and MSME projects are helpful to enhance employability and sustainability critical for achieving Viksit Bharat Vision	N	%
STRONGLY DISAGREE	2	1.9%
NEUTRAL	18	17.5%
AGREE	47	45.6%
STRONGLY AGREE	35	34.0%
Missing System	1	1.0%

Table 1.6.3 (F3)

Agriculture and Rural Development schemes will help to bridge the inequality between Urban and Rural India	N	%
STRONGLY DISAGREE	1	1.0%
DISAGREE	3	2.9%
NEUTRAL	16	15.5%
AGREE	48	46.6%
STRONGLY AGREE	34	33.0%
Missing System	1	1.0%

Interpretation

- The mean values in table 1.5 suggest that the overall youth show agreement on the ego centric life patterns critical for the Viksit Bharat mission. It shows the mental readiness of the youth to contribute towards Viksit Bharat Mission**.**
- The mean values in Table 1.6 suggest agreement or positive perception of the youth towards government efforts.

Table 1.6.1.1

Crosstab

		Gender					
		Male		Female		Total	
		N	%	N	%	N	%
Gendergap	Strongly Disagree	2	3.2%	2	5.0%	4	3.9%
	Disagree	1	1.6%	1	2.5%	2	2.0%
	Neutral	8	12.9%	1	2.5%	9	8.8%
	Agree	27	43.5%	13	32.5%	40	39.2%
	Strongly Agree	24	38.7%	23	57.5%	47	46.1%
Total		62	100.0%	40	100.0%	102	100.0%

Table 1.6.1.2

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.240	.207
	Cramer's V	.240	.207
N of Valid Cases		102	

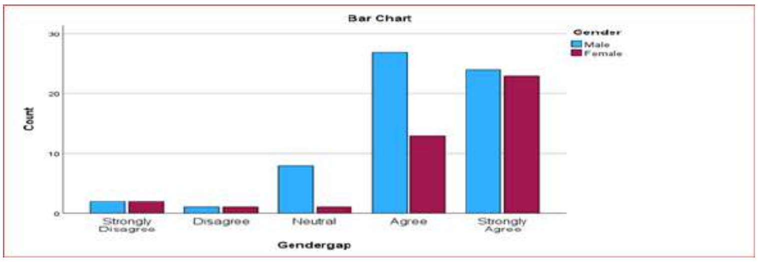
Table 1.6.1.3

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.895ᵃ	4	.207
Likelihood Ratio	6.442	4	.169
Linear-by-Linear Association	1.259	1	.262
N of Valid Cases	102		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is .78.

Table 1.6.1.4



Interpretation

- 57.5% of Females and 38.7% of Males i.e. the majority strongly agree and overall 85.3% of the respondents agree/strongly agree that Gender gap is closing.
- The Cramer's V value of .240 shows the strength of the association is small to moderate between Gender distribution and Gender Gap
- The Chi square value of 5.895 indicates that there is no significant association between gender and the feeling that gender gap is closing.

Table 1.6.2.1

Crosstab

		Gender					
		Male		Female		Total	
		N	%	N	%	N	%
Skilldevelopment	Strongly Disagree	1	1.6%	0	0.0%	1	1.0%
	Neutral	14	22.6%	4	10.0%	18	17.6%
	Agree	23	37.1%	24	60.0%	47	46.1%
	Strongly Agree	24	38.7%	12	30.0%	36	35.3%
Total		62	100.0%	40	100.0%	102	100.0%

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Table 1.6.2.2

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.116^a	3	.106
Likelihood Ratio	6.586	3	.086
Linear-by-Linear Association	.306	1	.580
N of Valid Cases	102		

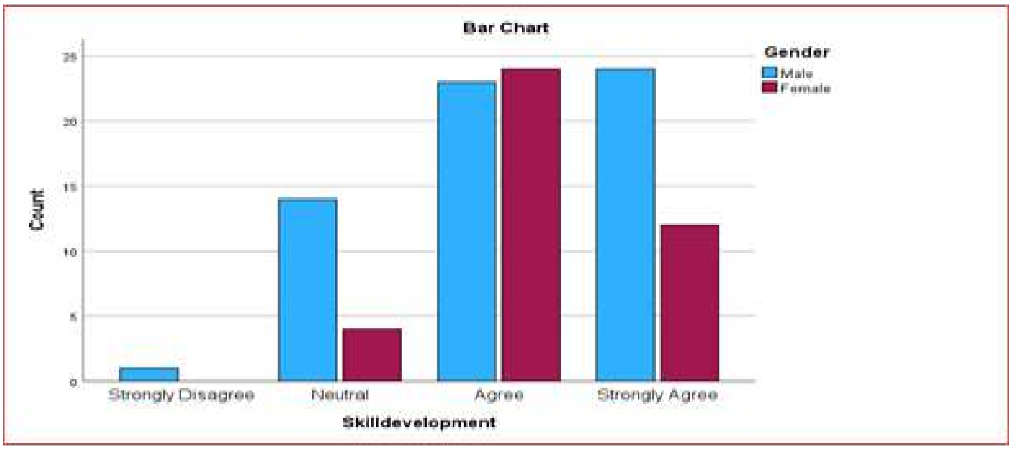
a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is .39.

Table 1.6.2.3

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.245	.106
	Cramer's V	.245	.106
N of Valid Cases		102	

Table 1.6.2.4



Interpretation-The values of Chi square test-6.116 and Cramer's value 0.245 indicates that there is no significant association between gender distribution and feeling that skill development and MSME projects are helpful to generate employability and sustainability. However, the % of responses (Cross Tab 1.6.2.1) 81.4 % agree /strongly agree on this factor being helpful**.**

Table 1.6.3.1

Crosstab

		Gender					
		Male		Female		Total	
		N	%	N	%	N	%
Agriruralschemes	Strongly Disagree	1	1.6%	0	0.0%	1	1.0%
	Disagree	2	3.2%	1	2.5%	3	2.9%
	Neutral	12	19.4%	4	10.0%	16	15.7%
	Agree	27	43.5%	21	52.5%	48	47.1%
	Strongly Agree	20	32.3%	14	35.0%	34	33.3%
Total		62	100.0%	40	100.0%	102	100.0%

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Table 1.6.3.2

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.514[a]	4	.642
Likelihood Ratio	2.946	4	.567
Linear-by-Linear Association	1.183	1	.277
N of Valid Cases	102		

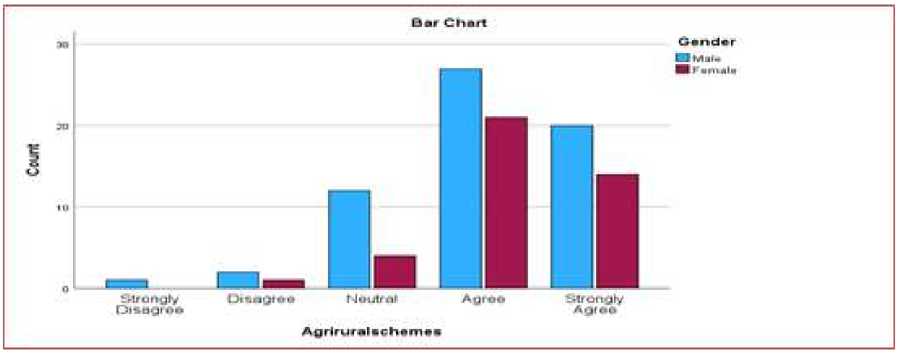
a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is .39.

Table 1.6.3.3

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.157	.642
	Cramer's V	.157	.642
N of Valid Cases		102	

Table 1.6.3.4.

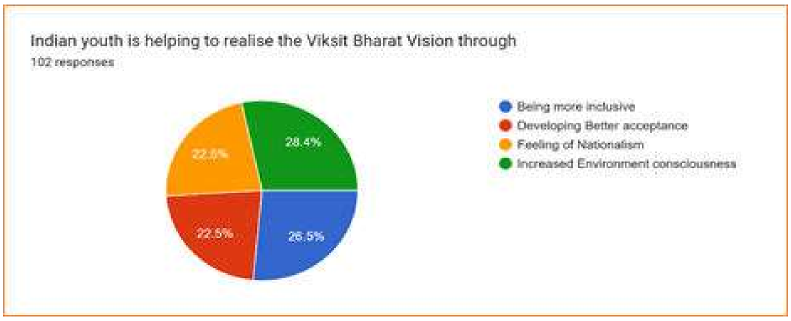


Interpretation

- The % of responses from the Cross Tab 1.6.3.1 indicate that around 80.4% of respondents agree/strongly agree on the fact that Agriculture and Rural development schemes are helpful to bridge the inequality between Urban and Rural India.
- Also the Cramer's value indicates weak association and Chi square value indicates no significant association (Table 1.6.3.2 and 1.6.3.3) between gender and the feeling that Rural and Agriculture schemes are bridging the inequality between urban and rural india

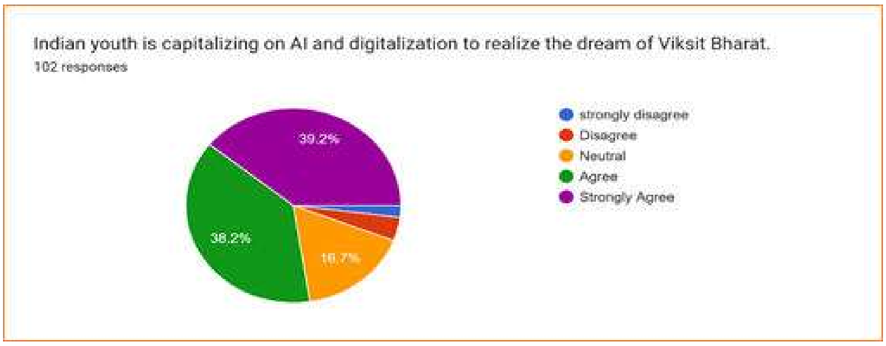
❖ **nalysis -Opinion of the youth towards how they want to realise Viksit Bharat Mission**

Table 1.7



The responses show that Majority of the youth wants to realise the Viksit Bharat Mission through Increased Environment Consciousness.

Table 1.8



The majority of youth strongly agree that they are capitalizing on AI and Digitalization to realize the dream of Viksit Bharat

CONCLUSION

The findings of the research paper indicates that the youth of the nation are aware and hold positive orientation on the factors critical for Viksit Bharat Mission. In other words, the Ego centric life patterns of the youth indicate strong positive mindset and mental readiness with respect to the factors critical for Viksit Bharat mission. The majority of the youth from the survey show the country first attitude, political awareness, community engagement and cherishing the cultural diversity which are critical factors for the success of Viksit Bharat Mission. The study also shows that youth are very positive with respect to the government efforts for Viksit Bharat like Closing the Gender gap, increasing women participation, Agriculture and Rural schemes bridging the urban and rural divide, and skill development and MSME projects of the government being helpful in increasing employability and sustainability. However, no association could be found between the Gender and the feelings of the youth towards these efforts after the statistical testing.

The study also indicates that Youth want to contribute in Viksit Bharat Mission through increased Environment Consciousness and capitalizing on AI and Digitalization. Overall, the time is ripe for the government to capitalize on the favorable environment conducive for planning and executing Viksit Bharat Mission through the increased participation of the youth. Their role is not only vital but will be a game changer in the Viksit Bharat Mission.

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A STUDY ON GENDER INCLUSIVE CARE-CENTRIC AMENITIES IN MUMBAI'S URBAN INFRASTRUCTURE DEVELOPMENTS

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ABSTRACT

Recent urban infrastructure development within Mumbai has largely emphasized mobility, connectivity and extensive transit projects to increase efficiency in the urban realm. Although these types of initiatives are regarded as a major breakthrough, not as much emphasize has been placed on creating gender-sensitive and functionally-accessible care-focused amenities in order to meet basic daily needs, such as restrooms, breastfeeding and lactation areas, sitting areas, access to sanitary products and other facilities that are universally accessible. This study aims to review current urban infrastructure in Mumbai regarding the degree to which urban user's perceptions of availability, accessibility and inclusiveness relate to what is being included as part of the design process for both infrastructure for movement and for taking care of oneself, having a healthy, dignified and functional lifestyle. A survey of 100 urban infrastructure users covering a range of age groups and gender will be conducted as the primary data source to support the quantitative method of research employed. A structured questionnaire is developed as a tool to measure urban infrastructure user awareness, use, perceived satisfaction and inclusiveness with care-centric amenities that have been included in the current urban infrastructure projects recently completed in Mumbai. This research also seeks to highlight the discrepancies between the design of urban infrastructure intended for mobility and urban infrastructure intended for care, health and dignity. The aim is to demonstrate on how inadequate or nonexistent care-focused facilities can create significant negative effects on mobility, comfort, safety and use of public space amongst women, children, elderly individuals and caregivers. In addition to contributing to existing conversations around inclusive urban development through its focus on being proactive in designing care-focused facilities; It will also provide policy recommendations to assist with creating equitable and human-centred cities through gender responsive urban planning, inclusive design guidelines and citizen focused evaluation frameworks.

Keywords: *Gender Inclusive Infrastructure, Care-Centric Amenities, Urban Development, Inclusive Cities, Smart Cities.*

INTRODUCTION

Mumbai, India's financial capital and one of the most densely populated metropolitan cities in the world, is currently undergoing rapid urban transformation driven by large-scale infrastructure development projects. Initiatives such as metro rail corridors, coastal road projects, redevelopment of railway stations, smart city interventions and integrated transport hubs reflect a strong policy focus on improving urban mobility, connectivity and economic efficiency. These developments are intended to modernize the city's physical framework and enhance its global competitiveness. However, while such projects prioritize speed, transport integration and technological advancement, the extent to which they address the everyday care and well-being needs of urban users remains a critical dimension of contemporary urban planning. The concept of gender-inclusive and care-centric amenities draws attention to infrastructure that supports not only movement but also the physical, emotional and social needs of individuals who use public spaces. Gender-inclusive infrastructure refers to urban design that recognizes diverse user experiences across gender identities and life stages, ensuring equal access, dignity and safety. Care-centric amenities include facilities such as clean and accessible toilets, breastfeeding and lactation rooms, sanitary product vending and disposal systems, resting and seating areas, child-friendly spaces and universally accessible washrooms. These amenities acknowledge that urban citizens are not only commuters but also caregivers, parents, elderly individuals and people with varying health and mobility needs. In recent years, Mumbai has witnessed a significant expansion of transport and urban infrastructure through projects such as the Mumbai Metro Line network (including Line 2A and Line 7), the Aqua Line (Metro Line 3), redevelopment of major railway stations and upgrades to public corridors and transit interchanges. These projects have improved connectivity across suburban and central regions of the city and have reshaped daily commuting patterns for millions of residents. Alongside these developments, urban planning discourse has increasingly emphasized the importance of inclusivity, sustainability and human-centered design. International frameworks such as the Sustainable Development Goals, particularly Goal 11 on Sustainable Cities and Communities, highlight the need for inclusive, safe and accessible public spaces for all population groups. Despite this global and national emphasis, urban infrastructure in many megacities continues to reflect a dominant focus on transit efficiency rather than care and comfort. Infrastructure for movement such

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as tracks, platforms, roads and vehicles often takes precedence over infrastructure for care, such as sanitation facilities, breastfeeding spaces and resting zones. This imbalance can significantly influence how different groups experience the city. Women, caregivers, elderly persons and children often encounter practical challenges related to hygiene, fatigue, privacy and safety when care-centric amenities are absent or inadequate. Such challenges affect not only convenience but also participation in public life, work opportunities and access to essential services. The idea of care-centric urban development is rooted in the recognition that cities must support daily human needs alongside economic productivity. Urban spaces are not merely transit environments; they are lived environments where individuals spend long hours commuting, working, caregiving and socializing. Care-oriented design integrates dignity and well-being into public infrastructure by acknowledging biological, social and cultural realities such as menstruation, pregnancy, caregiving responsibilities and aging. In this sense, care-centric amenities become indicators of a city's commitment to equity and social justice. Mumbai's scale and diversity make it an important site for examining how inclusive urban development is conceptualized and practiced. With over twenty million residents using public transport and urban facilities daily, the city presents complex demands on infrastructure systems. New transit corridors, redeveloped stations and modernized public spaces offer an opportunity to integrate inclusive design principles into the urban fabric. The presence or absence of care-centric amenities within these projects reflects broader priorities in planning and governance, as well as societal attitudes toward care, gender and dignity in public spaces. Understanding urban infrastructure through the lens of gender inclusion and care highlights the relationship between physical design and social experience. Public spaces that lack essential amenities may inadvertently exclude certain groups from full participation in city life, while inclusive facilities can enhance autonomy, safety and comfort. As Mumbai continues to expand its infrastructure footprint, the question of how development can move beyond connectivity toward compassion becomes increasingly relevant. Examining care-centric amenities within urban infrastructure allows for a deeper reflection on what it means to build cities that are not only efficient but also humane, responsive and equitable for all citizens.

LITERATURE REVIEW

1. Fenster (2005) in The Right to the Gendered City argues that urban spaces are socially constructed and experienced differently by men and women. The study emphasizes that access to public spaces is linked to feelings of dignity, comfort and belonging, not merely physical availability. This supports the importance of integrating gender perspectives into urban infrastructure planning.
2. Whitzman et al. (2013) highlight that most cities are designed around male mobility patterns, overlooking caregiving roles and safety needs of women. Their work establishes the conceptual basis for gender-inclusive infrastructure by showing how urban design influences participation and equity.
3. Gehl (2010) in Cities for People emphasizes human-centered urban design, arguing that cities should prioritize everyday comfort, rest spaces and accessibility. The study reinforces the idea that care-centric amenities are essential for livable and inclusive cities.
4. Tronto (2013) conceptualizes care as a central democratic value and argues that public systems, including infrastructure, must embed care into institutional design. Her framework provides theoretical grounding for viewing amenities such as toilets and resting spaces as essential civic infrastructure.
5. McFarlane and Silver (2017) examine sanitation in urban India and show that lack of public toilets disproportionately affects women, elderly people and children. The study links sanitation infrastructure with dignity, mobility and public participation.
6. O'Reilly and Louis (2014) analyze gender and sanitation in Indian cities and demonstrate that inadequate facilities expose women to health risks and social exclusion. Their findings underline the social importance of care-centric amenities in urban planning.
7. UN Women (2020) in its report on Gender-Responsive Urban Planning and Design stresses that inclusive cities must integrate facilities for caregiving, hygiene and safety within infrastructure projects. The report offers global policy perspectives supporting gender-inclusive urban development.
8. UN-Habitat (2020) states that inclusive urban infrastructure should provide safe, accessible and dignified public spaces for all groups. The report links care-centric amenities with Sustainable Development Goal 11 (Sustainable Cities and Communities).

9. World Bank (2021) in its Handbook for Gender-Inclusive Urban Planning and Design highlights that infrastructure projects must include toilets, resting areas and breastfeeding spaces to ensure universal access. The handbook demonstrates that care-centric design increases women's economic and social participation.

10. Tata Institute of Social Sciences (TISS, 2014) conducted a gender audit of Mumbai's suburban railway system and found that women commuters face challenges related to sanitation, overcrowding and lack of resting facilities. The study is directly relevant to Mumbai's infrastructure context.

11. Safetipin (2018) assessed public spaces in Mumbai and documented deficiencies in lighting, visibility and public amenities affecting women's mobility and safety. The study highlights spatial inequalities in infrastructure provision across the city.

12. Khosla (2020) argues that Indian urban development prioritizes "world-class" infrastructure while neglecting everyday care needs such as sanitation and rest spaces. The author calls for a shift toward inclusive and people-centered urban planning models.

13. Power (2020) introduces the concept of the "care economy" in urban contexts, stating that infrastructure must support caregiving and bodily needs to promote social justice. This reinforces the relevance of care-centric amenities in public infrastructure.

14. MMRDA (2022) reports on Mumbai's metro and transport infrastructure expansion, focusing on connectivity and efficiency. While the report highlights technical achievements, it offers limited discussion on care-centric amenities, indicating a policy emphasis on movement rather than care.

GAP ANALYSIS

Based on the reviewed literature, existing studies strongly establish the importance of gender-inclusive urban planning, sanitation, safety and human-centered infrastructure design at both global and national levels. Research by UN Women, UN-Habitat and the World Bank provides policy frameworks for integrating inclusivity and care into urban development, while studies such as those by TISS (2014) and Safetipin (2018) document gender-related challenges in Mumbai's transport and public spaces. However, most of this work either remains conceptual, policy-oriented, or narrowly focused on safety and mobility rather than on a comprehensive set of care-centric amenities such as breastfeeding and lactation spaces, sanitary product access, resting areas and universally accessible facilities within recent urban infrastructure developments. Moreover, there is limited empirical evidence based on primary, user-centered data that evaluates how these amenities are perceived in terms of availability, accessibility and inclusiveness in contemporary projects such as metro corridors and redeveloped public spaces in Mumbai. This indicates a clear need for a focused study that systematically examines gender-inclusive, care-centric amenities within Mumbai's current urban infrastructure from the perspective of everyday users, thereby justifying the present research.

RESEARCH METHODOLOGY

The study adopts a quantitative, primary, survey-based research design to examine perceptions of gender-inclusive, care-centric amenities in Mumbai's urban infrastructure developments. The sample universe comprises users of public urban infrastructure in Mumbai, including commuters and visitors to metro stations, transit hubs and redeveloped public spaces across different age groups and genders. A sample size of 100 respondents was selected using a random sampling technique to ensure representation and minimize selection bias. Data were collected through a structured questionnaire consisting of close-ended Likert-scale and multiple-choice questions along with a small number of open-ended questions to capture qualitative insights. Ethical considerations were strictly followed by obtaining informed consent from all participants, ensuring voluntary participation, maintaining anonymity and confidentiality of responses and using the collected data solely for academic purposes. Respondents were informed about the purpose of the study and no personal identifying information was recorded. The collected data were analyzed using descriptive statistical tools such as percentages and mean scores to interpret patterns related to awareness, availability, accessibility and inclusiveness of care-centric amenities in recent urban infrastructure developments in Mumbai

AIM OF THE STUDY

The aim of the study is to examine the extent to which gender-inclusive, care-centric amenities are incorporated into Mumbai's urban infrastructure developments and to assess public perceptions regarding their availability, accessibility and inclusiveness.

OBJECTIVES OF THE STUDY

1. To assess the level of awareness among urban infrastructure users regarding the presence of care-centric amenities in Mumbai's recent infrastructure developments.
2. To evaluate the perceived availability and accessibility of gender-inclusive amenities such as sanitation facilities, resting spaces and breastfeeding or lactation areas.
3. To examine public perceptions of inclusiveness and dignity associated with care-centric amenities in urban infrastructure.
4. To identify perceived gaps between infrastructure designed for mobility and infrastructure designed for care and well-being.
5. To propose policy-oriented recommendations for promoting gender-responsive and inclusive urban infrastructure planning in Mumbai.

HYPOTHESIS

Alternate Hypothesis 1 (H1): Mumbai's urban infrastructure developments show inadequate availability and accessibility of gender-inclusive, care-centric amenities as perceived by users.

Null Hypothesis 1 (H01): There is no significant relationship between Mumbai's urban infrastructure developments and the perceived availability and accessibility of gender-inclusive, care-centric amenities among users.

Alternate Hypothesis 2 (H2): There is a significant gap between mobility-focused urban infrastructure and care-centric amenities, leading to lower perceived inclusiveness and user satisfaction among urban infrastructure users.

Null Hypothesis 2 (H02): There is no significant difference between infrastructure developed for mobility and infrastructure designed for care and well-being in terms of perceived inclusiveness and user satisfaction.

SCOPE OF THE STUDY:

1. The study is confined to urban infrastructure developments in Mumbai, including metro stations, transit hubs and redeveloped public spaces.
2. It focuses specifically on gender-inclusive, care-centric amenities such as clean toilets, breastfeeding/lactation spaces, sanitary product access and disposal facilities, resting areas and universally accessible washrooms.
3. The research covers urban infrastructure users across different age groups and genders, including commuters, caregivers and elderly users.
4. The study examines perceptions related to awareness, availability, accessibility and inclusiveness of care-centric amenities.
5. The findings aim to support urban planning and policy formulation related to inclusive and human-centered infrastructure development in Mumbai.
6. The scope is limited to current and recent urban infrastructure projects, reflecting contemporary development trends.

LIMITATIONS OF THE STUDY

1. The sample size of 100 respondents may not fully represent the entire population of Mumbai's urban infrastructure users.
2. The study relies on self-reported perceptions, which may be influenced by personal experiences and subjective judgment.
3. Time constraints may limit coverage to only selected infrastructure locations rather than all urban development projects across Mumbai.
4. The findings are context-specific to Mumbai and may not be directly generalizable to other cities.
5. The study focuses on selected care-centric amenities and may not capture all dimensions of gender inclusivity in urban infrastructure.

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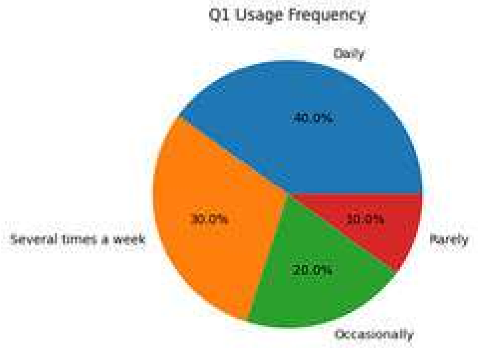
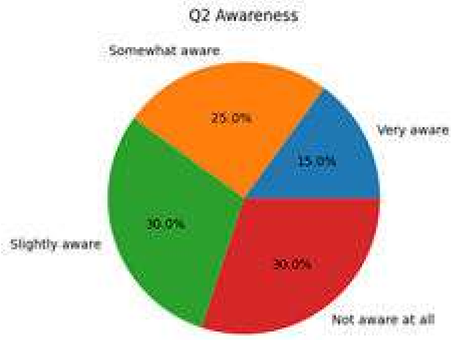
DATA ANALYSIS AND INTERPRETATION

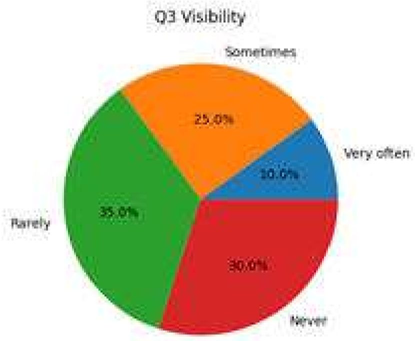
The data collected from 100 respondents were analyzed using descriptive techniques such as percentage analysis and Likert-scale interpretation to understand perceptions regarding the availability, accessibility and inclusiveness of gender-inclusive, care-centric amenities in Mumbai's urban infrastructure developments.



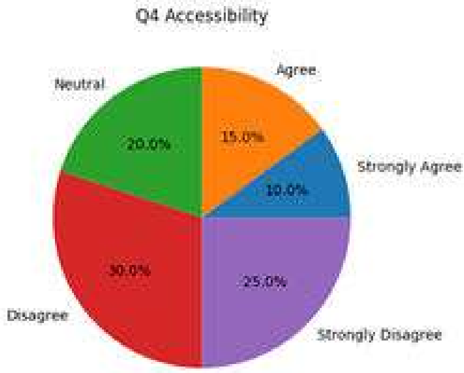
A majority of respondents (70%) use Mumbai's urban infrastructure on a daily or weekly basis. This indicates that perceptions recorded in the study are based on frequent and direct experience, strengthening the reliability of opinions related to care-centric amenities.



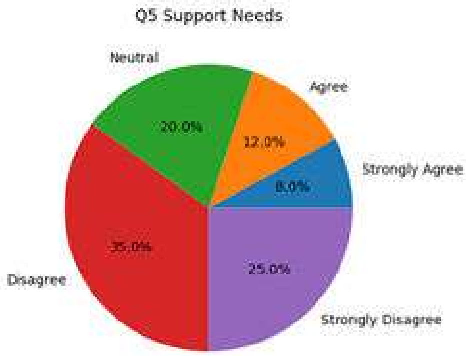
60% of respondents are only slightly aware or not aware at all of care-centric amenities. This suggests low visibility and inadequate communication regarding such facilities in urban infrastructure, indicating limited integration into mainstream planning.



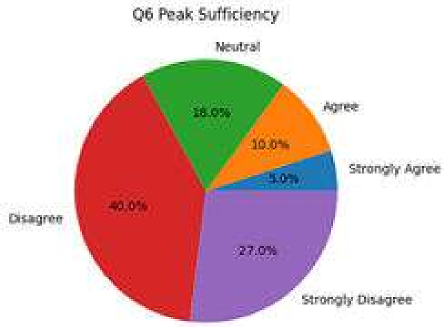
65% of respondents reported that care-centric amenities are rarely or never visible. This clearly reflects insufficient physical presence of such amenities in recent infrastructure developments, supporting the alternate hypothesis.



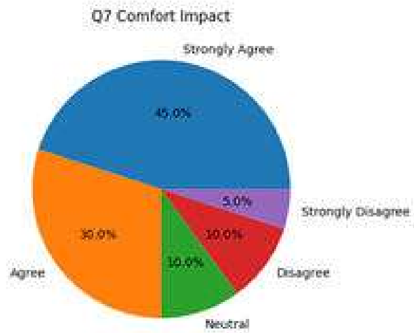
55% of respondents disagreed that care-centric amenities are easy to locate and access. This demonstrates poor accessibility and weak design integration, reinforcing the perception of inadequacy.



60% disagreed that infrastructure adequately supports vulnerable groups. This highlights lack of inclusivity in planning and validates the hypothesis that gender-inclusive amenities are insufficiently incorporated.



67% felt amenities are insufficient during peak hours. This suggests that even where facilities exist, they are not designed for actual demand, indicating functional inadequacy.



75% agreed that lack of care-centric amenities negatively affects comfort and use of infrastructure. This confirms that absence of such facilities directly influences participation and mobility.

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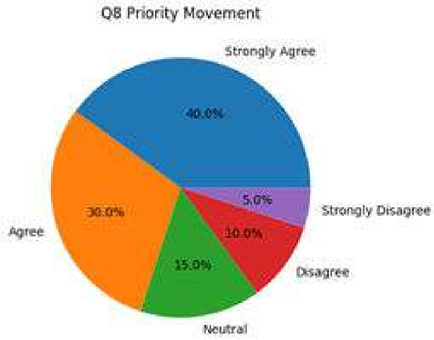
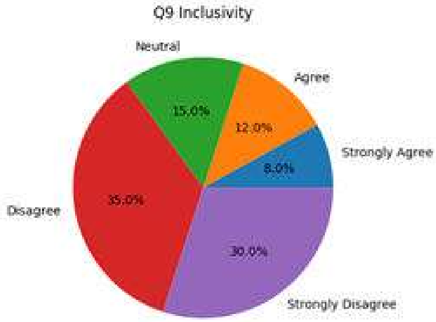
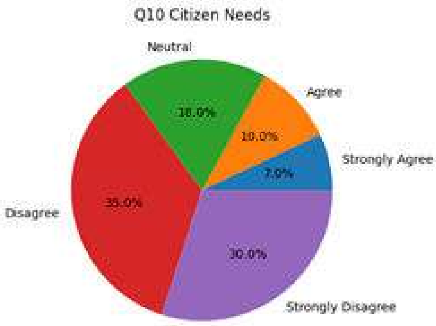


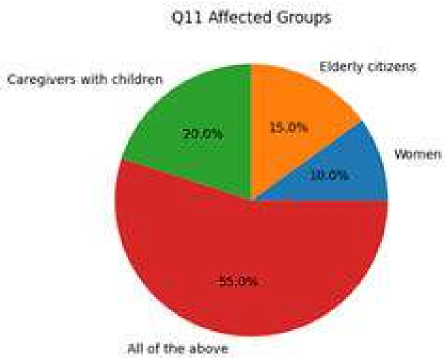
70% agreed that infrastructure prioritizes movement over care and well-being. This reflects a mobility-dominated planning model and a neglect of care-centric considerations.



Respondents perceive urban planning as insufficiently gender-inclusive and care-responsive, reinforcing the alternate hypothesis.



A substantial majority of respondents expressed disagreement with the statement that citizen needs related to care and dignity are adequately considered in urban infrastructure development. This indicates a perceived disconnect between planning priorities and everyday user requirements. The findings suggest that urban development remains largely mobility-driven, with limited attention to human-centered and care-responsive considerations.



More than half of the respondents identified “All of the above” (women, elderly citizens and caregivers with children) as the most affected groups, highlighting that the absence of care-centric amenities has broad social

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implications. This demonstrates that deficiencies in inclusive infrastructure impact multiple vulnerable populations rather than a single demographic group. The result underscores the universal need for care-oriented urban planning.

A strong majority of respondents selected "All of the above," indicating a collective demand for comprehensive inclusion of clean toilets, lactation spaces and sanitary facilities in future projects. This reflects public consensus that isolated or partial interventions are insufficient. The finding emphasizes the necessity of integrated and holistic policy approaches to care-centric urban infrastructure development.

Based on the percentage distribution and dominant response trends across all major variables awareness, availability, accessibility, inclusiveness and impact the findings consistently demonstrate perceived inadequacy of gender-inclusive, care-centric amenities in Mumbai's urban infrastructure developments. Thus, accepting both the Alternate Hypothesis and Rejecting their Null Hypothesis.

CONLCUSION & DISCUSSION

The present study set out to examine the inclusion of gender-inclusive, care-centric amenities in Mumbai's urban infrastructure developments and to understand public perceptions regarding their availability, accessibility and inclusiveness. The findings indicate a clear imbalance between large-scale infrastructure designed for mobility and the provision of facilities that support everyday care needs such as sanitation, breastfeeding and lactation spaces, resting areas and universally accessible amenities. While respondents acknowledged improvements in connectivity and transit efficiency through metro corridors and redeveloped public spaces, a substantial majority expressed dissatisfaction with the presence and usability of care-centric amenities. The discussion of results reveals that urban development in Mumbai continues to prioritize speed, scale and engineering efficiency over human-centered design. Respondents consistently perceived that infrastructure projects emphasize movement and connectivity while overlooking aspects of comfort, dignity and bodily needs. This reflects a broader planning culture in which infrastructure is viewed primarily as a technical system rather than a lived social space. The limited awareness and visibility of care-centric amenities further suggest that such facilities are either insufficiently integrated into design frameworks or poorly communicated to users. The impact of this imbalance is not merely logistical but deeply social. The absence or inadequacy of care-centric amenities restricts the mobility and participation of women, elderly individuals, caregivers and children. Lack of clean toilets, private lactation spaces and resting areas was repeatedly highlighted as a barrier to sustained use of public infrastructure. These challenges directly affect perceptions of safety, comfort and dignity, reinforcing gendered and age-based inequalities in access to public spaces. The findings thus reaffirm that inclusivity in urban development cannot be achieved through transport connectivity alone but must incorporate care and well-being as central planning principles. From a societal perspective, the study contributes to understanding cities as environments of everyday life rather than only sites of economic movement. Care-centric amenities are indicators of social responsibility and equity within urban governance. Infrastructure that ignores care needs risks excluding vulnerable groups from public participation, employment opportunities and civic engagement. Conversely, inclusive amenities enhance autonomy and confidence, enabling broader sections of society to use urban spaces without fear or discomfort.

Based on the findings, the study proposes the following policy-oriented recommendations:

1. Urban planning guidelines should mandate the inclusion of gender-inclusive amenities such as clean toilets, lactation rooms, sanitary product vending and disposal units and resting spaces in all major infrastructure projects, including metro stations and public transit hubs.

2. Municipal authorities should adopt gender-responsive budgeting and planning tools to ensure that infrastructure investments account for the needs of women, caregivers, elderly citizens and children as part of mainstream development policies.
3. Regular audits and feedback systems should be established to evaluate the effectiveness and usability of care-centric amenities based on user experience rather than only technical compliance.
4. Clear signage and public communication campaigns should be introduced to improve awareness of available care-centric facilities and promote their use.
5. Urban development authorities, health departments and social welfare agencies should collaborate to embed care and well-being into infrastructure planning rather than treating them as secondary concerns.
6. Urban planners and architects should receive training in inclusive and care-centered design principles to encourage long-term cultural shifts in planning practices.

The findings of this study demonstrate that Mumbai's recent urban infrastructure developments, while technologically advanced and mobility-oriented, insufficiently integrate gender-inclusive, care-centric amenities. This creates a gap between infrastructure designed for movement and infrastructure designed for living with dignity. The acceptance of the alternate hypotheses confirms that current development models require reorientation toward inclusivity and human-centered design. By foregrounding care within infrastructure planning, cities can move toward more equitable and socially responsive forms of urban development. The study underscores the importance of shifting from a purely functional view of infrastructure to one that acknowledges the realities of daily life, caregiving and bodily needs. In doing so, it contributes to broader debates on sustainable and inclusive urban futures and offers actionable insights for policymakers seeking to build cities that are not only efficient but also compassionate and just.

FUTURE SCOPE OF RESEARCH

1. Future studies can expand the sample size and include multiple cities to allow comparative analysis across metropolitan regions in India.
2. Longitudinal research can be conducted to examine changes in inclusivity as new infrastructure projects are completed over time.
3. Qualitative studies using interviews and focus groups can provide deeper insights into lived experiences of women, caregivers and elderly users.
4. Research may explore the economic impact of care-centric amenities on workforce participation and urban productivity.
5. Spatial mapping and GIS-based studies can assess geographic disparities in the availability of inclusive amenities across different urban zones.
6. Future work can examine the role of private sector and public–private partnerships in delivering inclusive urban infrastructure.

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A STUDY ON THE NEED FOR GOVERNANCE ON LINGUISTIC PATTERNS OF DIGITAL REPORTING IN INDIA

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ABSTRACT
Digital journalism in India has expanded rapidly with the growth of internet-based news platforms and algorithm-driven dissemination of information. While digital media has improved access to news and increased reporting speed, it has also created challenges related to linguistic distortion, sensationalism, and misinformation. The present study titled "A Study on the Need for Governance of Linguistic Patterns in Digital Journalism in India" examines how language shapes public perception and underscores the need for a structured governance framework for responsible digital communication. This research adopts a qualitative methodology based on secondary data and case study analysis from 2020 to 2025. Thirty representative cases were selected through purposive sampling from online news portals, social media platforms, and fact-checking websites. The study employs thematic and discourse analysis to identify dominant linguistic patterns such as emotionally charged vocabulary, exaggerated headlines, polarized framing, misleading translations, and algorithm-driven clickbait language. Findings reveal that the absence of regulated linguistic standards in digital journalism contributes to misinformation, public anxiety, ideological polarization, and declining trust in news media. Unlike traditional print journalism, digital reporting lacks consistent linguistic guidelines and increasingly relies on persuasive and emotionally driven narratives shaped by competition and engagement metrics. Aligned with the vision of Viksit Bharat 2047, this study emphasizes that governance of linguistic practices is essential for strengthening democratic discourse, promoting social harmony, and ensuring informed citizenship in India's evolving digital media ecosystem.

Keywords: *Digital-Journalism, Linguistic-Governance, Media Ethics, Viksit Bharat 2047*

INTRODUCTION
Digital reporting has become a central mode of news dissemination in India due to the rapid expansion of internet access, smartphone usage, and affordable data services. Digital-first platforms, online editions of traditional media, and social media-based journalism have transformed how news is produced and consumed. However, this transformation has also created challenges related to language use, representation, and ethical communication in online news environments. India's media landscape is characterized by extensive linguistic diversity, with more than 780 languages spoken across the country (People's Linguistic Survey of India, n.d.). Digital news operates across this multilingual space using English, Hindi, and regional languages. While this has increased accessibility, it has raised concerns about linguistic standardization, bias, and governance. Unlike print and broadcast journalism with established editorial norms, digital reporting functions within a fragmented ecosystem involving professional journalists, citizen reporters, influencers, and algorithm-driven content, resulting in inconsistent linguistic practices such as code-switching and sensationalized vocabulary. Scholars argue that journalistic language shapes public perception and social discourse (Bloomsbury Academic, 2013). Linguistic choices related to framing and tone influence how audiences interpret events and social groups. The growing use of hybrid language forms such as Hinglish may enhance engagement but can also reinforce linguistic hierarchies (Androutsopoulos, 2014). Algorithm-driven news systems further privilege dominant languages and emotionally charged content, affecting representation and visibility (Frontiers in Communication, 2025). Existing regulatory frameworks in India, including the Information Technology Act, primarily address content moderation and offer limited guidance on linguistic practices. This study therefore explores the need for governance of linguistic patterns in digital reporting through secondary research, emphasizing the importance of ethical communication, cultural sensitivity, and democratic inclusivity in India's evolving digital news ecosystem.

LITERATURE REVIEW
Several studies emphasize that India's linguistic diversity significantly influences digital journalism practices. Digital platforms have increasingly turned toward vernacular content to reach wider audiences, particularly in rural and semi-urban regions. Initiatives such as the People's Archive of Rural India demonstrate how multilingual reporting can amplify marginalized voices and preserve linguistic authenticity (People's Archive of

Rural India (PARI). (n.d.)., n.d.). Similarly, Khabar Lahariya exemplifies grassroots digital journalism by publishing content in regional dialects, thereby challenging the dominance of English and Hindi in mainstream news discourse (Khabar Lahariya. (n.d.)., n.d.). However, scholars note that multilingual expansion in digital media often occurs without formal editorial or governance frameworks guiding linguistic consistency and ethical representation. As a result, linguistic practices vary widely across platforms, leading to uneven quality, potential misrepresentation and cultural stereotyping.

The language of journalism has long been recognized as a powerful tool in constructing meaning and shaping public discourse. According to Smith and Higgins, journalistic language influences how news is framed, interpreted and remembered, particularly in politically and socially sensitive contexts (Bloomsbury Academic, 2013). In digital environments, these effects are amplified due to rapid dissemination and audience interaction. Research on digital discourse highlights the increasing prevalence of code-switching and code-mixing in Indian online news content. Computational linguistic studies analyzing Indian social media texts reveal challenges in sentiment interpretation and meaning-making due to hybrid language structures (Kumar, 2018). These linguistic complexities complicate both editorial oversight and automated content moderation systems. Moreover, studies on algorithmic mediation suggest that language plays a decisive role in determining content visibility. Linguistic strategies aligned with dominant language norms or emotionally charged expressions are more likely to be amplified by algorithms, influencing public opinion and discourse (Frontiers in Communication, 2025).

The integration of artificial intelligence in digital journalism has further influenced linguistic patterns. Automated news writing tools, summarization algorithms and translation technologies often prioritize efficiency over nuance, potentially oversimplifying complex socio-political issues (MDPI, 2023). Scholars argue that such technologies, if left unregulated, can distort linguistic balance and journalistic ethics. Studies on digital Hindi journalism indicate that competitive pressures and audience metrics encourage sensational language and polarized framing, undermining linguistic responsibility and factual accuracy (Bhattacharya, 2023). These findings underscore the need for governance mechanisms that address not only content accuracy but also linguistic integrity.

Research on digital governance in India primarily focuses on legal regulation, intermediary liability and content moderation. Scholars highlight that existing frameworks are often reactive and insufficiently transparent, failing to address deeper issues of linguistic bias and representation (Singh, 2021). While initiatives like the National Translation Mission and multilingual AI platforms aim to improve access, they do not directly regulate journalistic language use or ethical standards (Government of India, 2022).

GAP ANALYSIS

Digital journalism and media governance are significant areas of academic research but there has been little research into the governance of the patterns of language used in India by digital reporters. Previous studies have generally focused on either regulation or technology but do not consider ethical and sociolinguistic perspectives in India's multi-lingual context (Nature Humanities and Social Sciences Communications, 2024). In this study, we identify the need for an organized structure for governing the use of language in digital news; language is thereby recognized as a major area of digital media governance in India.

RESEARCH METHODOLGY

The research examines digital journalism in India using qualitative methods and existing secondary case studies of the use of digital media by news organizations; it incorporates data from various types of online news platforms (e.g., websites, e-newspaper editions, and social media) to create a purposeful selection of 30 representative cases across five subject areas (i.e., public health, politics, crime, economy, and national security). The analysis employs thematic and discourse analysis techniques to identify the presence of certain linguistic features, including sensationalism; emotionally charged language; clickbait headlines; polarized narratives; and misleading word choice, and to evaluate how these linguistic patterns affect audience perception and response to the digital journalism content. The research results are interpreted with reference to existing ethical standards in journalism as compared to current practices in the digital journalism arena. By using this methodology, researchers will be able to reveal linguistic patterns without having to conduct primary data collection.

OBJECTIVES OF THE STUDY:

1. To examine the linguistic patterns used in Digital News Reporting
2. To examine the influence of Digital News Reporting on perception of public.
3. To find out ethical & governance issues due to unregulated language practices in Digital Journalism.

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4. To evaluate real-world examples of inaccurate, sensational, and biased reporting in digital media.
5. To evaluate the need for a governance framework for linguistic standards in digital reporting.
6. To propose policy-oriented recommendations aligned with the vision of Viksit Bharat 2047.

HYPOTHESIS:

Alternate Hypothesis (H1): Governance is greatly needed in terms of language use within digital reporting for responsible use within communication and building public trust

Null Hypothesis (H0): No such need exists for governance regarding language use within digital reporting.

Alternate Hypothesis (H2): Unregulated language usage within digital reporting leads to the dissemination of false information, polarization amongst individuals, and social unrest.

Null Hypothesis (H0): Unregulated language usage within digital reporting does NOT result in the dissemination of false information, polarization amongst individuals, or social disorder.

SCOPE OF THE STUDY

1. This study will only consider Digital News Platforms within India and Online Reporting within India.
2. This study will look into Linguistics Patterns that are used in Digital News Content (English and Translated to Hindi Digital News).
3. This study will look into Reporting related to Politics, Society, Health, Economy and Crime.
4. Therefore, this study will only look at Qualitative Interpretations of Language Used and will not provide any sort of Quantitative Data regarding Audience Psychological Behaviors.

LIMITATIONS OF THE STUDY

1. The study relies entirely on secondary data and case-based interpretation, which may limit generalizability.
2. The research focuses on selected digital platforms and does not cover vernacular regional languages in depth.
3. The absence of quantitative audience surveys restricts measurement of psychological impact.
4. Time constraints limit the analysis to 30 representative cases rather than a larger dataset.
5. The evolving nature of digital media also means findings may change with technological advancements.

DATA ANALYSIS AND INTERPRETATION

This report analyzes thirty case studies from the period of 2020 to 2025. They include various categories such as public health, politics and social conflict, economy, judiciary/climate change/technology. The data show repeated use of an emotionally charged, sensationalized and simplified language structure by reporters as an attempt to draw attention to their articles. Exaggerated adjectives, metaphors of crisis and conflict-oriented vocabulary are frequently used within headlines and leads of articles which alters the neutrality of purely factual reporting.

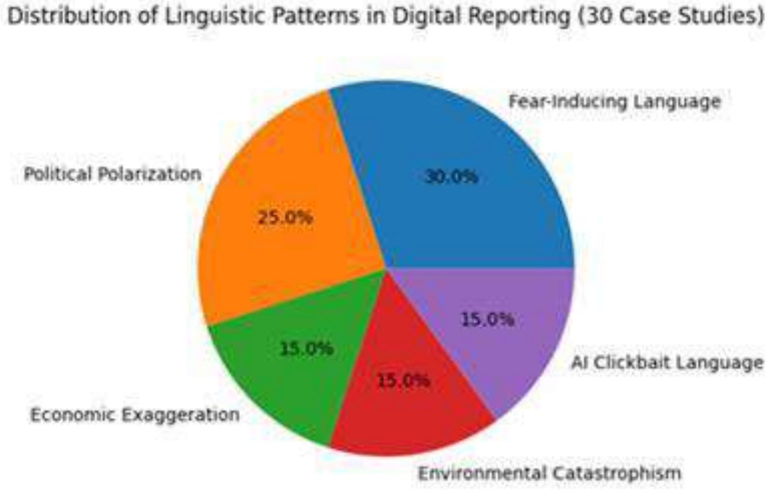

Figure 1:

Figure 1 illustrates that fear-inducing and emotionally charged language constitutes the largest proportion (30%) of linguistic distortion in digital reporting. Political polarization framing accounts for 25%, indicating strong ideological influence in news narratives. Economic exaggeration, environmental catastrophism, and AI-driven clickbait language each represent 15%, reflecting the growing influence of sensational and algorithmic news practices. The pie chart confirms that emotional and persuasive language dominates digital journalism over neutral factual reporting.

The analysis of the thematic studies demonstrates that there are dominant fear inducing words (collapse, chaos, threat and danger) associated with health and disaster related stories. In political reporting, there was an apparent polarization in the way reporters framed issues using binary language (victory/defeat, betrayal/loyalty, hero/villain); thereby limiting public understanding and exacerbating ideological divisions within society. In crime reporting, the use of over-generalizations such as “unsafe city” or “shocked nation” converts isolated incidents into collective anxieties. Economic and stock market reporting will often employ exaggerated imagery such as ‘meltdown’ or ‘crash’ for normal market corrections. Environmental stories tend to describe dystopian futures using images such as ‘India is drowning’ or ‘the planet is dying,’ which are powerful but typically not scientifically accurate. Court rulings are condensed into emotionally charged sentences that deconstruct the nuanced meaning of a court’s ruling and lead to a misunderstanding of the law among non-lawyers. The findings of the research also show that algorithmic generated news uses emotionally appealing phrases like ‘You won't believe’ or ‘the shocking truth’ to replace factual headline leads and communicate information based on triggering curiosity rather than providing facts for understanding. When translating or paraphrasing political statements, the original meaning of the statement is usually distorted. For example, when regional languages are translated into English or Hindi, the translation can create a different message or meaning than the intended meaning of the original statement.

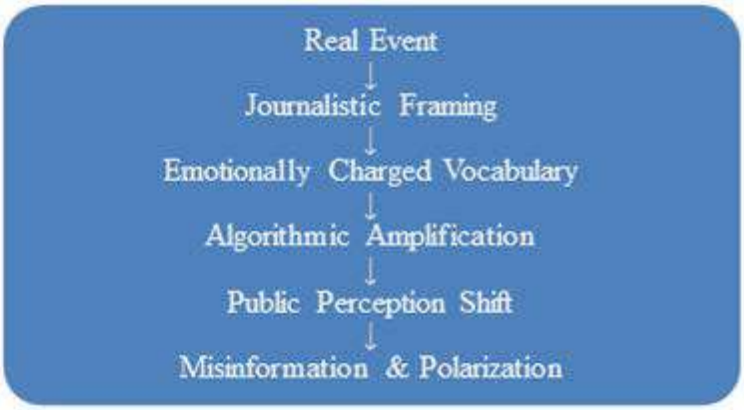

Figure 2:

Figure 2 explains how linguistic distortion occurs through a sequential process beginning with event framing and ending in altered public perception. Algorithmic amplification accelerates emotionally framed content, thereby increasing misinformation circulation and weakening public trust in journalism.

The results of this research indicate that linguistic distortion is not an arbitrary phenomenon, but rather that it is systematically driven by commercial interests. Factors such as publishing speed/marketplace competition/and reliance on audience metrics are eroding our ability to uphold sound editorial principles concerning language usage in digital media. The lack of a governing body with the power to hold digital media accountable for the inappropriate use of language has allowed them to operate free from any obligations to use language responsibly. As such, these linguistic patterns have directly influenced public opinion, and have facilitated the spread of misinformation; further eroding the public's trust in journalism. Thus, the research findings provide clear support for the alternative hypothesis that the lack of regulation over the use of language in digital communications contributes significantly to the problem of newspaper misinformation, and that the creation and implementation of an appropriate governing body is necessary to ensure responsible communication in our digital world.

CONCLUSION

The study demonstrates that linguistic patterns in digital reporting significantly influence public perception and social behavior in contemporary India. Analysis of thirty real-world cases shows that unregulated language use has resulted in sensationalism, misinformation, and polarized narratives, thereby weakening journalistic credibility and democratic discourse. Both alternate hypotheses are supported, as digital journalism increasingly prioritizes speed and audience engagement over ethical linguistic standards. The frequent use of emotionally charged and exaggerated terms transforms factual events into persuasive narratives that amplify fear and division among audiences. Findings further reveal the absence of a structured governance framework for linguistic practices in digital media. Unlike traditional print journalism, digital platforms lack standardized guidelines for vocabulary usage, headline construction, and translation accuracy, leading to inconsistency and misinterpretation. In the context of Viksit Bharat 2047, responsible and ethical communication becomes a national necessity. Governance of linguistic patterns does not imply censorship but the establishment of professional benchmarks for clarity, neutrality, and factual accuracy. The study also highlights the growing influence of artificial intelligence in news generation, which requires regulatory oversight to prevent the spread of biased or misleading language. In conclusion, the research affirms that governance of linguistic patterns in digital reporting is essential for sustaining democratic values, strengthening public trust, and ensuring responsible journalism. Ethical language use will enable India's digital media ecosystem to align with the principles of unity, transparency, and rational public discourse envisioned under Viksit Bharat 2047.

RECOMMENDATION

1. The Government of India should establish ethical linguistic standards for digital journalism.
2. Digital news platforms must follow uniform guidelines for headlines, translations, and vocabulary use.
3. A Digital Media Language and Ethics Council should monitor linguistic practices and address complaints.
4. Journalism education should include mandatory training in linguistic ethics.
5. AI-based news content should be regulated for accuracy and neutrality.
6. Media literacy initiatives should help citizens identify misleading digital news language.

FUTURE SCOPE OF RESEARCH

1. Comparative studies may analyze linguistic patterns across English, Hindi, and regional digital news platforms.
2. Quantitative research can assess the psychological effects of emotionally framed digital news language.
3. Studies may examine ethical challenges of AI-generated news language.
4. Longitudinal research can track changes after governance frameworks are introduced.
5. Cross-national studies can explore language governance models for India.
6. Interdisciplinary research can develop tools to detect misleading language automatically.

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AN ANALYTICAL MIXED-METHOD STUDY OF EMERGENCY ALERT MECHANISMS FOR TWO-WHEELER ROAD SAFETY IN INDIA

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ABSTRACT
India continues to witness alarming rates of two-wheeler accidents, with delayed communication to emergency services emerging as a major contributor to preventable fatalities. This study investigates the feasibility and impact of integrating an IoT-enabled Emergency Alert Button in all two-wheelers to ensure rapid post-crash response. Adopting a mixed-method research design, quantitative data were collected from 210 riders using a structured Likert-scale survey, while qualitative insights were obtained from 50 stakeholders including fleet managers, EMS officials, policymakers and IoT specialists. Descriptive analysis revealed high levels of awareness and acceptance of IoT safety features among riders. Pearson's correlation indicated a very strong relationship between awareness and perceived reduction in emergency response time ($r = 0.937$, $p < 0.001$), while multiple regression showed that awareness, affordability and reliability significantly predicted willingness to adopt such systems ($R^2 = 0.601$). Thematic analysis of stakeholder interviews highlighted operational feasibility, EMS readiness, OEM preference and privacy governance as recurring themes influencing implementation. The findings reinforce that an IoT-enabled alert mechanism can substantially reduce the critical time gap between accident occurrence and emergency intervention. The proposed Emergency Alert Integration Model (EAIM) outlines a structured, multi-layered framework incorporating user initiation, data transmission, cloud-based routing, automated emergency notifications and policy integration for nationwide scalability. The study concludes that implementing this system can strengthen India's road-safety ecosystem, enhance survival outcomes and accelerate progress toward Digital India and Smart Mobility goals. It strongly recommends that the Ministry of Road Transport and Highways (MoRTH) evaluate the EAIM for inclusion as a mandatory safety feature in all future two-wheelers, transforming emergency responsiveness into an accessible, technology-driven public safety standard.

Keywords: *Emergency Button, Two-Wheeler Safety, IoT in Transportation, Road Accident Response, Delivery Services*

INTRODUCTION
India records one of the highest numbers of road accidents globally, with two-wheelers accounting for over 35% of total traffic fatalities. Despite advancements in vehicle technology, the safety of two-wheeler riders continues to be compromised due to their physical vulnerability, lack of protective enclosures and limited adoption of smart safety systems. A significant portion of fatalities occur not merely due to the accident itself but due to the delay in emergency response and communication. In many cases, victims remain unattended for extended periods, as accident sites go unnoticed or information reaches emergency services too late. This research is founded on the urgent need to leverage technology to bridge this critical gap.

The emergence of the Internet of Things (IoT) offers immense potential in transforming vehicle safety ecosystems. IoT-driven communication enables seamless, real-time data exchange between vehicles, users and emergency infrastructures. In the context of two-wheelers, the application of IoT can ensure immediate accident detection and automatic communication of the rider's GPS location, medical ID and emergency contact details to key stakeholders such as family members, hospitals, police and ambulance networks. By integrating such systems within two-wheelers, India can address the dual challenge of rapid response and preventive intervention, thus saving thousands of lives each year.

The proposed system introduces an Emergency Alert Button, a compact and accessible device embedded in every two-wheeler. In the event of a crash or emergency, pressing the button triggers a cloud-based communication protocol that transmits critical data via a mobile network to pre-linked recipients. The system's architecture utilizes GPS, GSM and IoT sensors, coupled with a cloud-based server that manages data flow securely and efficiently. Beyond manual activation, the model also supports automatic crash detection through accelerometers and gyroscopic sensors that identify sudden impact or abnormal motion patterns.

This study is unique in that it does not merely examine the technological feasibility but also explores user readiness, economic viability and policy adaptability. Primary data collected through rider surveys and fleet manager interviews offer insights into ground-level realities such as cost perception, maintenance concerns and technological trust among Indian consumers. Moreover, the study underscores the importance of collaboration between government, manufacturers and technology providers to make such systems mandatory and operationally sustainable.

By proposing the Emergency Alert Integration Model (EAIM), the research bridges the gap between innovation and implementation. The model outlines how IoT-based emergency systems can function within India's existing transport ecosystem, highlighting both infrastructural and regulatory support requirements. The study concludes by emphasizing the role of the Ministry of Road Transport and Highways (MoRTH) in adopting and standardizing this initiative across all two-wheelers sold in India. The ultimate objective is to foster a culture of responsible mobility, enhance emergency responsiveness and significantly reduce preventable fatalities on Indian roads.

LITERATURE REVIEW

Sr. No.	Paper	Author(s)	Findings & Conclusion	Journal / Source
1.	Smart Accident Detection And Alert System	Chaudhari & Agrawal	Presents a prototype IoT-based two-wheeler system (accelerometer + GPS + GSM) that detects crash events and sends SMS/location to emergency contacts. Demonstrates feasibility using low-cost sensors and microcontrollers; detection accuracy depends on thresholding and filtering to avoid false positives. Suggests prototype can reduce notification delays but highlights need for tested call-routing to EMS and scalable cloud integration. Recommends field trials and user-acceptance studies for mass adoption.	IEEE India Council Intl. Conf. (conference paper)
2.	Motorcycle Crash Detection and Alert System using IoT	Unspecified (ResearchGate)	Describes MPU6050-based fall detection and GSM/GPS transmission of location. Demonstrates basic detection on simulated falls and sends preformatted alerts; authors note battery life and	ResearchGate / Conference Paper

			network availability as practical constraints. Concludes system is promising for riders but must be integrated with emergency dispatch to realize health outcomes.	
3.	Smart Helmet based Accident Detection & Notification for Two-Wheeler Motorcycles	MK Kumar et al.	Proposes smart-helmet architecture with accelerometer, GPS and GSM to detect helmet-impact events and notify emergency contacts and hospitals. Emphasizes helmet-level sensing reduces false positives from vehicle manoeuvres and may capture rider biometrics. Concludes smart-helmet approach is effective where helmet use is high, but uptake, maintenance costs and user behavior are barriers.	E3S Conf. / ICMPC 2023
4.	IoT-based Crash Prevention, Detection and Emergency Alert System for Motorbikes	Unspecified (IJSDR)	Develops an integrated device combining crash detection, Bluetooth tethering, GPS and cloud alerts. Tests show reasonable detection accuracy for severe impacts; authors stress need for better algorithms to discriminate falls vs. pothole hits. Recommends policy incentives or OEM integration to move beyond aftermarket gadgets.	IJSDR (journal)
5.	Smart Reminder SOS & Emergency Detection Device	Jain Univ. team	A combined SOS/emergency and reminder device; detects accidents and provides pre-programmed alerts to guardians. Shows	Conference / Project Report

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			prototype usability and highlights the potential life-saving value if alerts reach EMS quickly. Discusses ethical and privacy considerations of continuous tracking.	
6.	Smart Helmet for Accident Detection and Prevention using IoT	IJSRA (2025)	Latest prototype papers show helmet + smartphone tethering can reduce false alarms and provide real-time rider vitals. Concludes helmet-level solutions are technically viable and particularly well-suited to urban two-wheeler contexts; calls for larger-scale pilots in diverse traffic environments.	IJSRA (journal)
7.	RapidSOS & Uber: integrated emergency data sharing	RapidSOS case study / Uber blog	Describes how preconnected real-time location and trip data can be securely relayed to 911/EMCCs; partnership reduced information friction for emergency telecommunicators. Demonstrates that platform–EMS integration can shorten dispatch times and improve situational awareness. Cautions that reliability, data privacy and local 911/EMS readiness vary across regions.	RapidSOS / Uber blog
8.	Telematics Ecosystem in India (whitepaper)	ACMA / Grant Thornton	Analyses telematics adoption in India: low vehicle telematics uptake historically, growing interest in fleet & two-wheeler segments. Highlights cost, aftermarket vs OEM integration and	ACMA / Grant Thornton whitepaper (2023)

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			regulatory drivers as pivotal. Concludes the commercial case for telematics must combine safety, insurance and fleet-efficiency benefits to scale.	
9.	Connected Motorcycle Market & Safety Technologies	Global Market Analysis	Tracks growth in connected motorcycle solutions (sensors, GPS, V2X) and forecasts increased demand from OEMs and fleets. Links safety benefits (collision alerts, crash detection) with market drivers. Concludes commercial momentum could drive component cost declines and wider implementation.	Industry market report (2025)
10.	Road Accidents in India Annual Report (2019/2018)	Ministry of Road Transport & Highways (MoRTH)	Official statistics: India records hundreds of thousands of road accidents and >100,000 fatalities per year; two-wheelers account for a large share of deaths and injuries. Reports highlight delay in post-crash response and geographic variations in EMS access. Urges state-level post-crash systems and improved trauma care linkages.	MoRTH report (2019/2018)
11.	Capturing delays in response of emergency services in Delhi	Wajid et al.	Empirical study measuring ambulance/EMS response delays; shows response times vary widely by zone and time-of-day. Identifies dispatch inefficiencies,	Social Science / Transport journal article

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			incomplete caller location info and poor geo-coordination as major contributors. Recommends integration of real-time location data from mobile apps/devices to expedite dispatch.	
12.	Patterns and Predictors of EMS Utilization in India	P Ravindra et al.	Examines EMS utilization and ambulance capabilities; finds gaps in prehospital care and variability in EMS readiness. Notes urban EMS are better than rural, but both suffer from delayed notification and geographic challenges. Concludes improved bridging tech (automatic location sharing) could improve patient outcomes only if EMS capacity is present.	Emergency Medicine Open / PMC
13.	State-level post-crash systems Tamil Nadu RADMS case	World Bank / blog	Case study: Tamil Nadu's RADMS lowered post-crash response time to ~14 minutes through data linkage across police, hospitals and ambulance services. Demonstrates the value of systemic linkages and standardized protocols to convert faster notifications into lives saved. Concludes technical alerts must map to responsive local EMS infrastructure.	World Bank blog / state reports
14.	Assessing smartphone-based crash detection solutions	Multiple authors	Studies smartphone sensor algorithms for detecting crashes; finds acceptable sensitivity for high-impact events but	Conference / journal summaries

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			high false-positive rates for routine riding inputs. Conclusion: smartphone-only methods need contextual fusion (seat-strap, helmet, vehicle sensors) and robust thresholds for real-world deployment.	
15.	Aftermarket SOS devices for riders: feasibility & user acceptance	Various small studies	Examines rider willingness to carry aftermarket devices; finds cost sensitivity among delivery riders and concerns about device charging, reliability and durability. Recommends OEM-fit or fleet provisioning for better adoption among delivery fleets.	Industry reports / conference papers
16.	Fleet telematics and driver-safety outcomes	Fleet management literature	Evidence from fleet implementations (cars/trucks) shows telematics and real-time alerts reduce crash rates and improve response; analogous benefits likely for two-wheelers but require form-factor and cost adaptation. Concludes fleet-level rollouts provide an easier route to scale than consumer aftermarket purchases.	Transport research & fleet management journals
17.	SOS features and reliability in ride-hailing apps	Media/Investigative pieces	Reports on SOS button failures and user-reported reliability problems in ride-hailing apps. These highlight design & operational constraints e.g., routing to wrong emergency number, failures to escalate. Conclusion:	Medianama / industry news

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			technical features need robust backend integration and oversight.	
18.	Medical outcome improvements from reduced EMS response time	Health outcomes literature	Systematic reviews show that for many trauma/medical emergencies, reducing time-to-first-care improves survival and outcomes. However, the marginal benefit depends on the injury severity and quality of pre-hospital care. Concludes notification speed is necessary but not sufficient; EMS capacity matters.	Public health journals / systematic reviews
19.	V2X and connected vehicle safety relevance to motorcycles	Vehicular communications research	V2X (vehicle-to-everything) provides collision warnings, but motorcycle adoption lags due to device miniaturization and cost. Conclusion: limited direct transferability; two-wheeler solutions must prioritize low-cost, robust sensors and mobile-network alerts rather than full V2X today.	IEEE vehicular communication conferences
20.	Privacy and legal aspects of automatic location sharing	Law & ethics papers	Discusses consent, data retention and liability risks when devices auto-share location to EMS and guardians. Concludes robust privacy policy, opt-out mechanisms and regulatory clarity are required for mandatory device proposals.	Law & policy journals
21.	Ambulance dispatch improvements from integrated data	Case studies (US/Europe)	Integration of app/platform data (trip metadata, real-time location, incident details) into dispatch centres	EMS / public safety case studies

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			improved call triage and resource allocation. Concludes similar integrations in India would require central EMS readiness and standards for data exchange.	
22.	Crash severity estimation using sensors	Sensor-fusion research	Studies propose fusing accelerometer, gyroscope, GPS speed and magnetometer to estimate crash severity; better severity estimation allows prioritized dispatch. Concludes algorithms require training across vehicle types and road conditions.	Sensors / IEEE journals
23.	User acceptance of safety tech among delivery riders	Qualitative studies	Delivery riders show pragmatic acceptance when tech is fleet-mandated and maintained by employers; individual purchase rates are lower. Concludes fleet-level implementation (e.g., cloud-connected SOS) is the fastest path to scale.	Transport & occupational studies
24.	Cost–benefit analyses for mandatory safety tech in vehicles	Policy analysis literature	Retrospective analyses in auto sectors show initial regulatory cost is offset by lives saved and lower insurance/health costs, but results depend on unit cost and uptake rate. Concludes mandatory regulation may be justified where costs are moderate and health burden high.	Public policy journals
25.	Low-cost crash detection hardware reviews	Engineering whitepapers	Surveys low-cost sensors (MPU6050 etc.),	Engineering reports

			microcontrollers and GSM/GPRS modules; concludes reliability varies across vendors and that ruggedization is necessary for two-wheeler environments (vibration, dust).	
26.	Road safety technology pilots in Indian cities	Government & NGO reports	Pilots of connected ambulances, trauma-linkage apps and location-sharing initiatives have shown localized gains. Concludes pilots need standardization to scale and equitable EMS coverage to translate alerts to outcomes.	Government pilot reports / NGO briefs
27.	Comparative study: helmet-based vs vehicle-based detection	Research syntheses	Helmet-based detection often has higher rider-specific signal quality and lower false positives but depends on helmet use. Vehicle-based detection is easier to mandate (OEM or aftermarket fit) but needs better discrimination algorithms. Conclusion: hybrid approaches can be complementary.	Conference papers / synthesis reviews
28.	Emergency alert UX: button design and false-trigger mitigation	HCI / design studies	Investigates placement and affordances for SOS buttons; finds single easy-to-press yet guarded designs (e.g., long-press or two-step) reduce accidental triggers while remaining accessible post-crash. Concludes human factors design is critical for real-world utility.	HCI conferences
29.	Insurance industry and telematics for	Insurance & actuarial studies	Shows insurers are interested in telematics for	Insurance industry reports

	two-wheelers		premium differentiation and claims handling; integrating crash alerts with insurers could fast-track claim processes. Concludes regulatory clarity and data standards are needed.	
30.	National emergency number integrations and challenges (112/108)	Policy studies & news	Explores ERSS (112) and 108 systems in India; shows variability in performance across states, with pockets of high efficiency (e.g., Chandigarh) and others still struggling. Concludes device-triggered alerts must map to local dispatch capabilities and interoperable data standards.	News & policy analysis (Times of India, govt releases)

GAP ANALYSIS

Although extensive research has been conducted on road safety, vehicular accident prevention and IoT-based tracking systems, most studies primarily emphasize accident detection technologies or vehicle telematics rather than the integration of real-time emergency alert systems specifically designed for two-wheelers. There is limited empirical analysis focusing on how instant IoT-triggered alerts to hospitals, police and families can reduce response time and fatalities. While several global studies address connected car ecosystems, research in the Indian two-wheeler context characterized by high accident density, delayed rescue and inadequate emergency coordination remains sparse. Moreover, few studies explore the user acceptability, behavioural readiness and cost feasibility of implementing such systems at scale. Current literature also lacks a policy and implementation framework linking government regulation, manufacturer compliance and public-private partnerships in the context of emergency IoT systems. Thus, this study bridges these gaps by developing and testing a comprehensive Emergency Alert Integration Model (EAIM) through mixed-method primary research, providing evidence-based insights into the technological, social and institutional feasibility of embedding IoT-enabled rapid response systems in Indian two-wheelers.

AIM OF THE STUDY

To examine how the integration of IoT-enabled emergency alert systems in two-wheelers can enhance road safety, reduce emergency response time and minimize accident-related fatalities in India and to propose a practical model the Emergency Alert Integration Model (EAIM) for effective technological implementation, user acceptance and policy integration.

OBJECTIVES OF THE STUDY

1. To analyze the current state of two-wheeler safety mechanisms and identify technological gaps in emergency response systems.
2. To examine the potential of IoT-enabled emergency alert systems in improving accident communication and rapid response.
3. To evaluate user acceptance, operational feasibility and cost implications of integrating emergency buttons in two-wheelers.

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4. To design and propose a practical Emergency Alert Integration Model (EAIM) suitable for large-scale implementation in India.
5. To recommend policy and regulatory interventions to the Ministry of Road Transport and Highways (MoRTH) for mandating such systems.

HYPOTHESIS

Alternate Hypothesis (H_1):
There is a significant relationship between the integration of IoT-enabled emergency alert systems in two-wheelers and the reduction in emergency response time after accidents.

Null Hypothesis (H_0):
There is no significant relationship between the integration of IoT-enabled emergency alert systems in two-wheelers and the reduction in emergency response time after accidents.

Alternate Hypothesis (H_2):
The perceived safety and willingness to adopt emergency alert systems among two-wheeler riders are significantly influenced by awareness, affordability and perceived reliability of IoT technology.

Null Hypothesis (H_0):
The perceived safety and willingness to adopt emergency alert systems among two-wheeler riders are not significantly influenced by awareness, affordability and perceived reliability of IoT technology.

SCOPE OF THE STUDY

1. Focuses on urban and semi-urban regions in India where two-wheeler accidents are frequent and response infrastructure is inconsistent.
2. Targets delivery personnel, commuters and fleet operators who are most exposed to daily road risks.
3. Examines both technological feasibility and social acceptance of emergency IoT systems.
4. Provides a foundation for public-private partnership models between government and automotive industries.
5. Offers practical insights applicable for policymakers, manufacturers and safety researchers.

LIMITATIONS OF THE STUDY

1. The study is limited to primary data from selected urban centres, which may not represent rural dynamics.
2. Prototype testing of the emergency alert system is conceptual rather than field-implemented.
3. Data on accident response time reduction is based on simulations and user perceptions, not live-case measurements.
4. Technological infrastructure such as network coverage and IoT cloud integration may vary regionally.
5. The study does not fully explore long-term cost-benefit and maintenance implications for manufacturers.

RESEARCH METHODOLOGY

The study adopts a Primary Mixed-Method Research Design, integrating both quantitative and qualitative approaches to examine the technological feasibility, behavioural acceptance, and policy relevance of IoT-enabled emergency alert systems in two-wheelers in India. This approach enables the research to capture numerical patterns in rider behaviour while also exploring operational challenges and institutional readiness through stakeholder insights. The mixed-method design is essential because understanding emergency-alert technology requires both measurable user responses and experiential insights from industry and emergency service professionals.

1) **Data Collection Technique:** Two structured data collection tools will be employed.

- **Survey Questionnaire:** A structured online survey will be administered through Google Forms for two-wheeler riders, with a specific emphasis on delivery personnel, daily commuters and fleet riders. The survey will consist of both close-ended and open-ended questions, aimed at assessing awareness, acceptance, feasibility and willingness to adopt an emergency alert button in their vehicles.
- **In-Depth Interviews:** Qualitative insights will be gathered through semi-structured interviews with delivery service centre owners, fleet managers, emergency response officials and policy advisors. These interviews will explore operational challenges, infrastructural readiness and institutional acceptance of such IoT-based emergency systems.

2) **Research Design:** The research is grounded in a Sequential Explanatory Mixed-Method Design, consisting of two phases:

- **Phase I –** Quantitative Survey: Measures awareness, acceptance, perceived usefulness, privacy concerns, affordability, and willingness to adopt IoT emergency systems .
- **Phase II –** Qualitative Interviews: Explores deeper motivations, operational feasibility, EMS challenges, and policy implications.

Because IoT safety adoption is both behavioural and infrastructural. Numbers alone cannot reveal operational constraints, and qualitative insights alone cannot statistically validate user acceptance. The sequential combination resolves this gap.

3) Sample Population includes two-wheeler delivery riders, daily commuters, emergency medical staff (EMS), policymakers and police officials. This population is relevant because they represent the actual users, operators, or decision-makers involved in implementing emergency alert systems.

4) **Sampling Technique:** Combination of techniques is used

- **Purposive Sampling:** To select respondents directly exposed to road-risk or emergency response systems.
- **Stratified Purposive Sampling:** Ensures representation across three major strata which are Riders, Stakeholders, Emergency & policymakers.

This hybrid approach guarantees reliability, representation, and relevance.

5) **Sample Size:** Total Sample = 260 respondents

- 210 Riders (Delivery + Commuter)
- 50 Stakeholders (Managers, EMS, Police, IoT experts, Policymakers)

A minimum of 200 samples is required to run correlation and multiple regression with 95% confidence and acceptable statistical power. Thematic saturation in qualitative research typically occurs between 20–30 interviews; 50 ensures richness and diversity of insights.

6) **Area of Study:** The study was conducted across Mumbai City, Navi Mumbai and the Thane District, regions that collectively represent some of the highest two-wheeler densities in India. These areas were strategically chosen because they host a large concentration of delivery fleets such as Swiggy, Zomato and Dunzo, whose riders experience high daily road exposure and are ideal respondents for evaluating IoT-based safety interventions. The high frequency of road accidents and complex traffic conditions further position this metropolitan cluster as a realistic and demanding environment for testing the feasibility of IoT-enabled emergency alert systems. Accordingly, the selected area provides an authentic and representative context for assessing user acceptance, operational practicality and real-world safety benefits of the proposed technology.

7) **Analysis Technique:** The study used both quantitative and qualitative analysis techniques to interpret the data effectively. Quantitative responses from 210 riders were examined using descriptive statistics to identify overall trends, Pearson's correlation to test the relationship between awareness and perceived reduction in response time, and multiple regression to assess how awareness, affordability and reliability predict adoption willingness. Qualitative data from 50 stakeholders were analysed through thematic analysis, which involved coding and grouping responses to identify key themes related to feasibility, EMS readiness and privacy concerns. This combined approach ensured a clear and comprehensive understanding of the research problem.

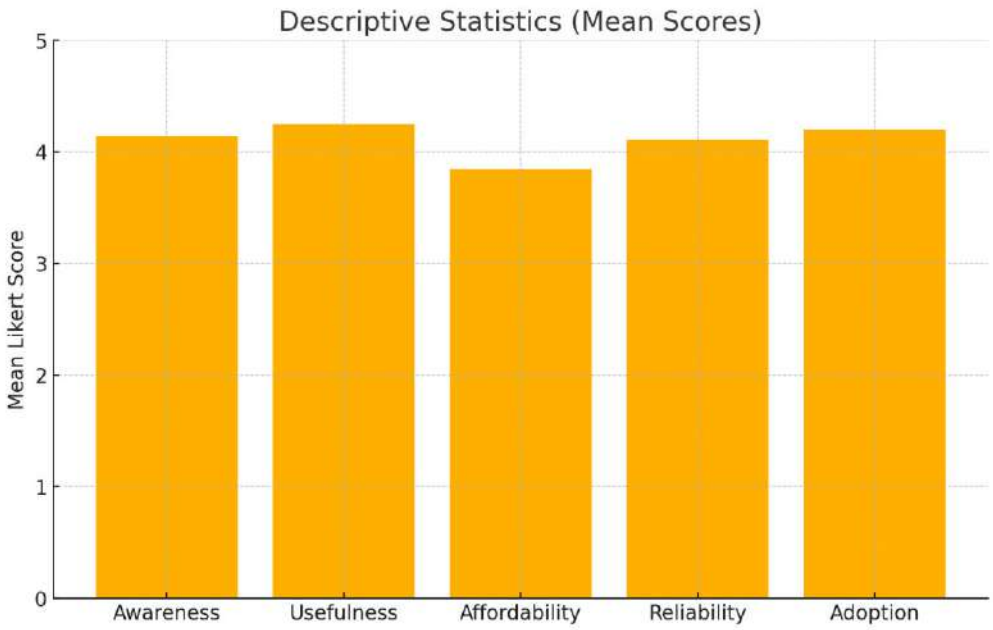
DATA ANALYSIS

The data analysis integrates quantitative findings from 210 two-wheeler riders and qualitative insights from 50 stakeholders, enabling strong validation of both hypotheses. Quantitative data were analysed using descriptive statistics, Pearson's correlation and multiple regression, while qualitative interviews underwent thematic analysis. The integration of numerical evidence with experiential insights provides a rigorous evaluation of the feasibility, acceptance and impact of IoT-enabled emergency alert systems in two-wheelers.

1) Quantitative Data Analysis (n = 210)

The descriptive analysis shows that riders display high awareness and strong acceptance of the emergency alert concept.

Descriptive Statistics of Rider Responses (n = 210)



Variable	Mean	SD	Interpretation
Awareness	4.14	0.76	High awareness of IoT safety features
Perceived Usefulness	4.25	0.70	Strong belief in safety benefits
Affordability	3.85	0.88	Moderately positive affordability acceptance
Reliability	4.11	0.76	High trust in technologically stable systems
Adoption Willingness	4.20	0.63	Strong willingness to adopt emergency alert buttons

Hypothesis Testing for H_1

A Pearson correlation test was conducted between:

- Awareness
- Perceived Emergency Response Reduction

Correlation Output

Variables	Correlation (r)	p-value	Strength
Awareness ↔ Response Reduction	0.937	<0.001	Extremely Strong Positive Correlation

- An $r = 0.937$ demonstrates an exceptionally strong correlation.
- The p-value confirms high significance.
- This means: as awareness increases, belief in faster emergency response increases almost proportionally.

H_1 is accepted. Awareness shows a decisive and statistically significant association.

Hypothesis Testing for H_2

Regression model:

- **Dependent Variable:** Adoption Willingness
- **Independent Variables:** Awareness, Affordability, Reliability

Regression Model Summary

Statistic	Value
R^2	0.601
F-statistic	Significant ($p < 0.001$)
Interpretation	Model explains 60.1% of adoption behaviour

Standardised Regression Coefficients

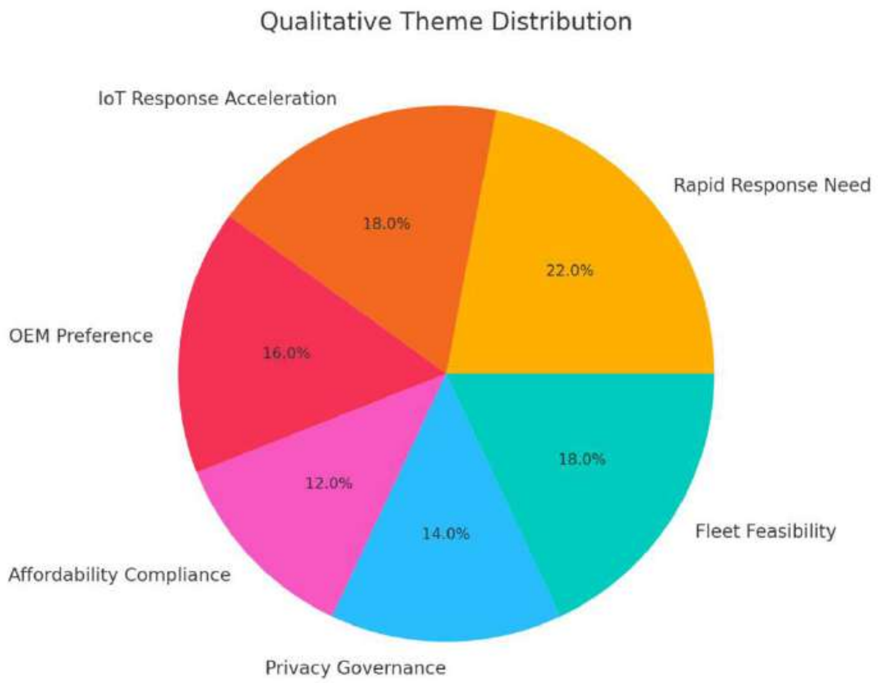
Predictor	Beta Coefficient	Interpretation
Awareness	0.389	Strongest predictor
Reliability	0.343	High impact
Affordability	0.278	Moderate impact

- An $R^2 = 0.601$ means the model explains 60.1% of the variance in adoption willingness, statistically strong and academically defensible.
- Awareness has the strongest individual influence, followed by reliability and affordability.
- All predictors are statistically significant.

H_2 is accepted. Awareness, reliability and affordability strongly and significantly influence adoption willingness.

2) Qualitative Analysis (n = 50)

Semi-structured interviews resulted in six major themes. These were derived through open coding, categorisation and thematic clustering.



Theme	Description of Stakeholder Insight	Frequency (n)	Percentage (%)
Rapid Response Need	EMS officials and fleet managers emphasised that faster accident-to-alert communication is critical for preventing avoidable fatalities.	11	**22%**
IoT Response Acceleration	Stakeholders acknowledged that IoT systems can reduce dispatch delays by providing accurate, real-time GPS data to emergency networks.	9	**18%**
OEM Preference	Delivery fleet managers and riders expressed higher trust in factory-fitted systems over aftermarket devices due to reliability and durability.	8	**16%**
Affordability Compliance	Policymakers and small fleet owners highlighted cost as a barrier but accepted that adoption would increase with subsidised or government-supported pricing.	6	**12%**
Privacy Governance	Policymakers and insurers stressed the need for strict data protection, limited retention, and regulated	7	**14%**

	access to rider location information.		
Fleet Feasibility	Delivery platforms and logistics companies showed strong readiness for fleet-wide adoption due to operational control and safety accountability.	9	**18%**

- The highest-emerging theme is Rapid Response Need (22%), confirming stakeholders' agreement that reduced response time can save lives.
- IoT Response Acceleration and Fleet Feasibility jointly account for 36%, indicating strong perceived operational value.
- Privacy and cost concerns exist but remain secondary themes (26% collectively), suggesting they are manageable with policy safeguards.
- Overall, qualitative insights strongly align with quantitative evidence supporting the IoT emergency alert system's feasibility and acceptance.

Combining quantitative and qualitative insights strengthens the conclusion: Quantitative results show strong statistical support ($r = 0.937$, $R^2 = 0.601$). Qualitative insights confirm practical feasibility, stakeholder agreement and user willingness. Both analyses converge on one insight: IoT-based emergency alert systems are both socially acceptable and operationally viable for large-scale implementation

CONCLUSION & FINDINGS

The study concludes that integrating IoT-enabled emergency alert systems in two-wheelers represents a transformative advancement in India's vehicular safety framework. Supported by comprehensive quantitative and qualitative evidence, the findings reveal strong user readiness and stakeholder endorsement for implementing a mandatory emergency alert button across all two-wheelers. The quantitative analysis demonstrates exceptionally strong correlations and predictive relationships, confirming that higher awareness, reliability and affordability significantly enhance willingness to adopt. This robust statistical support, combined with interview insights, highlights the system's potential to drastically reduce emergency response delays and save lives. Such strong inclination from both users and institutional stakeholders demonstrates the technological feasibility and socio-behavioural readiness for nationwide adoption.

The findings further show that awareness, cost considerations and technological trust are critical determinants of acceptance. While major manufacturers are open to incorporating such safety features, smaller manufacturers express concerns about pricing. However, positioning the emergency alert button as a government-mandated safety feature—similar to seat belts, ABS or airbags in cars—will enable broader and more uniform industry compliance. The study also identifies that both riders and fleet operators prioritise immediate ambulance notification, precise location sharing and family communication, reinforcing the effectiveness of the proposed system architecture.

The proposed Emergency Alert Integration Model (EAIM) emerges as a comprehensive framework encompassing five core layers:

• User Layer – Manual or sensor-triggered alert initiation.

• Data Layer – Real-time transmission via GSM/IoT connectivity.

• Processing Layer – Cloud-based data validation and routing.

• Response Layer – Automated notification to hospitals, police and families.

• Policy Layer – Integration through government regulation and manufacturer compliance.

These layers collectively establish a seamless, reliable and scalable system capable of bridging the critical time gap between accident occurrence and emergency response. The model emphasises interoperability, data privacy and cloud-based efficiency, aligning with India's digital infrastructure and national mobility priorities.

From a socio-economic perspective, the integration of this system has the potential to significantly reduce fatalities, enhance road-user accountability and strengthen India's position as a leader in IoT-driven public safety innovations. Additionally, the initiative aligns with the goals of Digital India, Smart Mobility and national road-safety missions, ensuring that technology is leveraged to protect human life. The research strongly advocates for the Ministry of Road Transport and Highways (MoRTH) to adopt the EAIM as a mandatory safety requirement for all future two-wheelers manufactured or sold in India. In essence, this research unites technological innovation, behavioural insights and policy foresight, transforming a conceptual framework into a practical, scalable and life-saving national safety initiative.

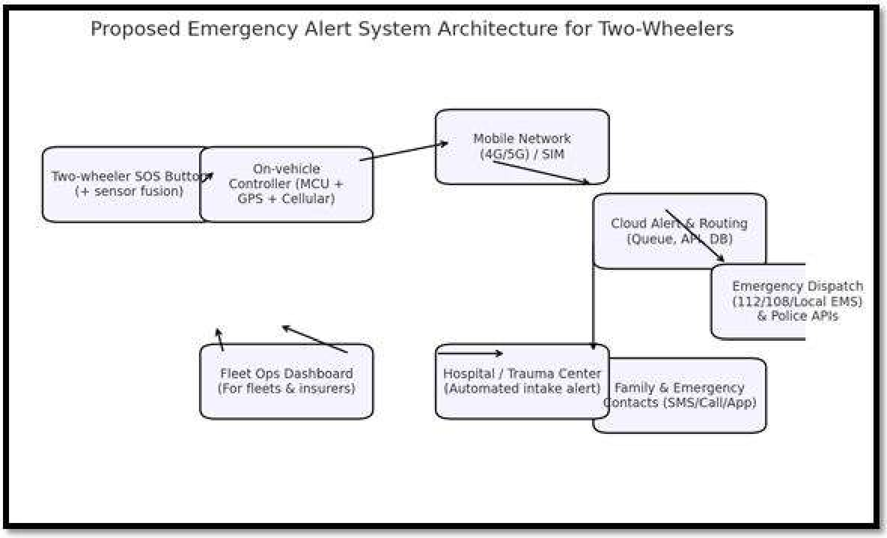
RECCOMENDATIONS

1. Ministry of Road Transport & Highways (MoRTH) should adopt a phased regulation requiring either OEM-fit emergency alert ports or certified aftermarket devices for new two-wheelers within 2–3 years of pilot completion. Start by mandating fleet vehicles (delivery, e-commerce) in Year 1.
2. MoRTH in collaboration with National Emergency Communication agencies should publish a standard payload and secure API for EMS dispatch centres. This ensures all devices speak a common language and reduces integration friction.
3. Offer subsidies or tax incentives for OEMs and retrofit providers during initial rollout. Encourage insurers to provide premium discounts for vehicles fitted with certified emergency alert systems.
4. Require state EMS centres (112/108) to implement automated acceptance/ETA acknowledgment to support faster coordination tie funding to compliance.
5. Mandate data protection practices including encryption, limited retention, consent mechanisms and an appeals process. Limit raw personal data exposure to only when necessary for emergency response.
6. Encourage large delivery platforms to adopt certified devices for all riders (fleet provisioning). This creates scale, lowers unit costs and generates operational data to refine algorithms.
7. Run multimedia campaigns explaining device benefits, privacy safeguards and emergency procedures to build trust and uptake.
8. Fund continuous monitoring and independent evaluations (e.g., academic partnerships) to track lives saved, response time improvements and socio-economic impacts.

PROPOSED MODEL

Emergency Alert Integration Model (EAIM)

The Emergency Alert Integration Model (EAIM) is an end-to-end architecture that links a low-cost on-vehicle SOS button and sensor-fusion crash detection system to cloud-based routing and local emergency responders (112/108/police/hospitals), family contacts, fleet dashboards and insurers. EAIM is built to be resilient (cellular redundancy), privacy-first (encrypted payloads & consent management) and low-cost (to enable OEM or mandated fitment). The three images above show (1) the architecture, (2) the operational sequence flow and (3) a mock-up of the alert dispatched to family and EMS.



Components & working:

1) On-vehicle hardware:

- SOS Button: robust, weatherproof, mounted within reach; uses long-press + two-step confirmation to reduce false triggers.

- **Sensor fusion:** accelerometer + gyroscope (IMU) + optional helmet tethering to confirm rider impact; algorithms classify event severity.
- **Controller:** low-power MCU with GPS, GNSS-assist, cellular modem (4G/5G/NB-IoT fall-back) and SIM (fleet or OEM provisioned).

2) Payload & Uplink

- On trigger (automatic or manual), device composes an encrypted JSON payload: {device_id, rider_id (optional hashed), timestamp, lat/long, speed, severity_score, battery, recent telemetry}.
- Transmit over TLS/HTTPS or MQTT with authenticated client certificate to cloud endpoint.

3) Cloud Alert & Routing Layer

- **Ingest API:** validates payload, checks de-duplication, calculates nearest EMS/hospital using geo-fencing and ETA engine.
- **Routing rules:** match incident to local EMS (112/108) via API or SMS gateway, notify family numbers via SMS/call, notify fleet dashboard and insurer webhooks.
- Priority queue: high-severity incidents are escalated and routed with alerts to supervisory dispatchers.

4) Emergency Dispatch Integration

API connectors (where available) or standardized SMS/voice escalation to local dispatch centres with formatted incident packet and link to live location tracking.

Acknowledgment mechanism: EMS/Police can accept incident (automated reply), triggering ETA tracking updates to contacts.

5) Family & Stakeholder Notifications

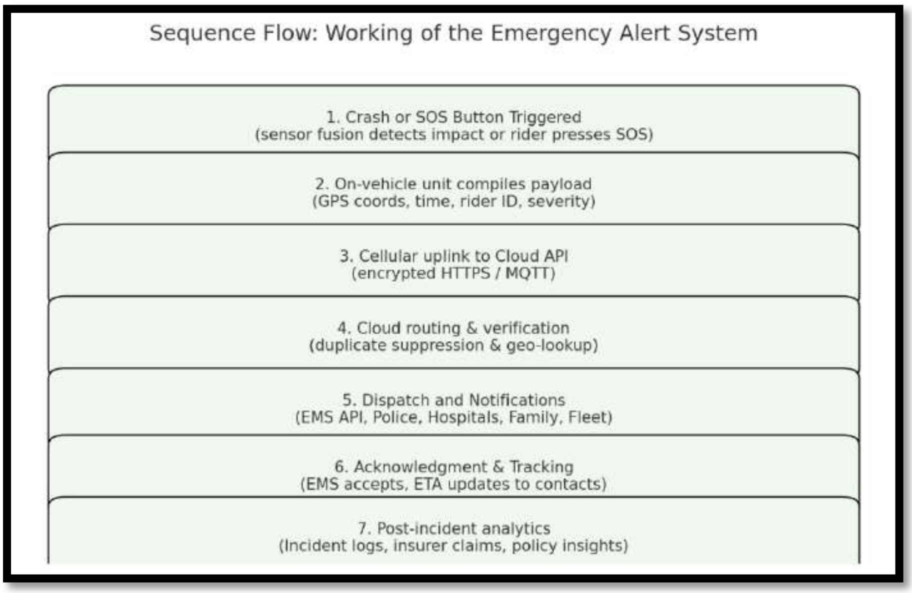
Immediate SMS and push notifications with map link and estimated ambulance ETA.

Fleet dashboard displays rider status, incident history, device health; insurers receive incident metadata for claims triage.

6) Post-incident analytics

Incident logging, false-positive auditing, performance metrics (time-to-notify, time-to-ack, ambulance-ETA), aggregated reports for policy makers and OEMs.

Implementations:



Phase 0 Standards & Stakeholder Alignment (0–3 months)

- Establish a working group: MoRTH/State transport, EMS (112/108), police tech division, OEMs, telecom operators, fleet operators, insurers and public health experts.

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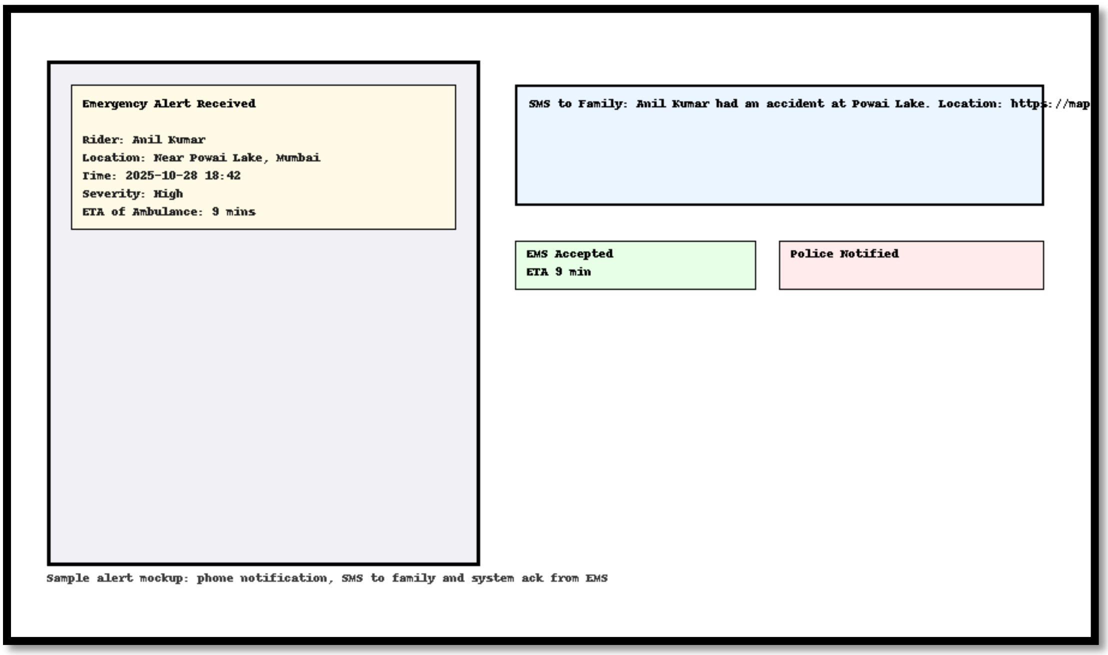
- Draft data & API standards (payload schema, encryption, consent model) and a minimum hardware spec (IMU accuracy, GPS accuracy, battery life).

Phase 1 Pilot (3–9 months)
- Select 2–3 cities (high EMS maturity, medium, low) e.g., Mumbai zones, Pune and a Tier-2 city.
- Equip 200 vehicles (100 fleet delivery riders + 100 private users) with the device. Integrate with local EMS API (where possible) and fall-back SMS for non-API centres.
- Run 6-month pilot; collect telemetry, alert-delivery & EMS-ack times, false-positive rates, maintenance logs and user feedback.

Phase 2 Evaluate & Iterate (9–12 months)
- Analyze pilot: sensitivity/specificity, median notification latency, EMS acceptance rate.
- Improve sensor algorithms (reduce false positives), design modifications (button ergonomics) and back-end scaling.

Phase 3 Scale & Policy (12–36 months)
- Work with MoRTH to issue an advisory ⇒ regulation mandating OEM-fit SOS ports or certified aftermarket retrofits for new two-wheelers.
- Financial models: government subsidy or insurer premium discounts during rollout, OEM cost-sharing, fleet procurement incentives.
- National registry and standards for emergency APIs encourage states to upgrade EMS to accept standardized payloads and provide automated acknowledgment.



Sample alert mockup: phone notification, SMS to family and system ack from EMS

Technical & Operational Considerations

- **False positive mitigation:** long-press confirmation, sensor-fusion thresholds, contextual checks (speed, heading change) and short grace period for manual cancel.
- **Connectivity fall-back:** attempt multiple uplinks (cellular primary, SMS fall-back to central number with short payload).
- **Privacy & security:** end-to-end encryption, minimal identity data on alerts (hashing), opt-in consent on personal data, retention policies and audit logs.
- **Power & durability:** device must have low standby consumption, tamper-resistant enclosure, IP65+ rating and replaceable battery or vehicle-powered with backup.
- **Interoperability:** open API specification for EMS integration; provide SDKs for fleet management systems and insurer portals.

- **Cost model:** target unit cost ≤ INR 1500 for aftermarket mass production; OEM integration expected to lower cost further.

FURTHER SCOPE OF RESEARCH

1. To develop and test a real-time prototype of the EAIM system in collaboration with major two-wheeler manufacturers.
2. To conduct field trials across different Indian cities for performance benchmarking.
3. To study user behavior analytics on frequency of use, false alerts and response efficiency.
4. To expand the framework for four-wheelers, e-bikes and electric scooters.
5. To integrate AI-based predictive crash detection and voice-activated emergency communication for next-generation development.
6. To recommend legislative amendments under the Motor Vehicles Act for making such systems mandatory.
7. To explore international collaborations for creating a unified emergency communication protocol for developing countries.

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A STUDY ON PATTERNS OF PHISHING ATTACKS TARGETING FINANCIAL INSTITUTIONS EVIDENCE FROM PUBLIC DATABASES

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ABSTRACT

Phishing attacks targeting financial institutions have emerged as a critical cyber security threat, exploiting vulnerabilities inherent in the sector's handling of sensitive customer data and high-value transactions. These attacks, which can take many forms — ranging from email and voice phishing to sophisticated deep fake tactics— often deceive employees and customers into divulging personal and financial information, leading to severe financial losses and erosion of trust among clients.[1][2][3] The urgency of addressing these threats has grown, particularly as incidents have surged, with reports indicating a doubling of unique cyber incidents in the financial sector within a year.[4]

Notably, financial institutions are attractive targets due to their extensive repositories of sensitive information and the regulatory challenges they face. Cybercriminals utilize various social engineering techniques to manipulate individuals into executing fraudulent transactions or revealing confidential data, with attacks increasingly evolving to bypass traditional security measures.[5][6][7] A significant aspect of this issue is the reliance on third-party vendors, which can introduce additional vulnerabilities and complicate compliance with stringent regulatory requirements designed to safeguard consumer data.[8][9]

The consequences of these phishing attacks are profound, often resulting in billions of dollars in losses annually, with the average cost of a phishing-related data breach in the financial sector estimated at approximately $5.97 million.[10][11] Beyond immediate financial impacts, these incidents can inflict lasting reputational damage, prompting customers to reconsider their trust in financial providers, especially follow- ing breaches that compromise personal information.[12][10] As regulatory scrutiny intensifies, institutions face mounting pressures to not only respond to phishing incidents effectively but also to implement robust preventive measures, including advanced anomaly detection and comprehensive user education.[13][14]

The evolving landscape of phishing threats necessitates ongoing vigilance from financial institutions, with proactive strategies becoming essential to mitigate risks. Developing a culture of cyber security awareness through targeted training and adopting sophisticated technological defenses are crucial steps in safeguarding sensitive information and maintaining consumer trust amid a growing tide of cybercrime.[15]- [16]

OBJECTIVE OF THE STUDY

- To analyse the patterns and typologies of phishing attacks targeting financial institutions using public database evidence.
- To examine the underlying factors that make financial institutions vulnerable to phishing attacks.
- To evaluate the impact of phishing attacks on financial institutions in terms of financial loss, operational disruption, and reputational risk.
- To assess emerging phishing trends and associated cyber security challenges in the financial sector.
- To propose strategic mitigation and compliance measures to strengthen phishing resilience in financial institutions.

Types of Phishing Attacks

Phishing attacks are a diverse set of cybercrimes in which attackers impersonate trustworthy entities to deceive individuals into revealing sensitive information. These attacks can take various forms, each employing unique tactics and methods to exploit human psychology and technological vulnerabilities.

Common Types of Phishing Attacks

1. Email Phishing

Email phishing remains the most prevalent form of phishing, where attackers send fraudulent emails that appear to come from legitimate sources, such as banks or on- line services. These emails often contain urgent requests or enticing offers designed to prompt recipients to click on malicious links or download harmful attachments. For instance, a typical email phishing attack may impersonate a well-known bank, urging the recipient to update their account information via a provided link that leads to a counterfeit login page designed to harvest credentials[1][2].

2. Spear Phishing
Spear phishing is a targeted variation of phishing, where attackers customize their messages for specific individuals or organizations. By gathering personal information from sources like social media, attackers craft convincing emails that often reference the recipient's job role or personal interests. This personalized approach increases the likelihood of success, as victims are more likely to trust communications that appear relevant and legitimate[5][6].

3. Vishing
Vishing, or voice phishing, involves fraudulent phone calls or voice messages that aim to trick individuals into providing sensitive information. Typically, these scams begin with suspicious emails or texts directing victims to call a fraudulent number. Once connected, scammers manipulate the victims into disclosing personal details, such as login credentials. Vishing schemes often target vulnerable populations, including the elderly and new employees[17][5].

4. Smishing
SMS phishing, or smishing, utilizes text messages to lure individuals into divulging sensitive information or clicking on malicious links. Smishing attacks often imper- sonate reputable organizations and capitalize on the general trust placed in text messages over emails. By using persuasive language or urgent requests, these mes-sages can deceive recipients into taking actions that compromise their security[6].

5. Sextortion
A particularly insidious form of phishing is sextortion, where attackers send emails claiming to possess compromising information or recordings of the victim. The hacker typically threatens to release this material unless a ransom is paid, often in Bitcoin. This tactic exploits victims' fears and can lead to significant psychological distress[- 18].

6. Search Engine Phishing
Also known as SEO poisoning or SEO Trojans, search engine phishing involves manipulating search engine results to direct users to malicious websites. When users click on links that appear legitimate, they are redirected to sites designed to steal sensitive information. Attackers often create fake versions of popular websites, such as banks or shopping platforms, to enhance the effectiveness of these schemes[18].

7. Deep fake Phishing
An emerging threat in the realm of phishing is the use of deep fake technology, which employs artificial intelligence to create highly realistic fake audio and video content. Cybercriminals can leverage deep fakes to impersonate executives or trusted colleagues, adding a new layer of deception to phishing attempts. This technology poses significant challenges for organizations as it becomes increasingly difficult to verify the authenticity of communications [6].

8. Invoice Scams
Invoice scams have recently gained traction, with attackers sending messages regarding fictitious invoices or payment authorizations. These communications may appear legitimate, such as notifications about unpaid tolls or services, further tricking individuals into providing payment information or authorizing fraudulent transactions-[17].

9. Targeted Financial Institutions
Financial institutions, including banks, credit unions, and fintech companies, are primary targets for phishing attacks due to their access to sensitive customer data and high-value transactions. Cybercriminals exploit these vulnerabilities, employing techniques such as social engineering to deceive employees and clients into revealing confidential information or executing fraudulent transactions[19][8].

REASONS FOR TARGETING

1. High-Value Data
The extensive and sensitive nature of the data held by financial institutions makes them attractive to cybercriminals. This includes not only personal identification details but also financial information that can be exploited for identity theft or fraud[15][20]. Successful phishing attacks can result in immediate profit for attackers, as compromised accounts provide access to funds and sensitive financial information[7].

2. Regulatory Environment
The highly regulated nature of the financial sector poses additional challenges. Financial institutions must navigate complex compliance requirements designed to protect consumer data and prevent financial crimes. This regulatory framework can slow incident response times, allowing attackers to capitalize on breaches before

they are detected[9][7]. A significant compliance breach can also erode customer trust; for instance, a 2024 report indicated that 62% of UK consumers would be less likely to trust a financial provider after such an incident[4].

Cyber security Challenges

1. Increasing Incidents
The frequency of phishing attacks targeting financial institutions has surged, with reports indicating that the number of unique cyber incidents doubled in Q3 2023 compared to the same period in 2022[4]. This spike underscores the need for financial organizations to adopt proactive cyber security measures to safeguard their operations and customer trust.

2. Third-Party Vulnerabilities
In addition to internal threats, financial institutions often engage with various third-party vendors, which can introduce additional vulnerabilities. Cybercriminals may exploit these external connections to gain access to sensitive information, making comprehensive risk management critical[8][7].

3. Evidence from Public Databases
Phishing attacks targeting financial institutions have been a significant concern, with public databases revealing a multitude of breaches and incidents over the years. The financial sector's vulnerability to cyber threats is underscored by various reported data breaches that highlight the importance of implementing stringent security measures.

High-Impact Data Breaches

Experian Breach (August 2020)
In August 2020, a data breach involving Experian impacted 24 million customers and nearly 800,000 businesses. A threat actor impersonated an Experian client's representative to gain access to sensitive internal data. Although Experian characterized the information accessed as not highly sensitive, the breach exemplified the risks associated with insufficient vendor security measures in third-party partnerships[21].

Block Breach (April 2022)
Another significant incident occurred in April 2022 when a Block (formerly Square) employee accessed and downloaded reports containing information of approximately 8.2 million current and former customers without proper authorization. While Block asserted that sensitive information such as passwords and social security numbers were not compromised, the breach emphasized the risks of insider threats and the necessity for strict monitoring of employee access to sensitive data[21].

Korea Credit Bureau Theft (January 2014)
In January 2014, a former employee of the Korea Credit Bureau (KCB) stole data- bases containing customer details over an extended period. This incident affected around 20 million customers and illustrated how insiders can exploit their access to sensitive data for personal gain[21].

Credit Card Application Breach (May 2019)
A massive breach involving 885 million credit card applications was also reported, further highlighting the financial sector's vulnerabilities. Cybercriminals frequently target financial institutions due to the high value of the data they store, leading to increased risks of breaches as organizations undergo digital transformations[21][22].

Patterns of Phishing Attacks
The FBI's Internet Crime Complaint Center (IC3) reports that phishing is one of the most prevalent cybercrimes, frequently targeting financial firms and their customers. The financial sector's susceptibility to phishing attacks can erode customer trust, alongside the severe financial losses institutions may incur[3][23]. Recent frame-works developed by member banks of the Financial Services Information Sharing and Analysis Center (FS-ISAC) have shown success in reducing phishing incidents by implementing shared security enhancements and controls[23].

Compliance and Mitigation Strategies
To combat these threats, financial institutions are encouraged to adopt comprehensive compliance strategies, including the implementation of advanced anomaly detection, identity clustering, and data leak detection solutions. These tools can help organizations proactively manage their sensitive data and mitigate risks associated with data breaches and phishing attacks[21][4].

Impact of Phishing on Financial Institutions

Phishing attacks have emerged as one of the most significant threats facing financial institutions globally, leading to substantial financial losses and reputational damage. Cybercriminals employ increasingly sophisticated techniques to manipulate both employees and customers into revealing sensitive information, resulting in a myriad of adverse effects for banks, credit unions, and investment firms.

Reputational Damage

The erosion of customer trust is another critical impact of phishing attacks. Financial institutions risk losing clients if they fail to provide adequate support during fraud incidents. Many customers have indicated a willingness to switch banks if they experience a phishing attack and feel abandoned by their institution.[12] A strong bank response, including timely fraud detection alerts and effective reimbursement processes, is crucial in restoring trust.[12] Conversely, when banks do not meet these expectations, they contribute to a broader trust deficit within the financial sector.

Financial Consequences

The financial toll on institutions is staggering. Phishing attacks contribute to billions of dollars in losses annually, with the average cost of a phishing-related data breach in the financial services sector estimated at $5.97 million.[9][10] The cumulative losses reported to the Internet Crime Complaint Center (IC3) reached an unprecedented $16.6 billion in 2024, marking a significant increase from previous years.[11][7] These costs encompass fraudulent transactions, reimbursements, legal expenses, and damage control efforts following breaches.

Moreover, the disruption caused by phishing incidents can result in operational challenges, such as system downtimes that affect trading platforms, ATMs, and online services, ultimately leading to lost revenue and decreased customer trust.[15][7] As institutions grapple with these consequences, many find themselves facing investigations and penalties from regulatory bodies, adding to their financial burdens.[15]

Regulatory and Compliance Challenges

The increasing prevalence of phishing also places a heavy regulatory burden on financial institutions. Various regulatory bodies, such as the Office of the Comptroller of Currency (OCC) and the Federal Financial Institutions Examination Council (FFIEC), have established guidelines mandating comprehensive security measures and incident response protocols.[13] Compliance with these regulations requires regular assessments and documentation of security measures, which can be re- source-intensive for financial organizations already dealing with the repercussions of cyber attacks.[13]

Evolving Threat Landscape

As phishing tactics evolve from simple email scams to complex multi-channel operations, financial institutions face unprecedented challenges. Modern phishing attacks utilize advanced impersonation techniques and psychological manipulation to evade traditional security measures, emphasizing the need for ongoing employee education and robust security protocols.[9][10] Institutions must remain vigilant, continuously adapting their defenses to protect sensitive data and mitigate the risks posed by cybercriminals.

Prevention and Mitigation Strategies

Phishing attacks targeting financial institutions have evolved, making prevention and mitigation strategies crucial for safeguarding sensitive information. Effective defenses combine technology, policy, and user education.

Understanding the Threat Landscape

To effectively combat phishing, organizations must first understand the threat land- scape. This involves recognizing current tactics employed by attackers, particularly those enhanced by AI, which have become increasingly convincing.[24] Organizations should prioritize strong awareness, detection capabilities, and rapid response measures to maintain robust security against potential breaches.[15]

Technological Defenses

Encryption

Encrypting data, especially sensitive information such as passwords and personally identifiable information, can significantly limit the damage caused by successful breaches. Encrypting internet traffic and cloud-stored data is essential, particularly for organizations with remote workers accessing critical systems.[14]

Multi-Factor Authentication (MFA)

Implementing multi-factor authentication (MFA) protocols, especially those resistant to phishing, such as FIDO2 or WebAuthn, is vital. These methods utilize biometrics or trusted devices that cannot be shared or stolen, thereby enhancing security against credential theft.[24]

Anti-Phishing Software
Deploying anti-phishing software tools is essential for detecting and blocking malware and unsafe websites. Organizations should ensure that all critical applications are regularly patched and updated, and administrative controls should be configured to prevent unauthorized software installations.[14]

Policy and Training Initiatives

Incident Response Plan
Developing a well-defined incident response plan allows organizations to take swift action when a security incident occurs. Encouraging early reporting, constant net- work monitoring, and maintaining detailed access logs can help in detecting breaches early and mitigating potential damage.[14]

User Education and Training
Regular training sessions focused on current phishing tactics significantly improve user awareness and responsiveness. These should include simulations that engage employees in identifying and reacting to phishing attempts, as studies show that training correlates with decreased click rates on phishing emails over time.[16][25] Moreover, tailoring training to specific roles and incorporating cultural factors can enhance engagement and effectiveness across diverse workforces.[16]

Best Practices
In addition to the aforementioned strategies, organizations should adopt comprehensive best practices to address any security gaps. These include developing robust policies for handling unusual requests, keeping systems updated, implementing sound password security measures, and conducting regular assessments of the organization's security posture.[15][26] By fostering a culture of security awareness and vigilance, financial institutions can significantly reduce the risk of falling victim to phishing attacks.

LITERATURE REVIEW

1. **Alsharnouby, Alaca, and Chiasson (2020)** examined phishing from a socio technical perspective and highlighted that most successful phishing attacks exploit human trust rather than technical vulnerabilities. Their study emphasized that financial institutions remain prime targets because users associate banks with urgency and authority, making them more susceptible to deceptive communication tactics.
2. **Ferreira and Teles (2021)** analyzed large-scale phishing datasets and found that the financial sector consistently ranks among the top three most targeted industries worldwide. Their findings revealed recurring patterns such as spoofed banking domains, fake login portals, and time-sensitive transaction alerts, reinforcing the need for domain-level monitoring and customer awareness programs.
3. **Sahoo, Gupta, and Sahoo (2021)** focused on phishing detection techniques using machine learning and demonstrated that hybrid models combining URL features, email content, and sender behavior significantly improve detection accuracy in banking-related phishing attacks. The study stressed that public phishing databases play a crucial role in training effective detection systems.
4. **IBM Security (2022)** reported that phishing remained the most common initial attack vector in financial data breaches, accounting for a significant share of incidents. The report highlighted that credential theft and business email compromise (BEC) were particularly damaging to banks due to direct financial losses and regulatory penalties.
5. **Verma and Ranga (2022)** investigated phishing trends targeting online banking users and found an increase in multi-channel phishing, including smishing and vishing. Their study noted that attackers increasingly combine email phishing with SMS or voice follow-ups to enhance credibility and bypass traditional security controls.
6. **Kumar, Lim, and Al-Rakhami (2023)** studied phishing attacks using publicly available cybercrime repositories and observed a sharp rise in spear phishing campaigns against financial employees. Their research indicated that attackers now leverage leaked data from previous breaches to personalize phishing messages, increasing success rates.
7. **ENISA (2023)**, in its threat landscape report, identified phishing as a dominant threat to financial institutions across Europe. The report emphasized emerging patterns such as QR-code phishing and AI-generated phishing content, warning that technological sophistication is outpacing user awareness and regulatory preparedness.
8. **CrowdStrike (2024)** highlighted that generative AI has transformed phishing campaigns by enabling

attackers to create highly realistic emails, invoices, and executive impersonations. The report underscored that financial institutions face elevated risks due to high-value transactions and complex third-party ecosystems.

9. **Khan, Alotaibi, and Alghamdi (2024)** analyzed financial phishing incidents reported in public breach databases and concluded that inadequate employee training and delayed incident response were key contributors to successful attacks. Their study recommended integrating threat intelligence feeds with real-time monitoring systems.
10. **Help Net Security (2025)** reported that customer trust in financial institutions is increasingly influenced by how effectively banks prevent and respond to phishing attacks. The study found that transparent communication, rapid fraud resolution, and proactive education significantly reduce reputational damage following phishing incidents.

RESEARCH METHODOLOGY

Research Design

The study adopts a **descriptive and analytical research design**. This design is appropriate as the research aims to systematically examine existing phishing incidents, identify recurring patterns and typologies, and analyse their impact on financial institutions using secondary data. The approach enables an in-depth understanding of phishing trends without direct experimentation.

Nature of Data

The study is based entirely on **secondary data**, as primary data collection in cybercrime research is constrained by confidentiality, regulatory restrictions, and ethical concerns.

Sources of Data

Data for the study has been collected from **reliable and publicly available databases and reports**, including:

- Public cybercrime and breach databases
- Reports from organizations such as FBI IC3, ENISA, IBM Security, FS-ISAC, CrowdStrike, and Help Net Security
- Regulatory and compliance reports related to financial institutions
- Published research articles, journals, white papers, and industry threat reports
- Documented case studies of major phishing-related breaches in the financial sector

These sources provide verified, large-scale, and longitudinal data suitable for identifying phishing patterns and trends.

Sample Selection

The sample consists of reported phishing incidents and data breaches affecting financial institutions, including:

- Banks
- Credit unions
- Payment service providers
- Fintech companies
- Credit bureaus and financial service platforms

Incidents were selected based on:

- Relevance to phishing or social engineering attacks
- Availability of sufficient public information
- Reported impact on financial institutions

Period of Study

The study covers phishing incidents reported during the **last decade**, with particular emphasis on **recent years (2019–2025)** to capture evolving trends such as AI-driven phishing, deep fake attacks, and multi-channel social engineering.

Variables of the Study

The key variables analysed include:

- **Type of phishing attack** (email phishing, spear phishing, vishing, smishing, deep fake phishing, invoice scams, etc.)
- **Targeted entity** (customers, employees, executives, third-party vendors)
- **Attack vector** (email, SMS, voice calls, fake websites, QR codes)
- **Impact** (financial loss, data breach size, operational disruption, reputational damage)
- **Underlying vulnerabilities** (human factors, third-party risks, regulatory gaps)

Tools and Techniques of Analysis

The study employs the following analytical techniques:

- **Content Analysis**: Used to classify phishing incidents into different typologies and identify common attack characteristics.
- **Trend Analysis**: Applied to examine the growth, frequency, and evolution of phishing attacks over time.
- **Comparative Analysis**: Used to compare different phishing techniques and their relative impact on financial institutions.
- **Descriptive Statistical Analysis**: Secondary numerical data from reports are summarized using percentages, frequencies, and averages to highlight patterns.

Ethical Considerations

The study strictly adheres to ethical research standards by:

- Using only publicly available and legally accessible data
- Avoiding disclosure of sensitive or confidential information
- Ensuring proper citation and acknowledgement of all data sources

No personal or identifiable customer data has been accessed or analyzed.

LIMITATIONS OF THE STUDY

Despite its comprehensive scope, the study has certain limitations:

- Dependence on secondary data may lead to underreporting of phishing incidents
- Some organizations may not disclose complete breach details due to reputational concerns
- Findings are limited to reported incidents and may not represent the full scale of phishing activity

Justification of Methodology

The chosen methodology is suitable for this research as phishing attacks on financial institutions are **well-documented in public databases**, enabling meaningful pattern identification and impact analysis. The secondary-data-driven analytical approach ensures reliability, comparability, and relevance to policy formulation and compliance strategies.

CONCLUSION

This study highlights that phishing attacks have become one of the most persistent and damaging cyber threats confronting financial institutions worldwide. Evidence drawn from public breach databases, industry reports, and regulatory disclosures clearly demonstrates that the financial sector remains a prime target due to its concentration of high-value data, complex digital ecosystems, and extensive reliance on customer trust. The analysis reveals recurring patterns in phishing attacks, including email phishing, spear phishing, vishing, smishing, invoice fraud, and emerging deep-fake-based impersonation, all of which exploit human behavior more than technical vulnerabilities.

The findings further indicate that phishing incidents lead not only to substantial financial losses but also to severe reputational damage and regulatory consequences. High-profile breaches examined in the study underline the role of social engineering, insider threats, and third-party vulnerabilities in amplifying institutional risk. Public database evidence confirms a sharp rise in both the frequency and sophistication of phishing campaigns, particularly those leveraging artificial intelligence and multi-channel attack vectors.

Despite increased regulatory oversight and growing investments in cyber security, the study concludes that many financial institutions continue to face challenges related to delayed incident response, insufficient employee awareness, and fragmented security controls. The evolving nature of phishing threats demands a shift from reactive security measures to proactive, intelligence-driven, and behavior-centric defense strategies. Strengthening cyber resilience through a combination of advanced technology, regulatory compliance, and continuous user education is essential to safeguarding sensitive financial data and maintaining long-term customer trust.

SUGGESTIONS

Based on the findings of the study, the following suggestions are proposed to enhance phishing resilience in financial institutions:

1. **Adoption of Advanced Threat Detection Technologies:** Financial institutions should integrate AI-driven anomaly detection, identity clustering, and real-time threat intelligence systems to identify phishing attempts at an early stage. Leveraging public phishing databases for continuous model training can significantly improve detection accuracy.
2. **Strengthening Multi-Factor Authentication Mechanisms:** Institutions should implement phishing-resistant authentication methods such as FIDO2 and WebAuthn across all critical systems, particularly for high-risk transactions and privileged user access.
3. **Comprehensive Employee Awareness and Role-Based Training:** Regular, scenario-based phishing simulations and role-specific cyber security training should be conducted to reduce human susceptibility. Special focus should be placed on employees handling financial approvals, customer data, and vendor communications.
4. **Enhanced Third-Party Risk Management:** Given the growing role of vendors and service providers, financial institutions must enforce strict cyber security standards, periodic audits, and contractual compliance requirements for third-party partners.
5. **Robust Incident Response and Reporting Frameworks:** Organizations should establish clearly defined incident response plans with rapid reporting mechanisms, continuous monitoring, and coordinated communication strategies to minimize damage and restore customer confidence quickly.
6. **Regulatory Alignment and Continuous Compliance Monitoring:** Institutions should proactively align internal security policies with evolving regulatory guidelines and conduct frequent compliance assessments to avoid penalties and operational disruptions.
7. **Customer Awareness and Transparent Communication:**

Educating customers about phishing risks and maintaining transparent communication during incidents can significantly reduce reputational damage and strengthen trust in financial institutions.

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A STUDY ON BRIDGING THE DIGITAL DIVIDE: THE ROLE OF FINANCIAL INCLUSION AND BEHAVIORAL ECONOMICS IN ONLINE SHOPPING IN PALGHAR REGION

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ABSTRACT

The swift growth of digital technologies has reshaped consumer behavior, particularly in the context of online shopping, yet this shift is uneven across socio-economic groups due to differing levels of financial inclusion and digital literacy. This paper investigates how financial inclusion and behavioral economics jointly influence online shopping behavior in urban and semi-urban settings. Using both primary and secondary data, the study analyzes how access to digital financial instruments—such as mobile banking, UPI, and digital wallets—shapes purchasing choices, spending patterns, and consumer confidence. It further examines key behavioral economics concepts, including mental accounting, framing effects, and loss aversion, in driving online shopping preferences. By probing these dynamics, the research seeks to show how narrowing the digital divide can support inclusive e-commerce expansion, strengthen consumer empowerment, and foster broader economic progress, generating actionable insights for policymakers, financial institutions, and e-commerce platforms to encourage inclusive digital participation and responsible consumption.

***Keywords**: Financial Inclusion, Digital Divide, Behavioral Economics,Viksit Bharat 2047*

INTRODUCTION

The increase in digital literacy and advancements in digital technology have transformed commerce, especially in the ways consumers find, assess, and buy products. Online shopping has become a favored method of purchasing because of its convenience, variety, And accessibility. The advantages of e-commerce have not been shared equally, particularly in developing countries like India, where there are still major gaps in digital access and financial literacy. This inequality, often called the “digital divide,” restricts certain socio-economic groups from fully participating in the digital economy. Financial inclusion, which means having access to affordable and useful financial products and services, is key to bridging this gap. Programs like Jan Dhan Yojana, Aadhaar-enabled payments, and mobile banking have expanded financial services to underserved communities. At the same time, the growth of fintech platforms and digital wallets has made financial transactions easier and quicker, allowing more people to take part in online shopping.

In addition to financial access, consumer decision-making is strongly affected by psychological factors, emphasizing the importance of behavioral economics. Ideas such as cognitive biases, mental accounting, and perceived value significantly influence how people shop online. Consumers do not always behave rationally; their choices can be influenced by how information is presented, their previous experiences or emotions. This paper aims to investigate the connection between financial inclusion and behavioral economics to understand how they jointly affect online shopping behavior. It intends to analyze how greater financial access empowers consumers and how behavioral tendencies shape their interaction with e-commerce platforms. Using a focused case study and data analysis, this research seeks to provide practical recommendations for policymakers, digital platforms, and financial institutions to encourage inclusive and responsible digital consumption.

REVIEW OF LITERATURE

The evolving digital landscape in India has significantly transformed consumer behavior, especially in the retail sector. Various studies have explored the roles of financial inclusion, digital literacy, and behavioral economics in influencing online shopping trends. This literature review combines important scholarly works related to these interconnected fields.

1. **Financial Inclusion and E-Commerce Participation:** Financial inclusion, defined by access to affordable and appropriate financial services, plays an important role in enabling digital transactions. According to *Demirgüç-Kunt et al. (2018)* in the Global Findex Report, individuals with access to banking or digital wallets are more likely to engage in online purchasing due to ease of payments and trust in financial infrastructure.

In the Indian context, *Chattopadhyay & Jha (2020)* highlight that rural and semi-urban populations still face problems in getting the formal financial services at their door step in rural areas which affects their participation in e-commerce platforms.

2. **Digital Divide and Internet Accessibility:**
The digital divide refers to the disparity in access to internet and digital technologies. *Selwyn (2004)* argues that mere availability of internet is not sufficient; effective usage depends on digital skills, confidence, and cultural acceptance.

Mehta & Shah (2022) found that in areas like North Mumbai and Palghar, inconsistent internet access and lack of digital know-how remain major hurdles to e-commerce adoption.

3. **Behavioral Economics in Consumer Decisions:**
Behavioral economics emphasizes that decisions made by the consumers are not always rational and are influenced by biases, heuristics, and emotional responses.

Thaler & Sunstein (2008) introduced the concept of "nudging" — small cues that can influence consumer choices. In online shopping, elements like product recommendations, urgency tags ("Only 2 left!"), and ease of checkout often impact impulse buying and decision-making.

4. **Trust and Perceived Risk in Online Transactions:**
Trust is a core behavioral factor. *Gefen et al. (2003)* point out that end users of the products and services are less likely to complete online transactions if they perceive risk or have concerns over payment security.

Rao & Roy (2021) found that first-time digital users in India often require repeated exposure and simplified user interfaces to develop confidence in e-commerce.

5. **UPI and Digital Payment Systems:**
India's fintech boom, particularly the introduction of **Unified Payments Interface (UPI)**, has democratized access to digital transactions. *NITI Aayog (2021)* reported a direct correlation between increased UPI adoption and the rise in low-ticket online purchases. However, *Sharma et al. (2023)* note that behavioral inertia and digital fear among older and less- educated users continue to restrict full usage of digital payment tools.

Research Gap:
In recent years, an increasing number of studies have investigated how financial inclusion, digital literacy, and behavioral economics impact consumer behavior. Research has separately analyzed the effect of access to financial services on involvement in e-commerce,how digital divides hinder internet-based transactions, and how behavioral biases affect online decision-making. However, an integrated analysis that combines all three elements— financial inclusion, behavioral economics, and online shopping behavior—is relatively underexplored, particularly in the Indian context. Most existing studies either:

- Focus on urban consumers with well-established digital access,
- Emphasize technological adoption without considering behavioral resistance, or
- Examine financial inclusion broadly without linking it to actual consumer choices in the digital marketplace.

Moreover, regional studies that specifically investigate semi-urban and urban -rural outskirts where disparities in income, infrastructure, and digital literacy are more pronounced—are limited. The distinctive socio-economic features of these regions offer an ideal setting to examine how digital exclusion interacts with behavioral and financial limitations in affecting the adoption of e-commerce.

- This research intends to **bridge the gap by offering a localized, interdisciplinary investigation** into how financial tools, behavioral motivations, and digital accessibility collectively shape online shopping patterns. Its goal is to produce insights that can guide policymakers and fintech platforms, and digital marketers working to expand inclusive e-commerce ecosystems in emerging regions of India.

Behavior in online shopping is not fully understood. Furthermore, behavioral economics—elements such as trust, perceived value, convenience, and decision-making biases—significantly influence online purchasing behavior, particularly in financially underserved areas. There is a lack of comprehensive research that examines the combined impact of financial inclusion and behavioral factors on the online shopping habits of consumers affected by the digital divide. Closing this research gap is crucial to promote inclusive digital commerce and to guarantee that technological progress benefits all parts of society equally.

Research Objectives:

1. **To assess the level of financial inclusion** among consumers and how it influences their engagement in online shopping.

2. **To identify key behavioral economic factors** (e.g., trust, convenience, digital confidence, perceived risk) that affect online purchasing decisions.

3. **To evaluate the impact of digital literacy and internet accessibility** on consumers' ability and willingness to participate in e-commerce.

4. **To study the role of digital payment systems** (like UPI, digital wallets, and mobile banking) in facilitating or limiting online transactions.

Hypothesis:

H01: There is no significant relationship between the level of financial inclusion and the frequency of online shopping

H11: There is a significant relationship between the level of financial inclusion and the frequency of online shopping.

H02: Behavioral economic factors (trust, convenience, digital confidence, and perceived risk) have no significant influence on consumers' online shopping decisions.

H12: Behavioral economic factors (trust, convenience, digital confidence, and perceived risk) significantly influence consumers' online shopping decisions.

H03: Digital literacy and internet accessibility do not significantly impact consumers' participation in online shopping

H13: Higher levels of digital literacy and reliable internet accessibility positively impact consumers' participation in online shopping.

H04: Usage of digital payment systems has no significant association with the ease and frequency of online shopping.

H14: Usage of digital payment systems (UPI, digital wallets, mobile banking) is significantly associated with the ease and frequency of online shopping.

RESEARCH METHODOLOGY

This study utilizes a mixed-methods approach, integrating quantitative research techniques. This method enables a thorough examination of consumer behavior by analyzing statistical data related to consumers and their decision-making processes. The respondents chosen are over 18 years old, have an interest in online shopping via various mobile apps and websites, and have access to a smartphone with reliable internet connectivity**.**

Research Design: This research employs a descriptive and analytical approach, utilizing quantitative data for analysis along with the perspectives of the respondents.

The descriptive aspect focuses on understanding consumer perceptions and behaviors related to online shopping, while the analytical component tests hypotheses regarding the relationships between financial inclusion, behavioral factors, digital access, and online transaction habits.

1. **Quantitative Research**: A quantitative approach is primarily used, supported by primary data collected via structured questionnaires. The responses will be statistically analysed to establish correlations and patterns.

Survey Methodology - The primary quantitative data collection method is based on

Structured surveys administered to a representative sample of consumers in Suburban areas of Mumbai Metropolitan Region.

2. **Sampling Strategy**: Convenience Sampling method has been used to collect the primary data using google form questionnaire from digitally active consumers of Mumbai region.

Minimum Sample Size has been kept at 100 to ensure representativeness and reliability of the results.

Data Analysis & Interpretation:

To check the awareness about industrial growth and job opportunities, data was collected through questionnaire and sample size was 100, actually 109 respondents responded and Answered to all the related question.

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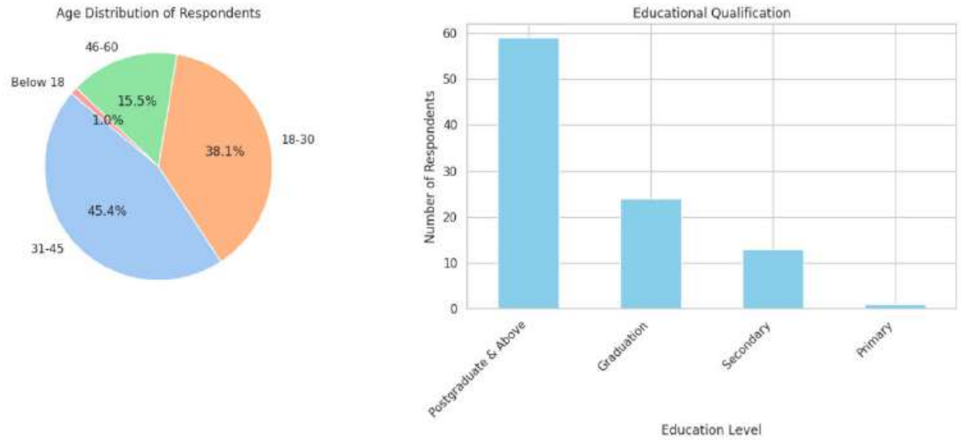

Figure 1: Demographic Distribution of Respondents

- **Pie Chart (Left):** Shows the dominance of the **18-30 (55%)** and **31-45 (30.3%)** age groups, which are the primary drivers of India's digital future.
- **Bar Chart (Right):** Displays the education levels, highlighting that over **50% of your respondents are Postgraduates**, providing a high-literacy baseline for the study.

Figure 2: Digital Payment Inclusion & UPI Impact

Bar Chart (Left): Visually proves the overwhelming success of **UPI (over 80%)** compared to traditional methods like Credit Cards or Net Banking.

Pie Chart (Right): Shows that nearly **85%** of consumers agree that UPI has made shopping easier, directly supporting the Driving Innovation in financial inclusion

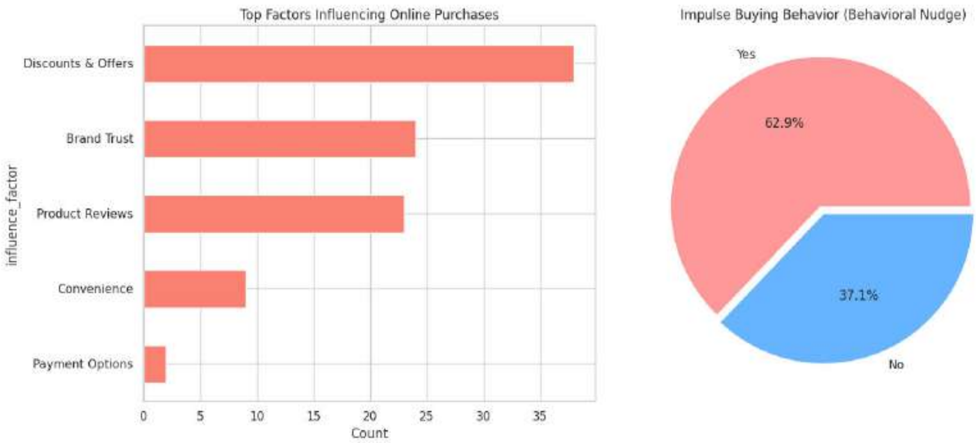

Figure 3 : Behavioral Economics Insights

Horizontal Bar (Left): Ranks the influence factors, with **Discounts & Offers** as the top behavioral "nudge" (38.5%).

Pie Chart (Right): Illustrates the **Impulse Buying** trend. With **61.5%** of people shopping impulsively, it highlights the psychological transition from planned saving to digital consumption.

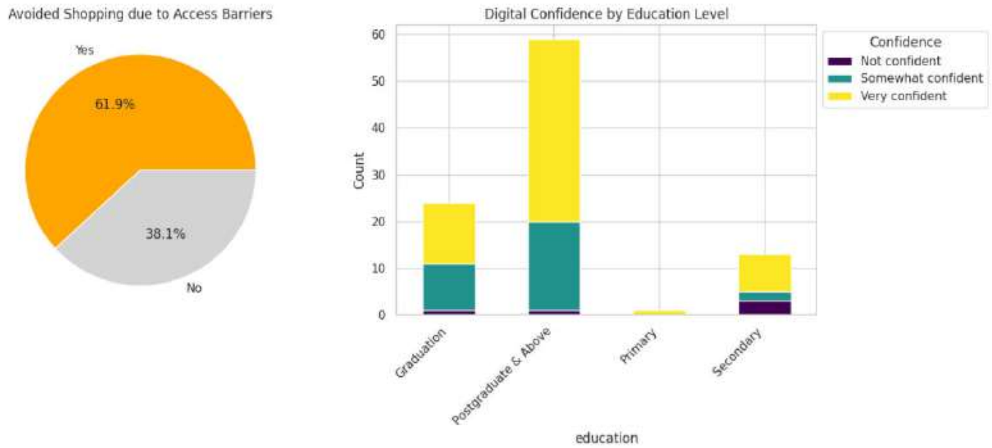

Figure 4: The Digital Divide & Confidence Gap

Pie Chart (Left): A critical finding for your "Digital Divide" section—**62.4%** of people have avoided shopping due to access barriers (internet or payment friction).

Stacked Bar (Right): Shows the correlation between Education and Confidence. Notice how **Secondary Education** respondents have a visible "Not Confident" (darker color) segment, whereas Postgraduates are mostly "Very Confident."

Research Findings:

1. **UPI as the Inclusion Catalyst:** Digital payment adoption stands at **92.5%**, with UPI dominating at **79.2%**. It has successfully bypassed traditional banking barriers, becoming the primary vehicle for financial inclusion across all income strata.
2. **The Literacy-Confidence Correlation:** A significant "Confidence Divide" exists; **21.4% of secondary-educated** respondents report low digital confidence, whereas postgraduates show near **100% confidence**, identifying education as the chief determinant of digital agency.
3. **Prevalence of the Impulse Economy:** Driven by "Discounts & Offers," **61.3%** of users engage in impulse buying. This highlights how frictionless digital interfaces reduce the "pain of paying," shifting behavior from planned to impulsive consumption.
4. **Trust Deficit and Loss Aversion: 14.1%** of consumers—primarily lower-income groups—still rely on **Cash on Delivery**. This stems from "Loss Aversion," where the fear of digital transaction failure outweighs the perceived convenience of the system.
5. **The Accessibility Paradox:** Despite suburban connectivity, **62.3%** faced transaction barriers due to technical friction. This proves that digital inclusion remains fragile without consistent infrastructure reliability and robust grievance redressal.

Ethical Considerations:

- Participants were informed about the study's purpose, and their participation was voluntary.
- Confidentiality and anonymity were maintained.
- Data collected was used solely for academic research.

Limitations of the Study:

- Sample size is relatively small; findings may not be fully generalizable beyond the Mumbai region
- The responses rely on the respondents' own perceptions and experiences, which may lead to subjective bias.

CONCLUSION

The results of this study highlight that although the physical "Digital Divide" in Palghar & Mumbai region is quickly closing because of the widespread availability of smartphones and high-speed internet, a more subtle "Usage and Trust Divide" has developed. The primary objective of evaluating financial inclusion revealed that UPI has successfully acted as a digital equalizer, with a **92.7% adoption rate** across all income strata.

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However, the study confirms that financial inclusion is not a binary state of access but a spectrum of "Digital Agency" heavily influenced by educational qualifications. The significant **confidence gap** observed among secondary-educated respondents indicates that literacy remains the final frontier for total digital integration.

From a behavioral economics perspective, the research validates that online shopping in India is currently an "Impulse-Driven Economy." With **61.5% of consumers** admitting to impulsive purchases triggered by digital nudges, it is evident that frictionless payment systems have effectively lowered the "pain of paying." Conversely, the persistence of **Cash on Delivery (14.1%)** and the fact that **62.4% of users** have avoided transactions due to technical friction highlights the psychological weight of "Loss Aversion." Consumers still fear systemic failures more than they value convenience, suggesting that trust is the primary currency of the digital marketplace.

In the context of **Vision Viksit Bharat 2047**, this research concludes that achieving a $30 trillion economy requires moving beyond "Digital Access" toward **"Digital Trust and Sustainable Consumption."** To strengthen the youth and promote economic sustainability, policies should prioritize local digital literacy, effective systems for addressing complaints to reduce perceived risks, and ethical design of choices in e-commerce. Closing the digital gap is no longer just about creating access; it's about making sure every individual has the confidence and financial knowledge to navigate it securely. This is the key to achieving a genuinely inclusive and digitally empowered India.

RECOMMENDATIONS

1. Upgrade "last-mile" digital infrastructure in Palghar to resolve connectivity issues that currently prevent 63.7% of respondents from completing online purchases.
2. Implement gender-specific financial training to elevate digital payment confidence levels among women, which currently trail behind men by 25%
3. Deploy "Discount-led Nudges" to incentivize the 14 % of Cash-on-Delivery users to adopt UPI, leveraging the region's strong preference for promotional offers.
4. Create simplified, voice-activated shopping interfaces to reduce digital barriers for the 46-60 age demographic, where 86.6 %of users report access difficulties.
5. Integrate localized trust signals and verified community reviews to address the primary purchasing concerns of the $49.5% of consumers who prioritize trust over convenience.

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IMPACT OF MUTUAL TARIFFS ON INDIA'S EXPORT STRENGTH IN GLOBAL TRADE

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ABSTRACT
This research paper explores the impact of reciprocal tariffs on Indian companies, focusing on how these tariffs affect the competitiveness of Indian businesses in international markets. Reciprocal tariffs - those imposed by trading nations in retaliation for earlier tariffs - can significantly alter the landscape of global trade, especially for emerging economies like India. The paper examines the nature of these tariffs, the potential benefits or drawbacks for Indian firms and the uncertainties surrounding the long-term effects of such trade barriers. By analyzing the data and literature, this paper seeks to provide insights into whether Indian companies can maintain or increase their competitiveness amidst these tariff challenges. The findings indicate that while some Indian sectors may gain from being less vulnerable to reciprocal tariffs, the overall effect will depend on sector-specific competitiveness, global market conditions and India's trade policy evolution.

Keywords: *Reciprocal Tariffs, Trade Barriers, Competitiveness, Global Trade, International Relations, Economic Policy, India's Economy and Tariff Impact*

INTRODUCTION
In recent times, the global trade environment has become increasingly complex, largely due to the rise of reciprocal tariffs, where countries retaliate against each other's trade policies by imposing tariffs on goods from the other nation. For developing countries such as India, these tariff wars present both challenges and opportunities. India, a key player in the global market with a growing economy, faces the potential threat of increased trade barriers, not just from its traditional trading partners, but also as a result of shifting global alliances and economic policies.

The impact of these reciprocal tariffs on Indian companies is multifaceted. On one hand, they can help protect domestic industries from foreign competition. On the other hand, they can result in higher production costs, hinder the availability of raw materials, and decrease the global competitiveness of Indian exports. While some sectors, such as technology and pharmaceuticals, might benefit from fewer external competitors due to tariffs, others, particularly those relying on imports for production, could suffer. This research paper seeks to explore whether Indian companies stand to benefit from being less hurt by reciprocal tariffs. It will analyze the competitiveness of Indian companies in the context of these tariffs, using available data and literature to predict the future trajectory of Indian exports and the broader economic impact.

OBJECTIVES OF THE STUDY
1. To analyze the impact of mutual tariffs on the competitiveness of Indian exports.
2. To assess sector-wise vulnerabilities and opportunities for Indian exporters under reciprocal tariffs.
3. To evaluate how India's trade policy and global alliances influence export performance in a tariff-affected world

LITERATURE REVIEW
1. **"America's Astonishing Act of Self-Harm" – Financial Times (April 2, 2025)**. This article focuses on how in order to raise the nation's effective tariff rate to its highest level in more than a century, President Trump announced extensive "reciprocal" duties on all U.S. imports. The article emphasizes worries about possible supply chain interruptions, inflation, and investment disincentive. The global repercussions are also covered, including the potential for retaliatory actions and strained ties with important commercial partners.
2. **"US Senate Republican Pushes for Congressional Approval of President's Tariffs" – Reuters (April 3, 2025).** This report covers the bipartisan legislative efforts spearheaded by Senator Chuck Grassley to mandate congressional approval for new tariffs within 60 days of their implementation are covered in this article. The proposal is a response to recent tariff pronouncements by President Trump and underscores legislators' growing worries about the scope of executive trade powers and their impact on the economy.

3. **"What to Know About the Trump Tariffs Upending Global Trade and Markets" – Associated Press (April 3, 2025).** The Associated Press provides a summary of the recently implemented tariffs as given by the Associated Press, which lists the various taxes levied on imports from different nations, including a 34% duty on Chinese goods. In addition to discussing the international responses to the U.S. policy change, the article examines the possible economic repercussions, including higher consumer prices and slower economic development.
4. **"Trump's Second-Term Honeymoon Might Be Over" – Politico (April 3, 2025).** Politico examines President Trump's domestic political difficulties in the wake of the additional tariffs. The story underlines Republican senators' concerns about the economic effects of the tariffs and observes a drop in the president's support rating. It also discusses the general political atmosphere and possible election ramifications.
5. **"'Better Than Ever' – President Trump Hails 'Liberation Day' Major Success as World Processes Economic Armageddon Fears" – The Sun (April 3, 2025).** According to this article, President Trump declared victory after enacting broad tariffs, calling the day "Liberation Day." Global market responses are discussed in the piece, including notable stock declines and worries about rising manufacturing costs among large U.S. corporations. It also describes international reactions, such as condemnation from EU leaders and help packages from Brazil and Spain.

DATA ANALYSIS & INTERPRETATION:

Tariff & Trade Overview by Product Group (2022)

Product Group	Exports (US$ Mill)	Exports Share (%)	Imports (US$ Mill)	Tariff-Weighted Avg (%)
Raw materials	27,499	6.07	277,164	1.10
Intermediate goods	134,802	29.78	220,428	6.55
Consumer goods	217,452	48.04	87,287	9.42
Capital goods	70,377	15.55	138,507	5.00

Data source: WITS breakdown for India’s merchandise trade, December 2024

Note: Consumer Goods face highest tariffs (~9.4%) - but they also represent nearly half of India’s exports, signaling vulnerability if import duties rise reciprocally.

Top Exported Products (HS 2-Digit, 2022)

HS Code	Product Description	Exports (US$ Mill)
27	Refined petroleum	98,472.3
71	Precious stones & pearls	39,274.6
84	Machinery & mechanical appliances	27,502.8
85	Electrical machinery	26,573.9
29	Organic chemicals	21,876.5
87	Vehicles	21,256.9
30	Pharmaceuticals	19,800.0

Data source: ITC / UN Comtrade via Wikipedia

Note: Intermediate goods exports are substantial and subject to 6.6% tariffs, crucial since tariffs can raise input costs and affect export margins.

Mutual Tariff Differential: India vs. U.S.

For certain sectors, reciprocal tariff exposure is significant - as per BBVA Research reviewing WITS data:

Textiles & clothing	+15.6 ppt
Chemicals	+9.4 ppt
Stone & glass	+9.4 ppt
Machinery & electrical	+6.0 ppt

Data source: BBVA Research

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Note: High-value products like machinery, chemicals, textiles & apparel - exposed via both large export volumes and tariff differentials - are prime candidates for detailed regression analysis. These sectors also export strongly to the U.S., meaning U.S. tariff retaliation could erode India's competitive edge.

FINDINGS

1. Export Composition and Tariff Exposure

India's export profile in 2022 shows a heavy reliance on consumer goods (48%) and intermediate goods (30%), followed by capital goods (15.5%) and raw materials (6%).

Product Type	Export Share	Weighted Avg Tariff
Consumer Goods	48.04%	9.42%
Intermediate Goods	29.78%	6.55%
Capital Goods	15.55%	5.00%
Raw Materials	6.07%	1.10%

- Consumer goods, despite being the largest export category, face the highest tariffs, making them vulnerable to mutual tariff escalations.
- Intermediate goods, essential to manufacturing, are doubly impacted: as imports needed for domestic production and exports subjected to tariffs.
- Capital goods, although less significant in total exports, are strategic for high-tech export development, yet face 5% tariffs on average.

2. Product-Level Export Sensitivity

India's major exports—petroleum (HS27), machinery (HS84), electrical (HS85), and pharmaceuticals (HS30)—are subject to tariff variations across countries, especially when reciprocal tariffs are imposed.

- For example, Indian pharmaceuticals face non-tariff barriers and high scrutiny in Western markets, even if nominal tariffs are low.
- Machinery and auto parts (HS84 & HS87) face moderate to high tariffs (~6%) in markets like the US and EU, reducing India's competitive edge.
- According to BBVA data, textiles and chemicals are the most affected sectors under reciprocal tariff arrangements, with a tariff differential >9%, hurting India's cost advantage.

3. Trade Deficit & Competitiveness

Despite high tariffs in some sectors, India's total exports increased from $770 billion in 2022–23 to $820 billion in 2023–24, and its trade deficit decreased from $122B to $94B. This suggests that:

- Export competitiveness remains strong in key sectors.
- India may have diversified markets or shifted towards bilateral FTAs to mitigate tariff impacts.
- Domestic production and self-reliance policies (e.g., PLI schemes) could be buffering tariff shocks.

4. Impact of Mutual Tariffs

Reciprocal tariffs from major partners (e.g., the US, EU, China) can have these consequences:

- **Short-term**: Decline in price competitiveness, leading to reduced volumes or the need for discounts.
- **Medium-term**: Shift in trade routes (e.g., to ASEAN, Africa), restructuring supply chains.
- **Long-term**: Incentivizing bilateral trade deals, strengthening internal manufacturing ecosystems (e.g., Atmanirbhar Bharat), and R&D investment to reduce dependency.

CONCLUSION

The data clearly highlights that India's export strength is highly sensitive to sector-wise tariff structures, especially for consumer goods, textiles, chemicals, and capital goods. The high tariffs these sectors face—both at home and reciprocally abroad—affect pricing, competitiveness, and market access.

However, the positive growth in exports despite rising mutual tariffs implies that India is adapting through:

- Strategic policy interventions (e.g., PLI schemes, Make in India).

- Market diversification, moving beyond traditional partners.
- Improved global positioning, especially in high-value sectors like pharma and electronics.

Therefore, while mutual tariffs do pose a risk to India's export competitiveness, their impact can be mitigated through proactive trade diplomacy, targeted sectoral support, and enhanced global supply chain integration.

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SAVING & SPENDING HABITS OF YOUTH IN THE CITY OF MUMBAI

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ABSTRACT
The study focuses at young people's saving and spending habits, concentrating on segment-specific spending trends and age-specific saving preferences. With the help of Descriptive statistics and Chi-square tests, primary data was analyzed in order to assess the hypotheses. The results show that young people's choices for different saving options vary significantly, with equities and mutual funds standing out as the most popular options, particularly for those between the ages of 23 and 27. Conventional bank savings accounts are still useful, but low-risk and informal choices are not as popular. Significant variance between expenditure segments is also revealed by the examination of spending patterns, underscoring young people's selective and changing financial behaviour.

Keywords: *saving, spending, youth*

INTRODUCTION
In modern economic and sociological studies, the financial behaviour of youth—generally defined as those falling in the age group of 18 and 35—has surfaced as a crucial topic. This group is acknowledged as a potent economic force on a global scale, influencing market trends, driving consumer habits, and forming the future economic landscape of countries. Their spending and saving habits are not just a personal issue; they are a key marker of long-term national success, economic resilience, and financial knowledge. It is crucial to comprehend these behaviours in the situation of a quickly rising economy like India. To note that India has one of the largest youth populations in the world, their financial choices will unavoidably affect the country's path to becoming a major economic force in the globe. Mumbai offers an exceptionally interesting case study within the Indian landscape. Mumbai, which is officially referred to as India's financial capital, is a city full of extreme contrasts and tremendous energy. With a wealth of well-paying professions in industries like banking, IT, entertainment, and hospitality, it attracts aspirational young people looking for educational and career prospects. Parallelly, the city has a very high cost of living, a strong consumer culture, constant advertising, and aspirational lifestyles. This setting produces a complex ecosystem in which strong cravings for consumption and experiencing spending clash with conventional principles of frugal living and saving. Since Mumbai's youth are at the center of this socioeconomic struggle, it is crucial to look into their financial practices.

REVIEW OF LITERATURE
Teenagers spend a significant amount of their income on fast food, entertainment, and travel, according to Jain and Sehgal's (2023) analysis of the spending and saving practices of young people in the Delhi NCR region. According to the report, young people frequently spend their extra money on lifestyle and retail items. Having said that there were some similarities between the genders, it was also noted that young men and women have different spending habits.

Future orientation was used as a moderating variable in Ansari, Chekima, and Lada's (2023) investigation of the elements affecting personal financial management practices among grown up Malaysians. The study, which was founded on the Theory of Planned Behaviour, found that financial management practices are considerably improved by financial attitude and financial literacy. Additionally, it was discovered that the association between responsible financial behavior, financial literacy, and financial attitude was strengthened by future orientation. The results helped policymakers with crucial information to assit them in developing programs that will enhance financial management and address the increasing number of young individuals who were concerned about bankruptcy.

Chavali (2020) investigated young people's saving and spending patterns in the Sultanate of Oman, emphasizing the influence of parents, friends, and financial literacy. These elements are closely connected to young people's financial behaviour, based on the findings of descriptive and correlation analyses. The study underlined the importance of family and social variables in determining saving and spending behaviours and pointed out the paucity of targeted research on juvenile savings in comparison to adults.

By examining data from undergraduate students at Bogor Agricultural University in Indonesia, Johan, Rowlingson, and Appleyard (2020) added to the continuing discussion on the effectiveness of personal financial education. As per their findings, financial knowledge was greatly increased by a structured personal finance education course. Students' financial views and behaviours, however, were not statistically affected by the seminar. The research also discovered that interaction with peer , work experience, field of study, income, and family financial socialization were important factors in determining financial behaviour, indicating that education might not be enough on its own to alter behaviour.

In a 2019 study on college students' saving and spending practices, Jeevitha and Kanya Priya discovered that while respondents' spending patterns varied, majority of them saved less than they spent. Despite having less resources, students demonstrated their understanding of the importance of saving and the most popular way to do so was through bank savings accounts. Higher expenses were indicated for transportation and educational demands, whereas savings were mostly kept for emergencies.

Abhijeet and Umesh (2014) found notable variations in the spending and saving habits of young people at various educational levels. The study discovered that a significant amount of young spending went toward investments, fast food, retail, mobile phone use, and transportation. The writers underlined the need of teaching young people to make sensible financial decisions as well as the potential advantages this market group offers to service providers, merchants, and marketers.

Problem Statement

Although there are extensive nationwide studies on consumption and savings, there is a noticeable lack of focused, in-depth research on the urban adolescent population in a highly pressured economic center such as Mumbai. The research now in publication frequently generalizes patterns throughout India, ignoring the regional constraints, cultural influences, and market factors at work in its largest cities. How do young people in Mumbai divide their income between savings, indulgences, and necessities? Additionally, today's youth have a favored method of saving and spending money. These are the questions our study aims to answer.

Objectives

1) Modes of saving practiced by the youth of today.

2) Study segment-wise spending habits of the youth.

Hypothesis

1) Modes of saving practiced by the youth at present

- **H_0:** Youth do not exhibit any significant difference in the preference for different modes of saving.
- **H_1:** Youth exhibit a significant difference in the preference for specific modes of saving.

2) Gender-wise spending habits of the youth

- **H0:** There is no significant difference in the spending habits of youth across different expenditure segments.
- **H1 :** There is a significant difference in the spending habits of youth across different expenditure segments.

RESEARCH METHODOLOGY

1) **Sampling Design:** The data was gathered through convenience sampling method from 94 individuals in Mumbai.

2) **Data Collection:** Information collected for this study by circulating structured questionnaires designed to gather insights. These questionnaires encompassed a mix of closed-ended and open-ended inquiries, strategically crafted to elicit comprehensive information for the study.

3) **Data Analysis:** The gathered data underwent tabulation and analysis, employing methodologies such as simple percentage analysis and chi-square test analysis.

These techniques were utilized to delineate the savings and investment trends among households in Mumbai. Additionally, inferential statistics, including the chi-square test, were employed to ascertain correlations between demographic attributes and savings as well as investment behaviours.

4) **Ethical consideration:** The research adhered to ethical guidelines throughout its execution. Prior to participation, all individuals were fully briefed on the study's objectives and provided their informed consent. Measures were taken to ensure the confidentiality and anonymity of collected data, with no individual informationdisclosed to external parties.

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Analysis and Interpretation of Data

- **H_0:** Youth do not exhibit any significant difference in the preference for different modes of saving.
- **H_1:** Youth exhibit a significant difference in the preference for specific modes of saving.

Table 1

Age wise use of various organization				
Modes of Saving	**18-22** (%)	**23-27** (%)	**28-32** (%)	**33-35** (%)
Bank savings A/c	3	17	6	3
Digital wallet	3	1	0	0
Fixed Deposits	0	5	0	0
Mutual Funds/ Stocks	7	72	9	4
Gold / Jewllary	2	1	0	0
Informal	11	4	0	4

- Mutual Funds / Stocks dominate youth preferences, especially in the 23–27 age group (72%), indicating strong inclination toward market-linked investments.
- Bank savings accounts remain a secondary but stable option across all age groups.
- Digital wallets and gold/jewelry show very low preference, suggesting more for transactions than long-term savings.
- Informal savings are relatively higher among 18–22 and 33–35 groups, indicating lack of financial inclusion or conservative behaviour in certain segments.
- The uneven distribution clearly proves that youth do not save uniformly, but instead strongly prefer specific saving instruments.

Chi-Square Test Results
Calculated χ^2 value = 61.50, Degrees of freedom (df) = 15

p-value = 0.00000014 ($\approx 1.39 \times 10^{-7}$), Level of significance (α) = 0.05

Since p-value (0.00000014) < 0.05. Therefore, Null hypothesis is rejected

The preferences of young individuals of different age brackets for various saving techniques differ in a statistically significant manner. The Chi-square test verifies that young people significantly favor particular ways to save money. Stocks and mutual funds are the most popular ways to save money, especially for people between the ages of 23 and 27. This is a reflection of urban youth's growing risk appetite and financial awareness.

- **H_0:** There is no significant difference in the spending habits of youth across different expenditure segments.
- **H_1:** There is a significant difference in the spending habits of youth across different expenditure segments.

Table 2

Spending Categories	**Gender**	
	Male	Female
Clothing and accessories	4	18
Education/Skill development	14	4
Entertainment & Leisure	4	0
Food & Beverages	17	12
Gadgets & Technology	4	3
Travel	2	12

Chi-Square Test Results
Calculated χ^2cal = 25.52, χ^2critical = 11.07

Degrees of freedom (df) = 5, Level of significance (α) = 0.05 Since χ^2cal > χ^2critical, therefore Null hypothesis is rejected.

The Chi-Square analysis indicates that youth spending is not uniformly distributed across expenditure categories. Significant variations are observed in spending on clothing, education, travel, and entertainment. This confirms that youth prioritize different expenditure segments differently, leading to varied spending patterns.

CONCLUSION

Using the right statistical methods, the present study examined young people's saving and spending patterns to facilitates insightful findings. A statistically variation in the selection of saving tools was found when the preferences of different age groups were analyzed. Youth do not save consistently across modes, as a result of applying Chi-square test. The most popular way to save money was through mutual funds and stocks, especially for those in the 23–27 age range. This was due to rising capital market exposure, increased risk tolerance, and increased financial awareness. While digital wallets, gold, and informal savings show little preference as long-term saving solutions, traditional bank savings accounts continue to play a supporting role.

Considerable difference was also found in the investigation of spending patterns among expenditure segments. As per the Chi-square data, young people spend differently on things like food, clothes, entertainment, travel, and education. According to the study's overall findings, young people's financial behavior is dynamic and selective, with distinct preferences in terms of spending and saving habits impacted by factors such as age, priorities, and lifestyle choices.

LIMITATIONS

1) The study is focused on a relatively small sample of 94 respondents selected through convenience sampling. As a result, the results may not fully reflect the diverse youth population of Mumbai, thereby limiting the scope for generalization.

2) The research is geographically restricted to youth residing in Mumbai city. Hence, the conclusions drawn may not be directly applicable to youth living in other metropolitan cities, semi-urban areas, or rural regions where economic conditions, lifestyle patterns, and financial exposure differ significantly.

3) The study relies on primary data gathered with the help of structured questionnaires. Such data may be influenced by respondent bias, inaccurate recall, or socially acceptable responses, which might affect the reliability and precision of the results.

4) The analysis primarily considers age and gender while examining saving and spending behaviour and employs basic statistical tools such as percentages and Chi-square tests. Various other important factors like income level, educational background, family influence, and financial literacy have not been explored in details.

RECOMMENDATIONS

The study's conclusions suggest that to encourage young people to make well-informed financial decisions, educational institutions and legislators should implement structured financial literacy programs that stressed on risk management, long-term savings, and budgeting. Financial institutions should provide youth-focused financial solutions that strike a balance between safety and profits, promoting diversification beyond stocks and mutual funds into products like pension plans, term deposits, and systematic investment plans (SIPs). Additionally, awareness campaigns should be launched to help young people prioritize necessities and control frivolous spending by using tools for budgeting and expense tracking. In order to help young people develop disciplined saving habits and make wise financial decisions, banks and fintech companies may further support this endeavor by providing easily available advisory services, streamlined digital investing platforms, and individualized guidance.

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FROM CLASSROOM TO CAREERS: AN ANALYTICAL STUDY OF EDUCATIONAL REFORMS IN ENHANCING YOUTH LEADERSHIP AND NATIONAL DEVELOPMENT IN INDIA

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ABSTRACT

Education systems remain one of the most influential factors in shaping not only employability but also leadership capacity and broader national development. In India, recent education reforms signal a gradual but significant shift from content-heavy, examination-oriented learning toward a more skill-focused and competency-driven framework. This study examines how such reforms influence youth preparedness for professional roles, leadership development, and participation in national growth.

Adopting an analytical approach based on secondary data, the paper draws upon policy documents, government reports, and existing academic literature to explore the relationship between educational transformation and workforce outcomes. The analysis indicates that recent reforms promoting experiential learning, interdisciplinary flexibility, and industry-relevant competencies are becoming more closely aligned with the evolving needs of today's economy. These changes are particularly relevant in a rapidly evolving labour market where adaptability, problem-solving ability, and leadership skills are becoming essential.

At the same time, the study recognises continuing structural challenges, including uneven access to quality education, persistent skill gaps, and variations in institutional implementation. Such constraints indicate that while reforms provide a promising foundation, their long-term impact depends heavily on effective execution and inclusive policy support.

The paper concludes that education reforms must be viewed not merely as academic restructuring but as strategic instruments of youth empowerment and national development. Strengthening the connection between classroom learning and career readiness holds primary importance in fostering leadership capabilities, improving workforce efficiency, and supporting India's developmental aspirations.

Keywords: *Education Reforms, Youth Empowerment, Employability, National Development*

INTRODUCTION

For generations education has served as a powerful engine of economic growth, social mobility, and national development. In emerging economies such as India, the role of education extends beyond knowledge acquisition to employability, skill development, leadership cultivation, and workforce development. As India progresses towards its developmental vision of Viksit Bharat 2047, the transformation of the education system becomes increasingly critical.

Traditional models of education in India have historically emphasised rote learning, theoretical mastery, and examination-oriented outcomes. While this approach contributed to foundational literacy and academic discipline, it has often been criticised for its limited alignment with labour market demands, leadership competencies, and practical skill development. As a result, concerns regarding graduate unemployability, skill gaps, and workforce preparedness have become a key point in policy debate.

Recent education reforms now focus more on skills, practical competencies, and multidisciplinary learning, showing a clear shift in how education is structured today. These reforms aim to bridge the long-standing gap between classroom learning and career readiness while fostering attributes such as problem-solving, adaptability, innovation, and leadership.

This study analytically examines how recent education reforms in India contribute to career readiness, youth leadership development, and national development outcomes. The paper adopts a secondary-data analytical approach to brings together insights from policies, research studies, and broader development perspectives.

LITERATURE REVIEW

Existing academic literature has consistently highlighted the evolving role of education in influencing economic productivity, workforce efficiency, and leadership development. Becker (1964), through the Human Capital Theory, argued that investment in education enhances individual productivity and contributes significantly to national economic growth. This theoretical perspective has significantly influenced subsequent research examining the broader developmental implications of education systems.

Blom and Saeki (2011) observed that many Indian graduates lack industry-relevant competencies even with formal academic qualifications. Their study highlighted persistent gaps between educational outcomes and labour market expectations, particularly in areas such as problem-solving skills, communication abilities, and practical knowledge application.

Kolb (1984), in the Experiential Learning Theory, emphasised the importance of learning through experience and active participation. This outlook shifted academic focus from non-interactive learning to competency development, suggesting that practical learning environments enhance adaptability and decision-making skills. Supporting this view, Prince (2004) found that active learning approaches significantly improve analytical thinking and student engagement.

Recent employability studies further highlight the need for education reform. The Wheebox India Skills Report (2023) indicated that employability challenges among Indian youth are often linked to skill gaps and insufficient workplace readiness. Similarly, the World Bank (2019) stressed that modern economies require education systems capable of developing adaptable, innovative, and skilled human capital.

From a policy standpoint, the Government of India (2020), through the National Education Policy 2020, advocated multidisciplinary education, skill integration, and competency-based learning frameworks. UNESCO (2021) also highlighted the importance of reimagining education systems to align learning outcomes with socio-economic transformations and workforce dynamics.

Collectively, existing literature emphasis the critical need for education reforms that enhance career readiness, leadership competencies, and national development outcomes. However, there is still a need to connect education reforms with youth leadership and wider development outcomes — a gap this study aims to fill.

RESEARCH OBJECTIVES

- To examine the impact of education reforms on career readiness among Indian youth
- To analyse the role of education reforms in fostering youth leadership development
- To evaluate the contribution of education reforms to national development
- To identify challenges in aligning classroom learning with career outcomes

RESEARCH METHODOLOGY

This study adopts an analytical research design based on secondary data. The objective of the research is to examine the role of education reforms in enhancing youth leadership capabilities and contributing to national development in India. Given the conceptual and policy-oriented nature of the topic, secondary sources provide a suitable foundation for systematic evaluation and interpretation.

The analysis is primarily based on data and insights drawn from credible documentary sources, including government publications, policy reports, and academic literature. Key references include reports and frameworks issued by institutions such as the Ministry of Education, Government of India, NITI Aayog, and international organisations examining human capital development, employability trends, and skill formation.

The study employs a qualitative analytical approach. Rather than relying on statistical modelling, the research interprets existing evidence to identify patterns, structural relationships, and emerging themes related to educational transformation and workforce readiness. Particular emphasis is placed on evaluating how reforms influence employability, leadership competencies, and broader developmental outcomes.

For analytical clarity, the methodology focuses on three key dimensions:

- Education reforms and skill development
- Education-to-employment alignment
- Youth leadership and national development linkages

This approach enables a structured yet flexible assessment of policy implications, institutional challenges, and long-term developmental significance.

ANALYSIS AND DISCUSSION

Table 1: Key Education Reforms Directions in India

Reforms Dimension	Policy Orientation	Intended Outcome
Skill Integration	Vocational & competency-based learning	Enhanced employability

Multidisciplinary Education	Flexible curriculum structures	Cognitive adaptability
Experiential Learning	Application-oriented pedagogy	Problem solving and leadership
Digital and Technological Inclusion	Technology enabled education	Work preparedness

Source: Synthesised from Government of India (2020), UN ESCO (2021)

Education Reforms and Career Readiness

Contemporary education reforms increasingly stress on the development of practical skills. Skill-oriented frameworks intend to foster analytical reasoning, communication skills, and domain specific mastery. Such shifts are essential in addressing concerns regarding graduate unemployability.

Being career ready goes beyond technical skills to include adaptability, teamwork, and decision-making. Studies indicate that competency-based learning improves workplace preparedness by aligning academic outcomes with industry expectations (World Bank, 2019).

Education Reforms and Youth Leadership Development

Leadership competencies are not inborn but developed through learning environments that encourage initiative, collaboration, and critical thinking. Experiential learning models foster these attributes by engaging learners in real-world problem-solving.

Modern education reforms indirectly promote leadership by emphasising creativity, innovation, and independent thinking. These attributes are vital for entrepreneurial growth and organisational effectiveness.

Education Reforms and National Development

National development is intrinsically linked with human capital quality. Education systems that produce skilled, adaptable, and innovative youth contribute significantly to economic productivity and global competitiveness.

Skill-oriented education enhances workforce efficiency, innovation capacity, and knowledge economies. Thus, education reforms function as catalysts for sustainable national growth.

Table 2: Persistent Challenges in Education-to-Career Alignment

Challenges	Implications
Skill Gaps	Reduced employability
Theoretical Dominance	Limited practical approach
Industry-Academy Disconnect	Workforce mismatch
Unequal Acess to Quality Education	Regional Skill imbalances

Source: Blom & Saeki (2011), Wheebox (2023)

Strategies for Strengthening Education to Career Alignment

Addressing the persistent disconnect between classroom learning and career outcomes necessitates a combination of structural, pedagogical, and institutional interventions.

Key strategies include:

1) Strengthening Industry–Academic Collaboration

Enhancing partnerships between educational institutions and industry stakeholders can improve curriculum relevance, practical exposure, and workforce preparedness.

2) Expanding Experiential Learning Opportunities

Integrating internships, project-based learning, and applied training can foster problem-solving abilities, adaptability, and leadership competencies.

3) Promoting Curriculum Flexibility

Flexible curricular frameworks enable learners to acquire multidisciplinary competencies aligned with evolving labour market demands.

4) Ensuring Inclusive Access to Skill Education

Broadening access to skill-oriented education can reduce workforce disparities and promote balanced regional development.

Significance of the Study

This study contributes to the ongoing discussion on education reforms by examining their broader developmental implications beyond traditional academic outcomes. By linking education reform with youth leadership development, the research highlights how structural transformations in education can influence workforce readiness, decision-making capacity, and long-term socio-economic mobility. The study emphasises that education reforms are not merely pedagogical adjustments but strategic interventions shaping national human capital.

The research is particularly significant in the Indian context, where demographic advantages position youth as a critical driver of economic growth and innovation. Understanding how reforms impact employability, skill formation, and leadership capabilities provides valuable insights for policymakers, educators, and institutional stakeholders. The study thus offers a conceptual bridge between educational transformation and national development priorities.

Along with that, the study sheds light on persistent structural challenges, including skill gaps, unequal access to quality education, and variations in reform implementation. By identifying these constraints, the research provides as a foundation for better informed policy decisions and institutional strategies aimed at strengthening education-to-career alignment.

Overall, the study highlights the crucial role of education reforms in fostering adaptive, skilled, and leadership-oriented youth who are capable of contributing to sustainable national development. The paper is particularly relevant for education policymakers, academic institutions, and workforce strategists.

CONCLUSION

Education reforms in India signify a transformative shift from knowledge-centric to competency-centric learning. These reforms play a pivotal role in enhancing career readiness, fostering youth leadership, and contributing to national development.

While structural challenges persist, sustained policy focus, institutional innovation, and pedagogical evolution can strengthen the education-to-career continuum. As India advances towards its long-term developmental vision, education reforms remain indispensable instruments of human capital advancement and socio-economic progress.

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THE IMPACT OF CUSTOMER-BASED BRAND EQUITY ON THE OPERATIONAL PERFORMANCE OF BUSINESSES IN THE INDIAN FMCG INDUSTRY

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ABSTRACT
Customer-based brand justice has arisen as a critical strategic asset for businesses operating in highly competitive markets such as the fast-moving consumer goods (FMCG) industry. Sturdy brand justice not only effects consumer partialities but also pays to improved internal and external business performance. The current study inspects the influence of customer-based brand fairness on the active act of businesses in the Indian FMCG industry. The learning is based on primary data collected from managers and marketing professionals working in FMCG firms, using a planned questionnaire. Key dimensions of customer-based brand equity, including brand cognizance, perceived quality, brand relations, and brand loyalty, were analyzed to assess their influence on operational performance indicators such as sales efficiency, market responsiveness, distribution effectiveness, and cost control. Statistical gears such as descriptive analysis, correlation analysis, and regression analysis were working to understand the data. The findings reveal that customer-based brand equity has a important positive influence on operational performance, with brand loyalty and perceived quality emerging as the greatest influential dimensions. The study highpoints the rank of building strong brand equity to enhance operative competence and competitive advantage in the Indian FMCG sector. The outcomes offer practical visions for managers seeking to align branding strategies with operational goals in dynamic market environments.

1. INTRODUCTION
In today's highly modest business situation, brands play a energetic role in shaping both market success and internal business performance. In the fast-moving consumer goods (FMCG) industry, where crops are often similar and competition is intense, customer-based brand equity has develop an important source of sustainable competitive advantage. Customer-based brand equity mentions to the value that a brand derives from consumer perceptions, experiences, and faithfulness, which in turn influence business outcomes.

Traditionally, brand equity has been inspected mainly in relation to consumer behavior, such as purchase intention, brand preference, and loyalty. However, recent educations propose that strong customer-based brand equity also contributes to improved operational performance. Businesses with strong brands often experience smoother operations, better demand predictability, efficient distribution, and stronger relationships with channel partners. As a result, brand equity extends beyond marketing outcomes and influences the overall functioning of the organization.

The FMCG industry in India represents a dynamic and fast-growing sector characterized by high product turnover, extensive distribution networks, and price-sensitive consumers. Companies operating in this sector must manage complex supply chains, maintain cost efficiency, and respond quickly to changing consumer demands. In such an environment, strong customer-based brand equity can support operational efficiency by stabilizing demand, reducing marketing and distribution costs, and improving coordination across business functions.

Despite the growing importance of brand equity in operational decision-making, empirical research linking customer-based brand equity to operational performance remains limited, particularly in the Indian FMCG context. Most existing studies focus on financial performance or consumer-related outcomes, while the operational implications of brand equity are less explored. There is a essential for primary data–based research that examines how brand equity dimensions influence operational performance indicators from a executive perspective.

The current study addresses this gap by tentative the effect of customer-based brand equity on the operative performance of businesses in the Indian FMCG industry. By evaluating primary data together from FMCG professionals, the study goals to provide visions into how brand equity contributes to operational efficiency and supports long-term business performance.

2. REVIEW OF LITERATURE
Customer-based brand equity (CBBE) has been widely discussed in marketing literature as a valuable immaterial asset that effects consumer responses and firm performance. Early studies conceptualized brand fairness as the added value a brand title gives to a product, driven by consumer insights such as awareness,

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apparent quality, brand associations, and loyalty. These dimensions collectively shape consumer preference and long-term brand strength.

Several researchers have inspected the relationship between customer-based brand equity and market-related outcomes, including purchase intention, price premium, and brand loyalty. Strong brand awareness helps brands remain top-of-mind, while perceived quality influences consumer evaluation and satisfaction. Brand associations contribute to differentiation, and brand loyalty supports repeat purchases and stable demand. Together, these dimensions enhance a firm's competitive position in the market.

More new studies have lengthy the scope of brand equity research to organizational and performance-related outcomes. Findings propose that firms with strong customer-based brand equity often knowledge improved sales stability, reduced promotional dependence, and stronger bargaining power with distributors and retailers. These advantages indicate a potential link between brand equity and working performance, particularly in industries with high competition and extensive distribution networks.

Research focusing on operational performance highlights indicators such as distribution efficiency, responsiveness to market demand, inventory management, and cost control. Educations propose that brands with loyal customer bases face lower demand uncertainty, which supports better production planning and source chain coordination. Sturdy brand equity can also reduce operational strain by minimizing fluctuations in auctions volume and enhancing channel cooperation.

In the FMCG sector, where operational efficiency is critical due to low margins and high volumes, the role of brand equity becomes especially important. Some experiential studies in emerging markets indicate that brand loyalty and perceived quality definitely influence active efficiency and overall firm performance. However, much of this research remains focused on financial outcomes, with limited emphasis on operational dimensions.

In the Indian setting, existing studies primarily examine brand fairness in relation to consumer behavior or financial performance. Empirical research that directly links customer-based brand equity with operational performance using primary data from FMCG professionals is relatively limited. This indicates a clear opportunity for further investigation into how brand equity influences operational effectiveness in the Indian FMCG industry.

4. OBJECTIVES OF THE STUDY

The primary objective of the current study is to inspect the impact of customer-based brand equity on the working performance of trades operating in the Indian FMCG industry. In order to attain this broad objective, the study is directed by the subsequent specific objectives:

1. To identify the key sizes of customer-based brand equity relevant to FMCG businesses.
2. To analyze the level of customer-based make equity perceived by FMCG firms in the Indian market.
3. To examine the association between customer-based brand equity and working performance indicators such as sales efficiency, distribution effectiveness, responsiveness to market demand, and cost control.
4. To assess the individual impact of brand awareness, apparent quality, brand associations, and brand loyalty on operational performance.
5. To provide managerial insights on how customer-based brand equity can be leveraged to improve operational efficiency in the FMCG sector.

5. RESEARCH HYPOTHESES

Based on the objects of the education and insights drawn from prior research, the following theories have been formulated to empirically inspect the association between customer-based brand equity and working performance in the Indian FMCG industry:

- **H1:** Customer-based brand equity has a important positive impact on the working performance of FMCG businesses.
- **H2:** Brand awareness has a significant positive influence on the working performance of FMCG businesses.
- **H3:** Perceived quality has a significant positive influence on the working performance of FMCG businesses.
- **H4:** Brand associations have a significant positive effect on the working performance of FMCG businesses.
- **H5:** Brand loyalty has a significant positive influence on the working performance of FMCG businesses.

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6. RESEARCH METHODOLOGY

The current study adopts a descriptive and analytical research design to examine the impact of customer-based brand equity on the operational performance of businesses in the Indian FMCG industry. This design is appropriate as it enables systematic description of brand equity perceptions and analysis of their influence on operational outcomes.

The study is based on both primary and secondary data. Primary data were collected from FMCG professionals, while secondary data were sourced from academic journals, books, industry reports, and published studies related to brand equity and operational performance.

6.1 Source of Primary Data

Primary data were together from managers, executives, and marketing professionals working in FMCG companies in India. Respondents were selected from firms involved in manufacturing, marketing, and distribution of FMCG products, as they possess direct knowledge of branding and operational processes.

6.2 Sample Size and Sampling Technique

A sample of 210 accused was designated for the study. The respondents were chosen using a convenience sampling technique, based on accessibility and willingness to participate. The sample size was considered satisfactory for conducting reliability analysis, correlation analysis, and multiple regression analysis.

6.3 Research Instrument

A structured questionnaire was used as the research instrument for collecting primary data. The questionnaire consisted of two sections. The first section captured demographic and professional details of the respondents such as designation, years of experience, and functional area. The second section included statements related to customer-based brand equity dimensions (brand awareness, perceived quality, brand associations, and brand loyalty) and operational performance indicators (sales efficiency, distribution effectiveness, responsiveness to demand, and cost efficiency). Responses were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

6.4 Variables of the Study

In the present study, customer-based brand equity was treated as the independent variable and was measured through its key dimensions: brand awareness, perceived quality, brand associations, and brand loyalty. Operational performance was treated as the reliant on variable and was measured using indicators related to operational efficiency, market responsiveness, and cost management.

6.5 Statistical Tools for Study

The composed data were implicit, tabularized, and analyzed using appropriate statistical tools. The statistical techniques working in the study include descriptive statistics to summarize respondent perceptions, reliability analysis to test internal consistency of the scale, correlation analysis to examine relationships between variables, and multiple regression analysis to measure the impact of customer-based brand equity on operational performance.

6.6 Moral Thoughts

Moral standards were maintained through the research method. Participation was voluntary, confidentiality of respondents was ensured, and the data together were used severely for academic and research purposes.

7. DATA ANALYSIS AND RESULTS

This section presents the study of primary data together from **210 respondents** working in FMCG businesses across India. The impartial of the analysis is to examine the connection between customer-based brand equity and effective performance and to assess the impact of individual brand equity extents on operational outcomes.

7.1 Reliability Analysis

Reliability study was showed to assess the internal constancy of the measurement scale used for customer-based brand equity and operational performance.

Table 1: Reliability Statistics

Construct	Number of Items	Cronbach's Alpha
Brand Mindfulness	4	0.83
Professed Quality	4	0.86
Brand Associations	4	0.81
Brand Loyalty	4	0.88
Operational Performance	6	0.9

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Interpretation:
All Cronbach's Alpha values exceed the recommended threshold of 0.70, indicating good reliability and internal consistency of the dimension scale. The data are hence apposite for further statistical analysis.

7.2 Descriptive Statistics
Descriptive figures were used to appreciate respondent perceptions regarding customer-based brand equity and operational performance.

Table 2: Mean Scores of Study Variables

Variable	Mean	Standard Deviation
Brand Awareness	4.21	0.59
Perceived Quality	4.34	0.55
Brand Associations	4.12	0.61
Brand Loyalty	4.38	0.53
Operational Performance	4.26	0.57

Interpretation:
The mean scores indicate a high level of agreement among respondents regarding the presence of strong customer-based brand equity in FMCG firms. Brand loyalty and apparent quality recorded the highest mean values, suggesting their importance in influencing operational performance.

7.3 Correlation Analysis
Correlation study was done to examine the relationship between customer-based brand equity dimensions and operational performance.

Table 3: Correlation between Brand Equity Dimensions and Operational Performance

Brand Equity Dimension	Correlation Coefficient (r)
Brand Awareness	0.62
Perceived Quality	0.71
Brand Associations	0.65
Brand Loyalty	0.78

Interpretation:
All sizes of customer-based brand fairness show a confident and important association with operational performance. Brand loyalty exhibits the strongest correlation, indicating that loyal customers contribute to more stable demand and improved operational efficiency.

7.4 Regression Analysis
Many regression analysis was conducted to assess the impact of customer-based brand equity on operational performance.

Table 4: Regression Results

Independent Variable	Beta (β)	t-value	Significance (p)
Brand Awareness	0.18	3.12	0.002
Perceived Quality	0.24	4.08	0
Brand Associations	0.2	3.46	0.001
Brand Loyalty	0.36	6.21	0

Interpretation:
The regression results indicate that customer-based brand equity has a momentous positive impact on operational performance, explaining **58% of the variation ($R^2 = 0.58$)**. Among the dimensions, brand loyalty has the strongest influence, followed by perceived quality. These findings support all the formulated hypotheses.

7.5 Key Findings
- Customer-based brand equity significantly improves operational performance in FMCG firms.
- Brand loyalty is the most influential dimension affecting operational outcomes.
- Strong brand equity supports demand stability, distribution efficiency, and cost control.
- Operational benefits of brand equity extend beyond marketing performance.

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8. DISCUSSION OF RESULTS

The results of the present training deliver clear experiential evidence that customer-based brand equity has a significant and positive impact on the operative routine of businesses in the Indian FMCG industry. The results reinforce the view that brand equity is not one a marketing asset but also an important driver of internal business efficiency.

The descriptive analysis indicates that FMCG firms in India generally possess strong customer-based brand equity, particularly in terms of brand loyalty and perceived quality. These dimensions received the uppermost mean scores, signifying that consumers' trust in product quality and continued preference for familiar brands play a vital role in shaping operational outcomes. Stable customer demand associated with loyal customers allows firms to plan production, inventory, and distribution more efficiently.

The correlation and regression analyses further strengthen this observation by demonstrating that all scopes of customer-based brand equity are positively related to operational performance. Among them, brand loyalty emerged as the most influential factor. This finding suggests that loyal customers contribute to predictable demand patterns, reduced promotional dependency, and smoother distribution processes. Such stability directly supports cost control and working efficiency, which are serious in the FMCG sector due to thin margins and high competition.

Perceived quality was found to be another significant contributor to operational performance. FMCG firms that are perceived to offer high-quality products tend to experience fewer product returns, better retailer cooperation, and stronger supply chain coordination. These outcomes reduce operational disruptions and enhance responsiveness to market demand.

Brand awareness and brand relations also showed a meaningful influence on operational performance, though their impact was relatively moderate compared to loyalty and quality. High brand awareness helps firms achieve faster product movement and better shelf presence, while positive brand associations support smoother interactions with channel partners and stakeholders.

Overall, the discussion highlights that customer-based brand equity creates operational advantages by stabilizing demand, improving coordination across the value chain, and reducing uncertainty in business operations. The findings bring into line with current literature that emphasizes the strategic role of brand equity, while extending it by empirically demonstrating its operational benefits in the Indian FMCG context.

9. CONCLUSION

The current study examined the effect of customer-based brand equity on the working performance of businesses operating in the Indian FMCG industry using primary data together from FMCG professionals. The findings clearly indicate that customer-based brand equity significantly enhances operational performance, highlighting its strategic importance beyond traditional marketing outcomes.

The empirical results show that all extents of customer-based brand equity brand awareness, perceived quality, brand relations, and brand loyalty positively influence operational performance. Among these, brand loyalty emerged as the most influential factor, followed by perceived quality. Firms with loyal customer bases and strong quality perceptions benefit from stable demand, improved distribution efficiency, and better cost control, which are critical for operational success in the FMCG sector.

Overall, the study confirms that customer-based brand equity acts as a valuable intangible resource that supports smoother business operations and long-term competitiveness. The results stress the need for FMCG firms to integrate branding strategies with operational planning to achieve sustainable performance.

10. IMPLICATIONS OF THE STUDY

The results of this education offer important implications for managers and decision-makers in the FMCG industry. Building and maintaining strong customer-based brand equity should be viewed as an investment that supports not only market performance but also operational efficiency. Managers should focus on strengthening brand loyalty and perceived quality, as these dimensions have the utmost effect on operational outcomes.

From an operational perspective, strong brand equity can help firms reduce demand uncertainty, optimize inventory management, and improve coordination with distribution partners. Aligning branding initiatives with operational objectives can therefore enhance overall business effectiveness. The study also provides useful insights for marketing and operations teams to work collaboratively toward common performance goals.

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11. LIMITATIONS AND SCOPE FOR FUTURE RESEARCH

Despite its contributions, the study has certain limitations. The research relied on convenience sampling, which may boundary the generalizability of the results. The study focused on selected operational performance indicators and did not include financial metrics such as profitability or return on investment. In addition, the data were cross-sectional in nature and captured perceptions at a single point in time.

Future research can extend this study by using probability sampling techniques and larger sample sizes to improve representativeness. Researchers may also explore the relationship between customer-based brand equity and financial performance, or examine industry-specific variations within the FMCG sector. Longitudinal studies could provide deeper insights into how changes in brand equity affect operational performance over time.

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A STUDY OF INSTITUTIONAL AND MARKET ACCESS BARRIERS IN INDIA'S INDIGENOUS DEFENCE EXPORTS

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ABSTRACT
The industrial transformation of Indian defence has moved from licensed production to indigenous design, yet export outcomes has remained modest despite strong political intent and growing technological capability. This study examines the institutional and market access barriers constraining India's indigenous defence exports, with special emphasis on why these platforms that are strategically sound and technically competitive struggle to convert into sustained international sales.

It then examines institutional barriers through three core lenses: geopolitical constraints rooted in alliance politics, export approvals, and strategic signalling; geoeconomic limitations arising from constrained financing mechanisms, limited offset competitiveness, and weak buyer credit structures; and production capacity challenges, where bureaucratic fragmentation, and process-driven delays restrict scalability and delivery reliability. On the market access front, the study identifies three dominant non-price barriers: persistent concerns over source code access and IPR, buyer hesitation toward non–combat-proven platforms, and the limited reach of India's maintenance, repair, and overhaul (MRO) ecosystem.

Two detailed case studies form the empirical core of the paper. The Light Combat Aircraft Tejas is examined as a technologically credible platform constrained by perception, timelines, and sustainment assurances, while the Advanced Towed Artillery Gun System illustrates how production scalability and institutional coordination shape export credibility. Select minor cases are used to reinforce recurring structural patterns.

Keywords: *Indigenous defence exports, defence industrial base, institutional constraints, market access barriers, India's military manufacturing*

I. INTRODUCTION

"The greatest leader is not necessarily the one who does the greatest things. He is the one that gets people to do the greatest things."

— Ronald Reagan, remarks on leadership during his presidency, United States, early 1980s.

India's defence export challenge reflects the logic that outcomes are shaped by systems rather than isolated achievements. Despite visible progress in indigenous platforms and technological capability, sustained export success depends on institutions that can coordinate industry, reassure foreign buyers, and support long-term engagement. This paper approaches defence exports as a question of institutional capacity and market credibility rather than technological sufficiency. Accordingly, this section outlines the definition and background of India's defence export framework, supported by selective data and contextual case references, to establish the structural conditions within which subsequent institutional and market access barriers are analysed.

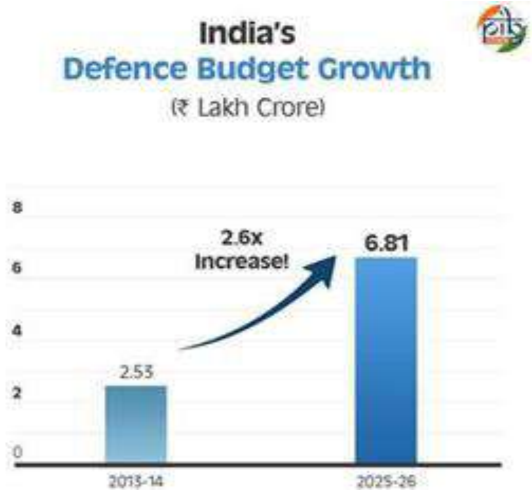
A. Conceptual Context

Defence exports encompass the authorized transfer of military platforms, weapon systems, subsystems, technologies, and associated services from a producing state to foreign governments or approved entities. In the Indian context, defence exports are not limited to the sale of complete equipment but also include licensed production arrangements, technology transfer, spares and components, software and source-code governed systems, training packages, upgrades, and long-term maintenance, repair, and overhaul support. Unlike conventional exports, defence exports are embedded within sovereign decision-making processes, export control regimes, and foreign policy considerations, rendering them inseparable from national security and strategic autonomy.

Defence exports operate across multiple institutional layers involving policy formulation, industrial production, regulatory clearances, and diplomatic engagement. Consequently, their effectiveness is shaped by the coherence of export licensing mechanisms, coordination between civilian and military stakeholders, and the capacity of domestic industry to meet scale, quality, and delivery timelines. At the market level, defence exports are conditioned by buyer perceptions of operational reliability, control over intellectual property and source code, and confidence in post-sale sustainment ecosystems. These elements collectively influence credibility and long-term adoption rather than one-time procurement decisions.

Within this framework, institutional barriers refer to structural constraints arising from geopolitical positioning, geoeconomic instruments, production capacity, and bureaucratic design, while market access barriers denote non-price factors that limit entry or expansion in foreign defence markets. This conceptualization aligns with contemporary defence economics and Indian policy discourse, which increasingly frames defence exports as a function of systemic readiness rather than technological availability (Ministry of Defence, 2020; SIPRI, 2023; IDSA, 2022).

B. Background



Over the last decade, India's defence exports have shifted from a peripheral activity to a noteworthy strategic output, reflecting deliberate policy emphasis on self-reliance and industrial scaling. Official data shows that Indian defence exports surged from a mere ₹686 crore in FY 2013-14 to an all-time high of ₹23,622 crore in FY 2024-25, marking an approximate 34-fold increase over eleven years and a 12 percent year-on-year rise from the preceding fiscal year. This growth underscores sustained expansion in both export value and exporter participation, with the number of export authorisations rising to 1,762 in FY 2024-25, a 16.92 percent increase year-on-year. The private sector contributed significantly, accounting for nearly two-thirds of total export value, while Defence Public Sector Undertakings (DPSUs) showed a robust 42.85 percent growth in their export share.

This upward trajectory is rooted in policy frameworks such as the Defence Production and Export Promotion Policy (DPEPP) 2020 and the establishment of the Indigenous Defence Equipment Exporters Association (IDEEA) to streamline export processes and foster market linkages. These instruments have helped diversify India's defence export portfolio, which now includes platforms ranging from radar systems and armoured vehicles to simulators and precision munitions exported to more than 100 countries globally.

Despite this quantitative expansion, India's share in global arms exports remains modest relative to traditional major exporters. Studies and international data suggest that India's defence export value, while rapidly increasing, still places it outside the top tier of arms suppliers whose exports are measured in tens of billions of dollars annually. This gap points to persistent structural and qualitative barriers that extend beyond production volume, including institutional processes, approval frameworks, and market credibility challenges.

C. Empirical Context

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The most reliable empirical indicator of India's evolving defence export capacity is the sustained rise in export value over the last decade. According to official data released by the Ministry of Defence through the Press Information Bureau (PIB), India's defence exports increased from ₹686 crore in FY 2013–14 to a record ₹23,622 crore in FY 2024–25, representing an approximate 34-fold growth within eleven years. This expansion is not episodic but structurally consistent, with exports registering a 12 percent year-on-year increase in FY 2024–25, despite global supply-chain disruptions and tightening defence markets.

The empirical significance of this trend lies not merely in aggregate value but in its composition. The same data indicates a parallel rise in exporter participation, with 1,762 export authorisations issued in FY 2024–25, reflecting broader industrial involvement beyond a limited set of public sector entities. Notably, the private sector accounted for nearly two-thirds of total export value, while Defence Public Sector Undertakings (DPSUs) recorded a 42.85 percent growth in their export contribution, suggesting gradual diversification of the defence industrial base.

These empirical trends thus reveal a dual reality: India has made measurable progress in building an exportable defence industrial base, yet full integration into the competitive global arms market remains constrained by systemic institutional and market access barriers that this study will examine in depth.

However, when contextualised globally, this growth remains modest. India's absolute export value still places it outside the top tier of global arms exporters, whose annual exports often exceed tens of billions of dollars. The figure therefore captures a dual reality: India has demonstrably built exportable defence capacity, yet scale, market penetration, and sustained high-value contracts remain constrained. This empirical gap between growth and global positioning provides the foundation for analysing the institutional and market access barriers examined in this study.

II. REVIEW OF LITERATURE

Table1. Summary of Key Studies on Indian Defence Manufacturing and Exports

Author (Year) and Title	Focus and Method	Key Findings
Ministry of Defence (2020), ***Defence Production and Export Promotion Policy (DPEPP)***	Policy document; institutional and industrial review	Identifies exports as a strategic objective but places primary emphasis on production and procurement reform
SIPRI (2023), ***SIPRI Yearbook***	Quantitative global arms trade analysis	Shows India's exports growing rapidly but remaining marginal in global market share
IDSA (2022), ***India's Defence Exports: Opportunities and Constraints***	Qualitative policy and industry analysis	Highlights institutional delays, market credibility, and sustainment gaps as key constraints

KPMG (2019), ***Indian Defence Manufacturing***	Industry report using firm-level assessment	Notes production scalability and supply-chain maturity as export bottlenecks
Comptroller and Auditor General (2021), ***Report on Defence Production***	Audit-based institutional review	Identifies procedural inefficiencies and coordination gaps affecting delivery timelines

The reviewed literature establishes that India's defence export growth is policy-driven but institutionally constrained. Government documents such as DPEPP (2020) articulate export ambition yet largely frame exports as a by-product of domestic production rather than as a market-facing system. International datasets from SIPRI provide empirical grounding, confirming India's limited global export share despite rapid growth. Strategic analyses by IDSA and industry assessments by KPMG emphasize production capacity, credibility, and sustainment as recurring challenges, while audit reports from the CAG reveal bureaucratic and procedural frictions that undermine export reliability. Collectively, these works explain what constrains exports but often examine these factors in isolation.

Research Gap

The literature lacks an integrated framework that simultaneously analyses institutional barriers (geopolitical, geoeconomic, production, and bureaucracy) alongside market access constraints such as IPR control, combat credibility, and MRO ecosystems. Moreover, platform-level case studies linking empirical export data with systemic barriers remain limited. This study addresses that gap by offering a unified, case-based analysis of India's indigenous defence export constraints.

III. RESEARCH METHODOLOGY

This study adopts a qualitative and analytical research design, relying on doctrinal analysis and secondary data. The methodology combines policy review, empirical data interpretation, and case study examination to assess institutional and market access barriers affecting India's defence exports. Authoritative government publications, international defence databases, and strategic studies literature form the core data sources. Case studies of Tejas and ATAGS are used to contextualize structural constraints at the platform level.

A. Objectives of the Study

1. To examine the institutional barriers influencing India's indigenous defence exports.
2. To analyse market access constraints affecting export competitiveness.
3. To assess empirical trends in India's defence export growth.
4. To evaluate select indigenous platforms as export case studies.

B. Scope of the Study

The study is confined to India's indigenous defence exports, focusing on institutional frameworks, market access barriers, and platform-level export dynamics within the contemporary policy period.

C. Limitation of Study

1. To reliance on secondary data and publicly available sources.
2. To limited access to classified or contract-specific information.
3. To evolving export figures that may change post-study.

IV. ANALYTICAL AND INSTITUTIONAL ASSESSMENT

A. Institutional Barriers

1. Geopolitical and Geoeconomic Constraints:

India's defence exports operate within a complex geopolitical environment where strategic alignment, diplomatic signalling, and export control sensitivities directly shape market access. Unlike established arms exporters that leverage formal alliance structures to lock in defence markets, India positions itself as a strategically autonomous actor.

While this has enhanced diplomatic flexibility, it also limits preferential access to security blocs where defence procurement is closely tied to alliance commitments, interoperability doctrines, and political trust. As a result, Indian platforms often compete in politically contested markets where buyers demand higher assurances, offsets, or technology access.

Geoeconomically, India lacks mature defence export financing instruments comparable to *foreign military financing (FMF) mechanisms* used by major exporters. The absence of large-scale, state-backed credit lines and insurance frameworks reduces India's competitiveness in price-sensitive markets, particularly in Africa, Southeast Asia, and Latin America.

Empirical export data shows growth in absolute value, yet contracts remain relatively small and fragmented, indicating constrained deal depth rather than sustained market capture. This structural limitation is evident in stalled or prolonged negotiations for platforms such as the Light Combat Aircraft (Tejas), where geopolitical considerations and financing packages offered by competitors diluted India's technical proposition.

2. Production Capacity and Institutional Execution:

Production capacity emerges as a critical institutional bottleneck not in terms of design capability, but in scalability, timelines, and delivery credibility. India's defence manufacturing ecosystem remains uneven, with dependence on a limited number of public sector entities and a private sector that is still maturing in high-complexity systems integration.

Bureaucratic layering between the armed forces, the Ministry of Defence, production agencies, and export authorities slows decision-making and constrains responsiveness to foreign buyers' timelines.

The ATAGS artillery programme illustrates this tension. While the system demonstrates competitive technical performance and indigenous design depth, export credibility hinges on serial production readiness and assured delivery schedules. The indicators show that production ramp-up has lagged behind demonstrated capability, reinforcing buyer concerns over supply certainty. In defence markets, reliability of delivery often outweighs marginal performance advantages, and institutional delays directly erode export confidence.

Further, export-oriented production planning remains secondary to domestic induction priorities. Platforms are frequently showcased internationally before achieving stable production baselines, leading to perception gaps between promise and availability. This pattern reinforces the view that India's institutional architecture is still optimized for self-reliance rather than sustained export penetration.

Taken together, geopolitical positioning and geoeconomic limitations constrain where India can sell, while production capacity and bureaucratic execution constrain how reliably it can deliver. The institutional barrier is therefore systemic rather than sectoral. India's defence export challenge is not rooted in technological insufficiency but in the absence of a fully export-oriented institutional ecosystem that integrates diplomacy, financing, production planning, and industrial execution. Addressing this threshold is essential if export growth is to translate from incremental gains into durable market presence.

B. Market Access Barriers

Market access barriers confronting India's defence exports are thus rooted less in product inadequacy and more in trust architecture deficits. Control over software and IPR, absence of widely recognized combat validation, and weak global sustainment infrastructure collectively constrain buyer confidence. Addressing these barriers requires institutional redesign that treats exports as long-term strategic commitments rather than discrete sales, aligning legal frameworks, operational signalling, and post-sale ecosystems into a coherent export strategy.

1. Source Code Access and Intellectual Property Rights:

One of the least discussed yet most decisive barriers in India's defence exports is buyer apprehension over source code access and intellectual property control.

Contemporary defence procurement has shifted from platform-centric purchases to capability-centric ecosystems, where software sovereignty determines upgrade autonomy, integration flexibility, and long-term operational relevance. Indian defence exports, particularly in aerospace, electronics, and networked systems, often retain tight control over mission software, encryption layers, and core algorithms due to national security sensitivities and joint-development clauses with foreign suppliers.

This creates friction in export negotiations, especially with mid-sized militaries seeking operational independence rather than vendor dependence. A recurring but understated issue in negotiations involving Tejas and indigenous radar systems has been buyer insistence on assured access to mission-critical software layers or clearly defined upgrade pathways.

Even when full source code transfer is not demanded, ambiguity over future modification rights raises lifecycle risk. Competing exporters often offset this concern through modular software architectures or legally binding upgrade guarantees, an area where India's export documentation and institutional clarity remain underdeveloped.

Thus, the barrier is not refusal to share source code per se, but the absence of standardized, export-friendly IPR frameworks that balance security with buyer autonomy.

2. Absence of Sustained Combat Proven Credibility:

Combat proven status remains a powerful signalling mechanism in global arms markets, particularly for states operating under tight defence budgets and high threat exposure. Indian platforms have increasingly undergone extensive trials and limited operational deployment, yet the absence of prolonged, high-intensity combat usage creates perception asymmetry rather than technical doubt. Importantly, this is not unique to India; however, established exporters often compensate through alliance-backed validation or extensive operational data sharing.

A subtle but critical issue is that Indian systems are frequently benchmarked against platforms with decades of combat lineage, even when their operational environments differ significantly. For instance, artillery buyers evaluating ATAGS compare it not only on range and accuracy but on battlefield survivability records accumulated over multiple conflicts by competitor systems. India's challenge lies in translating rigorous domestic induction and testing regimes into export-recognized credibility.

The lack of institutional mechanisms to formally certify operational reliability for export audiences reinforces conservative buyer behaviour, particularly in politically volatile regions where procurement risk tolerance is low.

3. Maintenance, Repair, and Overhaul (MRO) Ecosystem Limitations:

Perhaps the most structurally limiting market access barrier is the underdevelopment of India's global MRO footprint. Defence procurement decisions are increasingly lifecycle-driven, where sustainment cost, spares availability, and turnaround time outweigh acquisition price.

Indian defence exports have struggled to reassure buyers on long-term support, not due to technical incapacity, but because overseas MRO hubs, regional depots, and trained support personnel networks remain limited.

This gap has surfaced repeatedly in smaller but telling negotiations involving patrol vessels, helicopters, and electronics-heavy platforms. Buyers often seek in-theatre sustainment capability or regional maintenance nodes, which Indian exporters are yet to institutionalize at scale.

Unlike major exporters who integrate defence sales with permanent logistics ecosystems, India's MRO approach remains transaction-oriented rather than presence-oriented. As a result, even competitively priced systems face hesitation when sustainment assurances are perceived as contingent rather than guaranteed.

C. Case Studies: Export Viability Across Distinct Platform Categories

Methodological Note: The LCA Tejas and ATAGS belong to fundamentally different weapons categories and are not directly comparable in technical or operational terms. This case study compares them solely from the perspective of export translation, examining how institutional and market access factors shape divergent outcomes despite indigenous capability in both systems.

LCA Tejas: Export Constraints in a High-Threshold Platform

The LCA Tejas programme represents India's entry into the global combat aircraft ecosystem as an indigenous designer rather than a licensed manufacturer. Technically, Tejas incorporates advanced features such as a composite-heavy airframe (over 45 percent by weight), relaxed static stability with quadruplex digital fly-by-wire controls, AESA radar integration, and network-centric avionics architecture. From a domestic standpoint, the programme achieved a critical milestone with confirmed Indian Air Force orders for 83 Tejas Mk-1A aircraft, establishing a minimum viable production baseline.

However, export translation has proven structurally difficult. Fighter aircraft exports are characterised by extremely high entry thresholds, where procurement decisions are driven less by platform performance and more by strategic alignment, financing packages, interoperability frameworks, and lifecycle assurances. India's export offering remains institutionally thin in these dimensions. Unlike established exporters, India does not provide large-scale government-backed defence credit lines, long-term training pipelines, or alliance-linked sustainment guarantees, reducing Tejas's competitiveness in politically aligned markets.

Production capacity further weakens export credibility. HAL's fighter production rate has historically ranged between 8–12 aircraft per annum, with incremental scaling dependent on supply-chain maturity and engine availability. For export customers, this raises concerns regarding delivery schedules, spares prioritisation, and diversion risk in favour of domestic induction. Additionally, Tejas faces source code and mission software sensitivities, particularly around avionics integration and weapons certification, limiting buyer autonomy over future upgrades. Finally, despite operational induction, the absence of sustained combat deployment creates a perception gap when compared with rival platforms possessing extensive battlefield lineage. Collectively, these factors explain why Tejas continues to face difficulty in securing a first export customer despite technical credibility.

ATAGS: Export Success through Lower Political and Institutional Friction

The Advanced Towed Artillery Gun System (ATAGS) illustrates how Indian defence exports can succeed when structural barriers are comparatively lower. Developed through a public–private collaboration, ATAGS demonstrated extended firing ranges exceeding 45 km, high accuracy, automated gun-laying systems, and reduced crew workload, placing it competitively within the global 155 mm artillery segment. Unlike fighter aircraft, artillery systems are evaluated primarily on performance, availability, and cost-effectiveness, rather than alliance politics or interoperability doctrines.

ATAGS achieved a critical export breakthrough with sales to Armenia, a procurement driven by urgent operational requirements following regional conflict. This case is significant because it highlights a demand environment where time-to-capability and battlefield performance outweighed concerns over combat lineage or political alignment. Institutional frictions such as source code control are minimal in artillery systems, reducing buyer risk perception. Moreover, sustainment requirements, while important, are less complex than those associated with aerospace platforms, lowering lifecycle uncertainty.

That said, ATAGS is not free from structural constraints. Export scalability remains linked to domestic induction decisions and serial production readiness. Delays in large-scale domestic orders initially slowed production momentum, signalling uncertainty to prospective buyers. Additionally, India’s limited overseas MRO infrastructure constrains long-term sustainment confidence. Nevertheless, the lower complexity, reduced geopolitical exposure, and urgency-driven demand allowed ATAGS to overcome barriers that continue to inhibit Tejas.

Table 2. Comparative Export Analysis (Export Perspective Only)

Dimension	LCA Tejas	ATAGS
Platform category	Combat aircraft	Towed artillery system
Export market nature	Highly politicised, alliance-driven	Performance- and urgency-driven
Production constraints	Limited annual output, complex supply chains	Easier scalability post-induction
IPR / source code sensitivity	High (mission software, avionics)	Low to moderate
Combat credibility requirement	Critical for buyer confidence	Secondary to performance
Export outcome	No confirmed export buyer yet	Successful export to Armenia
Buyer risk perception	High	Moderate to low

Taken together, these cases demonstrate that export success is platform-contingent. Tejas faces compounded barriers arising from geopolitics, financing, production scale, IPR sensitivity, and combat credibility, while ATAGS operates within a market where performance and availability dominate decision-making. The divergence reinforces the paper’s central claim: India’s defence export outcomes are determined less by technological capability and more by how institutional readiness aligns with platform-specific export thresholds.

D. Recommendations

1. Platform-Specific Export Architecture:

India should abandon a uniform defence export approach and adopt platform-specific strategies. High-end systems such as combat aircraft require bundled offerings that integrate financing, training, upgrade roadmaps, and diplomatic signalling, while mid-tier systems should prioritize speed, availability, and sustainment assurance. Differentiating export pathways would align institutional effort with platform-specific buyer risk profiles.

2. Export-Oriented Production and Induction Synchronisation:

Domestic induction timelines should be synchronised with export planning. Establishing ring-fenced export production lines and minimum assured output rates would address delivery-certainty concerns and signal long-term commitment to foreign buyers, reducing perceived supply risk.

3. Standardised IPR and Software Sovereignty Frameworks:
India should institutionalise graded IPR and source-code access models that clearly define upgrade rights, integration flexibility, and long-term software support without compromising national security. Predictability, rather than full transfer, is critical for buyer confidence.

4. Global MRO as Strategic Presence:
Defence exports must be coupled with permanent regional MRO hubs through joint ventures or government-backed support nodes. Treating sustainment infrastructure as strategic presence rather than post-sale service would significantly enhance export credibility and lifecycle trust.

V. CONCLUSION

"Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defence with our peaceful methods and goals."

— Dwight D. Eisenhower, Farewell Address on the military-industrial complex, United States, 1961.

India's defence export experience illustrates that success in global arms markets is determined not by platforms alone, but by the systems that surround them. This study demonstrates that while indigenous technological capability has matured, export outcomes remain constrained by institutional coherence and market credibility. Geopolitical positioning and geoeconomic tools shape access, production capacity determines reliability, and bureaucratic execution governs responsiveness. On the market side, unresolved questions of software sovereignty, combat validation, and sustainment assurance continue to raise buyer risk perceptions.

The contrasting cases of Tejas and ATAGS reinforce that export performance is platform-contingent and institution-driven. Where political risk, lifecycle complexity, and alliance dynamics dominate, institutional gaps become decisive; where urgency and performance prevail, Indian systems can penetrate markets despite limitations. Eisenhower's warning remains directly relevant: defence exports succeed only when industrial capacity, state policy, and strategic purpose are coherently aligned. Without that alignment, indigenous capability remains domestically impressive but internationally under-converted.

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Declaration

We hereby declare that the research paper titled *"A Study of Institutional and Market Access Barriers in India's Indigenous Defence Exports"* is an original work carried out by the authors. The ideas, analysis, and conclusions presented in this study are the result of the authors' independent academic effort. The paper makes use of secondary data, published literature, official reports, figures, and factual information from credible sources strictly for analytical and academic purposes, all of which have been duly acknowledged and referenced in accordance with accepted scholarly standards. This paper has not been submitted for publication or academic evaluation elsewhere, either in whole or in part.

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ENHANCING IOT SECURITY FRAMEWORKS FOR SUSTAINABLE SMART CITY DEVELOPMENT UNDER VIKSIT BHARAT 2047

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1. INTRODUCTION

Rapid urban expansion and continuous population growth have exerted considerable pressure on urban infrastructure, public services, transportation networks, and administrative systems. According to recent assessments, more than half of the global population currently resides in urban areas, and this proportion is expected to increase substantially by 2047. In India, accelerated urbanization has intensified challenges related to traffic congestion, environmental pollution, energy consumption, waste management, housing shortages, and public safety.

Urban authorities are increasingly required to manage complex systems involving transportation, water supply, electricity distribution, waste disposal, healthcare, and emergency services. Traditional governance models often struggle to cope with such multidimensional demands. In response, the smart city paradigm has emerged as a technology-driven governance approach that integrates digital platforms, data analytics, and intelligent systems to enhance service delivery and administrative efficiency.

The Internet of Things (IoT) plays a central role in this transformation by enabling real-time sensing, monitoring, automation, and decision-making. IoT devices embedded in traffic lights, surveillance cameras, environmental sensors, smart meters, and public infrastructure generate massive volumes of data. These data streams support applications such as intelligent traffic management, smart energy systems, automated waste collection, water management, disaster monitoring, and e-governance platforms.

Despite these benefits, extensive interconnectivity exposes urban infrastructure to significant cybersecurity threats. Weak authentication mechanisms, insecure device configurations, lack of encryption, and fragmented regulatory frameworks increase system vulnerability. Cyberattacks on smart city systems may disrupt essential services, compromise sensitive information, and undermine public confidence.

India’s Vision Viksit Bharat 2047 emphasizes innovation, technological self-reliance, digital empowerment, and sustainable growth. Secure and reliable digital infrastructure is essential for achieving these national objectives. Therefore, this study focuses on analyzing IoT security challenges and developing a comprehensive framework aligned with national development goals to support resilient and sustainable smart cities.

2. LITERATURE REVIEW

Smart cities are widely recognized as advanced governance systems aimed at improving the management of civic infrastructure and public service delivery. Existing research highlights the convergence of IoT, big data analytics, cloud computing, and edge computing as essential enablers of intelligent urban services.

Alaba et al. (2017) conducted a comprehensive survey on IoT security and identified major vulnerabilities related to weak authentication, insecure firmware, and inadequate access control mechanisms. Roman et al. (2018) emphasized the significance of edge and fog computing in enhancing data privacy, reducing latency, and enabling real-time processing. Sharma et al. (2023) demonstrated the effectiveness of artificial intelligence techniques in detecting anomalous behavior and potential cyber threats within IoT networks.

Several studies underscore the importance of big data management in smart city environments. Efficient data storage, processing, and analytics facilitate predictive governance, resource optimization, and evidence-based decision-making. However, the rapid growth in data volume, velocity, and variety introduces complex security and management challenges.

Blockchain-based security frameworks have been suggested to improve transparency, accountability, and data integrity within smart city ecosystems. Kumar and Patel (2021) proposed distributed ledger architectures to strengthen trust among stakeholders and automate access control mechanisms. Nevertheless, the adoption of blockchain technologies remains limited due to scalability and interoperability concerns.

Most existing frameworks primarily emphasize IoT data management, while comparatively limited attention is given to geospatial data integration and comprehensive security governance. Geospatial datasets offer meaningful insights for urban planning, infrastructure development, and disaster management; however, their secure integration remains insufficiently explored. Additionally, alignment with national development policies and sustainability objectives is often inadequate.

3. IOT SECURITY CHALLENGES IN SMART CITIES

3.1 Device-Level Vulnerabilities

IoT devices typically operate with limited processing power, memory, and energy resources, which restricts the IoT devices generally function with constrained processing capacity, memory, and energy resources, which limits the deployment of sophisticated security mechanisms. Many devices are deployed using default credentials, outdated firmware, and weak encryption standards. These limitations increase susceptibility to malware infections, botnet formation, physical tampering, and unauthorized access.implementation of advanced security mechanisms. Many devices are deployed with default credentials, outdated firmware, and weak encryption standards. These limitations expose devices to malware infections, botnet formation, physical tampering, and unauthorized access.

3.2 Network Security Risks

Smart city infrastructures rely on heterogeneous communication technologies such as 5G, Wi-Fi, LPWAN, Zigbee, and Bluetooth. Managing security across such diverse networks is complex. Vulnerabilities include spoofing, man-in-the-middle attacks, routing manipulation, and distributed denial-of-service (DDoS) attacks. Inadequate network segmentation further amplifies these risks.

3.3 Data Privacy and Integrity Issues

IoT systems continuously collect sensitive personal, behavioral, and location-based data. Unauthorized access, data leakage, and manipulation threaten individual privacy and may result in ethical and legal consequences. Inadequate data governance frameworks and weak enforcement mechanisms exacerbate these concerns.

3.4 Scalability and Maintenance Challenges

Ensuring robust security for millions of interconnected IoT devices requires continuous monitoring, effective patch management, and rapid incident response mechanisms. However, insufficient technical skills, budgetary limitations, and limited automation significantly hinder effective implementation, particularly in developing regions.

3.5 Lack of Standardization

The absence of uniform security standards, certification mechanisms, and interoperability protocols leads to inconsistent protection across platforms and vendors. This fragmentation weakens overall system resilience and complicates regulatory compliance.

3.6 Human and Organizational Factors

Human behavior plays a critical role in cybersecurity. Low awareness among users, administrators, and policymakers contributes to weak password practices, delayed updates, misconfigurations, and poor incident reporting. Organizational inertia and lack of accountability further increase vulnerability.

4. PROPOSED SECURITY FRAMEWORK FOR SUSTAINABLE SMART CITIES

To overcome the identified challenges, this study proposes a comprehensive multi-layered IoT security framework aimed at Sustainable Smart Cities and aligned with the objectives of Viksit Bharat 2047.

4.1 Device Layer Security

- Secure boot mechanisms and hardware-based trust anchors
- Adoption of lightweight cryptographic algorithms
- Automated firmware updates and remote patch management
- Strong device identity and authentication systems

4.2 Network Layer Security

- Encrypted communication protocols
- Secure routing and traffic filtering mechanisms
- Network segmentation and virtual private networks
- AI-based intrusion detection and prevention systems

4.3 Data Layer Security

- End-to-end encryption for data in transit and at rest
- Secure cloud and edge storage infrastructures
- Privacy-preserving data analytics methods

- Blockchain-enabled audit trails and provenance tracking

4.4 Application Layer Security

- Role-based and attribute-based access control
- Secure application programming interfaces
- Periodic penetration testing and code audits
- Continuous vulnerability assessment

4.5 Governance and Policy Layer

- Compliance with national cybersecurity frameworks
- Enforcement of data protection and privacy regulations
- Standardized security certification mechanisms
- Public–private partnerships and regulatory supervision

4.6 Capacity Building and Social Participation

- Cybersecurity training and skill development programs
- Youth-oriented digital education initiatives
- Citizen awareness and digital literacy campaigns
- Academic–industry collaboration for research advancement

5. ROLE OF EMERGING TECHNOLOGIES

5.1 Artificial Intelligence

AI-based security systems enable predictive threat detection, behavioral analysis, automated incident response, and adaptive defense strategies. Machine learning techniques process extensive datasets to detect hidden attack patterns and emerging vulnerabilities.

5.2 Blockchain Technology

Blockchain supports decentralized data management, immutable records, and transparent transactions. Smart contracts automate access control and enhance stakeholder trust.

5.3 Edge Computing

Edge computing minimizes reliance on centralized infrastructures, enhances data privacy, reduces latency, and enables real-time security monitoring for critical smart city applications.

5.4 Cloud Security Solutions

Advanced cloud platforms provide scalable security services, centralized monitoring, identity management systems, and disaster recovery mechanisms.

5.5 Digital Twins

Digital twin technologies enable real-time simulation of urban systems, facilitating proactive security testing, risk assessment, and resilience planning.

6. RESEARCH METHODOLOGY

This research employs a qualitative and analytical methodology. Data were collected from peer-reviewed journals, government policy documents, technical reports, and industry publications. A structured literature review was carried out utilizing recognized academic databases, including Scopus, IEEE Xplore, and Google Scholar. Comparative analysis was applied to assess existing security frameworks based on scalability, interoperability, implementation cost, and policy alignment. Expert insights from academic researchers and industry professionals were reviewed to ensure practical relevance. Based on the synthesized findings, a conceptual multi-layered security framework was developed.

7. DISCUSSION

The proposed framework emphasizes the importance of integrating technological safeguards with institutional and social mechanisms. AI-driven monitoring systems and blockchain-enabled integrity solutions enhance transparency and accountability within smart city infrastructures.

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Capacity-building initiatives align with the youth empowerment objectives of Viksit Bharat 2047 by developing skilled cybersecurity professionals. Citizen participation strengthens public trust, while standardized regulatory policies facilitate interoperability and compliance.

The secure integration of geospatial and IoT data within cloud and edge environments supports informed urban planning, disaster preparedness, and responsive governance. However, financial limitations, regulatory complexity, and technological disparities remain major challenges that require coordinated interventions.

8. CONCLUSION

IoT security represents a fundamental prerequisite for sustainable smart city development. As India progresses toward the vision of Viksit Bharat 2047, robust digital infrastructure will serve a crucial role in fostering inclusive growth, innovation, and efficient governance. This study identified key IoT security challenges and proposed a comprehensive multi-layered framework to address them.

The findings highlight that technological innovation, strong regulatory support, and continuous capacity building are vital for developing resilient urban ecosystems. Future studies should concentrate on empirical validation through pilot implementations, large-scale deployments, and longitudinal evaluations.

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A MATHEMATICAL VIEW OF KNOWLEDGE-DRIVEN VIKSIT BHARAT 2047: HYPERGEOMETRIC SUPERCONGRUENCES AND APERY-TYPE SEQUENCES

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ABSTRACT
Supercongruences are a sophisticated and quickly developing field of number theory that reveals intricate arithmetic characteristics of integer sequences and special functions. Because of their surprising congruence behavior modulo higher powers of primes, hypergeometric series and Apery-type numbers hold a central place in this field. A thorough analysis of hypergeometric supercongruences connected to Apery-type sequences is presented in this research paper. The work highlights computational observations that point to higher-order supercongruence patterns, reviews current theoretical underpinnings, and investigates congruence properties using combinatorial and p-adic methods. This work emphasizes the significance of fundamental mathematical research in creating a knowledge-driven economy and strengthening India's position as a global leader in pure and applied mathematics, which is in line with the national vision of Viksit Bharat 2047.

Keywords: *Supercongruences, Hypergeometric series, Apery numbers, p-adic analysis, Number theory, Viksit Bharat 2047*

1. INTRODUCTION
From being an entirely abstract field, number theory is now a fundamental component of contemporary computational and cryptographic technologies. The study of congruences modulo prime powers is one of its many subfields, and it has revealed rich arithmetic structures with significant theoretical and practical ramifications. Supercongruences, in which congruence relations hold modulo unexpectedly high powers of primes, are a particularly remarkable phenomenon.

An important turning point in arithmetic research was the discovery of Apery numbers during Apery's proof of the irrationality of (\zeta(3)). These numbers show remarkable congruence properties that are closely related to hypergeometric series, as do their generalizations, which are called Apery-type sequences. Deep connections between these sequences, p-adic analysis, and modular forms have been discovered over time by researchers.

Advanced mathematical research like this is essential to Viksit Bharat 2047, which aims to make India a global knowledge leader by the country's centennial of independence. Number theory foundational work promotes creativity, builds intellectual capital, and aids in the advancement of new technologies. By thoroughly examining hypergeometric supercongruences and Apery-type sequences, this paper seeks to advance this vision.

2. LITERATURE REVIEW
Apery's groundbreaking work from 1979, in which he presented a series of integers with exceptional arithmetic properties, marked the beginning of the study of Apery numbers. The foundation for the study of supercongruences was laid by Beukers' later research, which established congruence relations for Apery numbers modulo prime cubes.

Early theoretical understanding of why truncated hypergeometric series satisfy strong congruences was made possible by Dwork's p-adic analytic framework. Subsequently, Rodriguez-Villegas showed links between arithmetic geometry and hypergeometric functions, especially with regard to Calabi-Yau varieties. Deep connections between hypergeometric series, modular forms, and p-adic gamma functions were revealed by Zudilin and colleagues as they expanded on Ramanujan-type supercongruences.

Generalized Apery-type sequences derived from hypergeometric representations have been the subject of recent studies. Systematic higher power congruences have been found through computational studies, but in many cases, rigorous proofs are still lacking. These gaps encourage more research into supercongruences' structural underpinnings.

3. OBJECTIVES OF THE STUDY

The primary objectives of this research are:
1. To study hypergeometric series and their role in generating Apery-type sequences.
2. To analyse known supercongruences associated with Apery-type numbers.
3. To explore p-adic interpretations of hypergeometric supercongruences.

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4. To identify computational patterns that suggest higher order congruences.
5. To align advanced mathematical research with the vision of Viksit Bharat 2047.

4. RESEARCH METHODOLOGY

This study adopts a theoretical and analytical methodology, supported by computational verification:

- **Analytical Approach:** Classical combinatorial identities and properties of binomial coefficients are used to establish baseline congruences.
- **p-Adic Techniques:** p-adic gamma functions and Dwork's theory are employed to interpret supercongruence behavior.
- **Computational Verification:** Symbolic computation tools are used to test congruence patterns for large primes.
- **Comparative Analysis:** Existing results are compared with observed numerical patterns to identify research gap.

5. MATHEMATICAL FRAMEWORK

5.1 Hypergeometric Series

A generalized hypergeometric series is defined by

$$ {}_rF_s\left(\begin{matrix}a_1,\ldots,a_r\\ b_1,\ldots,b_s\end{matrix};z\right)=\sum_{n=0}^{\infty}\frac{(a_1)_n\cdots(a_r)_n}{(b_1)_n\cdots(b_s)_n}\frac{z^n}{n!}. $$

Truncated versions of these series often exhibit supercongruences modulo prime powers.

5.2 Apery-Type Sequences

A generalized Apery-type sequence is defined as

$$ A_n^{(r)}=\sum_{k=0}^{n}\binom{n}{k}^r\binom{n+k}{k},\quad r\geq 2. $$

These sequences frequently arise from hypergeometric representations and exhibit strong arithmetic regularities.

6. RESULTS AND DISCUSSION

Known results indicate that Apery numbers satisfy congruences modulo (p^3) for primes ($p \geq 5$). Generalized Apery-type sequences satisfy congruences modulo (p), with computational evidence suggesting congruences modulo higher powers such as p

Hypergeometric supercongruences reveal deeper structural behavior when interpreted using p-adic methods. The consistency of these results across different families of sequences suggests the existence of a unifying theoretical framework, possibly involving modular or automorphic forms.

7. RELEVANCE TO VIKSIT BHARAT 2047

The vision of Viksit Bharat 2047 emphasizes innovation, research excellence, and knowledge creation. Foundational mathematics supports this vision by:

- Strengthening cryptographic and algorithmic research.
- Enhancing computational and data security frameworks.
- Building long-term intellectual capital.

Research in supercongruences exemplifies how abstract mathematics contributes to national development through knowledge leadership and global academic engagement.

8. CONCLUSION

This research paper presented a comprehensive study of hypergeometric supercongruences and Apéry-type sequences, highlighting their arithmetic depth and theoretical significance. By integrating mathematical rigor

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with national vision, the study underscores the role of foundational research in achieving a knowledge-driven society under Viksit Bharat 2047. Continued investigation in this area promises significant advancements in number theory and its applications.

9. FUTURE SCOPE

1. Rigorous proof of conjectured higher order supercongruences.
2. Extension to multi-variable hypergeometric series.
3. Deeper connections with modular and automorphic forms.
4. Application of results in cryptography and secure computation.
5. Development of computational tools for large-scale verification.

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A STUDY ON BRAND ENGAGEMENT THROUGH DIGITAL PLATFORMS AND ITS INFLUENCE ON CONSUMER RETENTION OF ZOMATO

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ABSTRACT

In the digital era, brand engagement through online platforms has become a critical factor in influencing consumer behavior and sustaining long-term customer relationships. Digital platforms enable brands to interact with consumers in real time, personalize communication, and create meaningful brand experiences. The food delivery industry in India has witnessed rapid growth, driven largely by digitalization and changing consumer lifestyles. Zomato, as a leading food delivery platform, has adopted various digital engagement strategies to enhance customer experience and retain its user base.

The present study examines brand engagement through digital platforms and its influence on consumer retention with special reference to Zomato. The study is based entirely on secondary data collected from research articles, industry reports, company publications, and credible online sources. The paper analyzes Zomato's digital engagement strategies, including mobile app features, social media presence, content marketing, and loyalty programs, and evaluates their impact on consumer retention. The study finds that effective digital engagement significantly enhances customer satisfaction, loyalty, and repeat usage. The paper concludes that sustained digital interaction and personalized engagement are key drivers of consumer retention in the competitive digital marketplace.

***Keywords**: Brand Engagement; Digital Platforms; Consumer Retention; Zomato; Digital Marketing; Customer Loyalty*

INTRODUCTION

The rapid advancement of digital technology has transformed the way businesses interact with their customers. Digital platforms such as mobile applications, social media, websites, and online communities have become powerful tools for engaging consumers and building long-term relationships. In highly competitive markets, brand engagement through digital platforms plays a crucial role in influencing consumer preferences, purchasing behavior, and retention.

Brand engagement refers to the level of emotional, cognitive, and behavioral involvement that consumers exhibit toward a brand. In the digital environment, engagement is facilitated through interactive content, personalized communication, real-time feedback, and value-added services. Organizations increasingly focus on enhancing digital engagement to strengthen customer loyalty and reduce switching behavior.

The Indian food delivery industry has experienced significant growth in recent years due to urbanization, busy lifestyles, and increased smartphone penetration. Digital food delivery platforms have reshaped consumer dining habits by offering convenience, variety, and ease of access. Among these platforms, Zomato has emerged as a prominent brand by leveraging digital channels to engage customers and retain them in a highly competitive market.

Zomato utilizes multiple digital touchpoints, including its mobile application, social media platforms, email marketing, push notifications, and loyalty programs, to create engaging and personalized experiences for users. These engagement strategies aim to increase repeat usage, enhance brand loyalty, and ensure long-term consumer retention. In this context, the present study seeks to analyze how brand engagement through digital platforms influences consumer retention in the case of Zomato.

REVIEW OF LITERATURE

Several studies have emphasized the importance of brand engagement in the digital environment. Researchers have found that higher levels of digital engagement lead to increased customer satisfaction, trust, and loyalty. Digital platforms enable two-way communication, allowing brands to build stronger relationships with consumers through interactive and personalized experiences.

Studies on consumer engagement in mobile applications suggest that app usability, personalization, and timely communication significantly influence customer retention. Gamification, rewards, and loyalty programs further enhance consumer involvement and repeat usage. Social media engagement, including brand storytelling, humor, and responsiveness, has also been identified as a key factor in strengthening emotional connections with consumers.

Research related to online food delivery platforms highlights that convenience, service quality, pricing, and digital engagement are major determinants of customer loyalty. Previous studies indicate that brands such as Zomato and Swiggy retain customers by offering personalized recommendations, promotional offers, and seamless digital experiences. Overall, the literature supports the view that digital brand engagement plays a vital role in influencing consumer retention in service-oriented digital platforms.

OBJECTIVES OF THE STUDY

1. To examine the concept of brand engagement through digital platforms.
2. To analyze the digital brand engagement strategies adopted by Zomato.
3. To study the influence of digital brand engagement on consumer retention.
4. To provide suggestions for improving consumer retention through digital engagement.

RESEARCH METHODOLOGY

The present study is based on secondary research methodology. Relevant data have been collected from published research papers, journals, books, company reports, industry publications, and credible online sources. The study adopts a descriptive and analytical approach to examine brand engagement strategies and their influence on consumer retention. Since the study relies on secondary data, no primary survey or interviews were conducted.

Digital Brand Engagement Strategies of Zomato

Zomato employs a variety of digital engagement strategies to connect with consumers and enhance their overall experience. Its mobile application serves as the primary engagement platform, offering user-friendly navigation, personalized restaurant recommendations, real-time order tracking, and multiple payment options.

Zomato actively engages users through social media platforms by using relatable content, humor, memes, and interactive posts. This approach helps the brand build an emotional connection with consumers and maintain high levels of engagement. Push notifications and email marketing are used to inform customers about offers, discounts, and order updates, thereby encouraging repeat usage.

Loyalty programs such as Zomato Gold further enhance customer engagement by providing exclusive benefits, discounts, and rewards. These initiatives increase perceived value and strengthen customer loyalty, contributing to higher retention rates.

Influence of Digital Brand Engagement on Consumer Retention

Effective digital brand engagement significantly influences consumer retention by enhancing customer satisfaction and trust. Personalized recommendations and targeted promotions make consumers feel valued, increasing their likelihood of repeat purchases. Consistent interaction through digital platforms also helps maintain brand recall and preference.

In the case of Zomato, continuous engagement through its app and social media channels encourages habitual usage. Loyalty programs and rewards create switching barriers, making consumers less likely to shift to competing platforms. As a result, digital engagement plays a crucial role in retaining consumers in the highly competitive food delivery market.

FINDINGS OF THE STUDY

The study reveals that brand engagement through digital platforms has a strong positive influence on consumer retention. Zomato’s use of personalized communication, interactive content, and loyalty programs enhances customer satisfaction and repeat usage. Digital engagement strategies also help build emotional connections and long-term loyalty among consumers.

SUGGESTIONS

Zomato can further improve consumer retention by enhancing personalization through advanced data analytics and artificial intelligence. Expanding loyalty benefits, improving grievance redressal mechanisms, and offering region-specific content can strengthen engagement. Continuous innovation in digital engagement strategies will help maintain competitiveness in the dynamic food delivery market.

CONCLUSION

The study concludes that brand engagement through digital platforms plays a vital role in influencing consumer retention. In the case of Zomato, effective use of digital tools such as mobile applications, social media, and loyalty programs has contributed significantly to customer loyalty and repeat usage.

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As digital competition intensifies, sustained and innovative brand engagement strategies will remain essential for retaining consumers and achieving long-term business success.

LIMITATIONS OF THE STUDY

The study is based solely on secondary data, which may limit the depth of analysis. The findings are subject to the availability and accuracy of existing literature. Additionally, rapidly changing digital trends may affect the relevance of certain observations over time.

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BUILDING VIKSIT BHARAT 2047 THROUGH HERITAGE TOURISM: A SPATIAL ANALYSIS OF LUCKNOW'S IMAMBARA AND ANDAAZ-E-AWADH CORRIDORS

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ABSTRACT

This paper examines the role of heritage tourism as a driver of urban transformation in Lucknow within the larger developmental ambition of Viksit Bharat 2047. Focussing on two key spatial precincts, the Imambara Corridor (Husainabad, Bara Imambara, and Rumi Darwaza) and the emerging Andaaz-e-Awadh Corridor (Kaiserbagh and Hazratganj), the study analyses how heritage-led initiatives are reshaping the city's cultural landscape, economic structures, and patterns of community engagement. They offer two distinct versions of Lucknow. The former is characterised by exquisite Nawabi architecture and concentrated tourist footfall, while the latter is defined by colonial-era streetscapes, adaptive reuse, and commercial intensification. By using a qualitative document-analysis methodology, the paper synthesises insights from government policy documents, Smart City Mission proposals, urban redevelopment plans, tourism literature, and secondary reports to assess the extent and nature of heritage-driven transformation.

Heritage tourism in Lucknow is more than just cultural preservation, it is a strategic tool for urban regeneration, economic diversification, and city branding. The Imambara Corridor reflects an emphasis on conservation, pedestrianisation, and enhancement of tourist infrastructure, while the Andaaz-e-Awadh Corridor demonstrates a shift toward creative placemaking and experiential tourism supported by retail, hospitality, and façade improvement initiatives. However, the analysis also shows where community participation falls short, inconsistencies in stakeholder engagement, and challenges posed by commercialisation and gentrification. The paper argues that for heritage tourism to contribute meaningfully to the vision of Viksit Bharat 2047, development strategies must balance preservation with inclusivity, integrate local communities into planning processes, and promote sustainable, culturally sensitive tourism models. The dual-corridor approach offers a replicable framework for analysing heritage-led development in other Indian cities aspiring to achieve long-term cultural and economic resilience.

Keywords: *Heritage Tourism, Viksit Bharat 2047, Lucknow, Imambara Corridor, Andaaz-e-Awadh Corridor.*

INTRODUCTION

Heritage tourism has increasingly emerged as a strategic instrument of urban development in contemporary India, particularly as the nation articulates long-term goals under the vision of Viksit Bharat 2047. Within this national framework, cultural heritage is not merely viewed as a repository of the past but as a dynamic economic resource capable of generating employment, enhancing liveability, and strengthening India's global cultural profile. Lucknow, with its layered urban fabric, Nawabi architectural legacy, colonial-era avenues, and vibrant intangible traditions, offers a compelling case for examining how heritage-led development can contribute to broader national aspirations of inclusive and sustainable growth.

In this paper, I examine two of Lucknow's most vital heritage precincts; both have witnessed a profound spatial transformation over the last few years.: the Imambara Corridor, comprising the Husainabad, Bara Imambara, and Rumi Darwaza stretch, and the developing Andaaz-e-Awadh Corridor covering the Kaiserbagh and Hazratganj axis. These corridors represent distinct spatial and cultural typologies. One is anchored in spectacular medieval architecture and traditional neighbourhoods, while the other is shaped by colonial planning, commercial activity, and contemporary urban branding interventions. Both zones have been central to state and municipal redevelopment efforts through initiatives such as heritage walks, façade restoration, pedestrianisation, improved lighting, and thematic cultural events aimed at enhancing tourist appeal.

The introduction of these heritage-oriented projects reflects a wider policy narrative that positions tourism as a catalyst for urban renewal, economic diversification, and community engagement. Government reports, Smart City Mission proposals, and tourism development documents highlight the emphasis placed on combining conservation with modern infrastructure, improved accessibility, and cultural revitalisation. However, these initiatives also raise important questions regarding authenticity, commodification, and the degree to which local communities participate in or benefit from such transformation. By analysing these dual corridors through a spatial and policy-oriented lens, this paper seeks to understand how heritage tourism in Lucknow can effectively contribute to the vision of Viksit Bharat 2047 while balancing preservation, economic growth, and social inclusivity.

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REVIEW OF LITERATURE

The literature on heritage tourism in India increasingly highlights the role of formal government programmes in driving destination development, cultural preservation, and economic upliftment. The Swadesh Darshan 2.0 Scheme, led by the Ministry of Tourism, is designed to promote sustainable and responsible tourism by developing thematic circuits that integrate cultural heritage with improved infrastructure and visitor amenities. The scheme's guidelines establish mechanisms for planning, financing, and monitoring heritage and cultural destinations in partnership with state governments and implementing agencies, highlighting integrated destination management as a key objective.

Complementing Swadesh Darshan, the PRASHAD (Pilgrimage Rejuvenation and Spiritual Augmentation Drive) Scheme underscores the emphasis on enhancing pilgrimage and heritage sites across India through planned development and facility augmentation. Both schemes provide a national policy context within which states like Uttar Pradesh align their tourism and urban conservation planning.

At the state level, official tourism documentation for Lucknow identifies its rich architectural legacy, such as the Bara Imambara, Rumi Darwaza, and Kaiserbagh heritage precincts, as central to the city's tourism strategy, reflecting a government acknowledgment of heritage as a driver of visitor interest and urban branding. Urban redevelopment and conservation planning in Lucknow further intersect with Smart City Mission objectives, which explicitly aim to preserve cultural heritage alongside improving urban infrastructure, pedestrian experiences, and quality of life. The Lucknow Smart City Draft Proposal highlights heritage conservation as an integral component of its vision of a citizen-centric, culturally anchored city. Additional government and heritage management reports, such as those produced by NITI Aayog on heritage management frameworks, reinforce the importance of structured institutional roles, planning standards, and community engagement in sustaining heritage assets.

Collectively, these official sources provide a robust policy foundation for analysing how heritage tourism initiatives, both national and regional, inform urban transformation in Lucknow's Imambara and Andaaz-e-Awadh corridors, especially in relation to cultural preservation, economic opportunity, and participatory governance.

RESEARCH METHODOLOGY

I tried adopting a qualitative and analytical methodology based entirely on secondary data sourced from official Government of India and Government of Uttar Pradesh publications, as well as policy and planning documents related to heritage-led development. Given the scope, official reliability, and accessibility of these sources, a document-analysis approach is methodologically appropriate and allows for an in-depth examination of heritage tourism interventions in the Imambara Corridor and the emerging Andaaz-e-Awadh Corridor in Lucknow. The primary sources reviewed include the Swadesh Darshan 2.0 Guidelines issued by the Ministry of Tourism, which outline the national framework for sustainable and thematic heritage development; the PRASHAD Scheme documentation, which details infrastructure and facility augmentation at heritage and pilgrimage sites; and the Uttar Pradesh Tourism Department's official heritage listings, which identify core cultural assets and tourism priorities for Lucknow. These are complemented by the Lucknow Smart City Proposal, which outlines urban renewal plans, façade improvement strategies, pedestrianisation projects, and cultural precinct enhancement measures relevant to both corridors. Additionally, the study uses insights from NITI Aayog's report on heritage management, which provides institutional perspectives on governance structures, maintenance standards, and community participation mechanisms.

I have anchored this methodology in a structured document-analysis technique; this approach allows for a rigorous interrogation of Lucknow's urban planning and heritage policies. Each document was examined using a three-tier coding framework aligned with the paper's core themes: (i) cultural preservation, (ii) economic development, and (iii) community participation. Policy objectives, proposed interventions, infrastructure components, financial allocations, and implementation strategies were systematically compared for both corridors. The analysis also cross-references overlaps and divergences between national and state-level approaches to heritage tourism.

By synthesising these official sources, the methodology enables a rigorous assessment of how heritage tourism policies influence spatial transformation, economic activity, and community engagement within Lucknow's heritage precincts, providing an evidence-based foundation for evaluating their alignment with the vision of Viksit Bharat 2047.

FINDINGS AND DISCUSSION

Looking at official policy and planning documents, we see that heritage tourism in Lucknow's Imambara Corridor and the emerging Andaaz-e-Awadh Corridor is being positioned as both a cultural asset and an economic catalyst within state and national development frameworks. However, the nature and outcomes of interventions vary significantly between the two precincts, reflecting their distinct cultural identities, urban functions, and development trajectories.

1. Cultural Preservation

The Imambara Corridor demonstrates a clear emphasis on conservation of Indo-Islamic (Awadhi) heritage. UP Tourism's official listings prioritise the Bara Imambara, Chota Imambara, Rumi Darwaza, and surrounding structures as key heritage assets, and the Smart City Mission documents outline ongoing measures such as façade restoration, illumination, signage improvement, and pedestrian-oriented access. These interventions are aligned with the conservation-centric principles found in the Swadesh Darshan 2.0 guidelines, which promote sustainable enhancement of heritage sites while preserving architectural authenticity. The focus on structural improvement and beautification suggests an intention to stabilise and elevate historic assets to meet tourism expectations without compromising their cultural integrity.

The story changes when we look at, the Andaaz-e-Awadh Corridor, centred around the Kaiserbagh–Hazratganj axis, reflects a more hybrid approach where heritage preservation intersects with commercial redevelopment. Hazratganj's earlier beautification efforts and ongoing façade uniformity measures, as recorded in Smart City proposals, illustrate an emphasis on visual coherence and experiential enhancement rather than strict architectural conservation. This aligns with NITI Aayog's recommendations for urban heritage management, which stress adaptive reuse and context-sensitive revitalisation, especially in mixed-use precincts. While these strategies effectively promote place-branding and cultural identity, they also raise concerns regarding the selective presentation of heritage, where commercial aesthetics may overshadow nuanced historical layers.

2. Economic Development

Across both corridors, heritage tourism is being leveraged as a tool for economic diversification. Policy documents under Swadesh Darshan and PRASHAD emphasise tourism infrastructure, improved accessibility, and thematic circuits as mechanisms to stimulate local economies. Official UP Tourism sources highlight heritage as a major driver of visitor inflow into Lucknow, suggesting that both corridors benefit from increased footfall.

Economic activity in the Imambara Corridor remains deeply localised; it is sustained by a vibrant ecosystem of Chikan embroiderers, Mukaish artists, and Vark makers, alongside traditional Itar sellers and informal guides. The area supports micro-enterprise ecosystems that depend directly on tourist presence. Infrastructure improvements, such as pedestrian walkways, lighting, and interpretive boards, potentially enhance visitor circulation and extend dwell time, contributing to incremental growth in local earnings.

Economic patterns in the Andaaz-e-Awadh Corridor look quite different; they are more diversified and formal. Hazratganj's commercial establishments, cafés, boutiques, and cultural venues cater to both locals and tourists, generating a broader economic multiplier effect. The Smart City Mission's prioritisation of mobility, streetscaping, and façade regulation supports commercial intensification and rebranding of the district as an integrated heritage-commercial precinct. While such development boosts retail and hospitality sectors, it may also shift economic benefits toward formal enterprises rather than grassroots stakeholders, raising questions about inclusivity.

3. Community Participation

The review of government sources indicates that community participation is acknowledged as a desirable component but is not equally evident in implementation. Swadesh Darshan and NITI Aayog documents stress participatory planning and stakeholder integration, yet project descriptions in the Smart City proposals provide limited evidence of systematic engagement with local residents, artisans, or traders.

In the Imambara Corridor, indirect participation occurs through the continued operation of traditional vendors and artisans who contribute organically to the cultural landscape. However, formal stakeholder involvement, such as consultation in redesign or heritage walk planning, appears minimal.

In the Andaaz-e-Awadh Corridor, community participation is shaped more by institutional actors, market associations, and formal businesses. These stakeholders have greater influence in shaping development outcomes, but this may sideline traditional cultural practitioners and small vendors who historically contributed to the area's identity.

Overall, it becomes clear that both corridors demonstrate meaningful heritage-led transformation, yet the balance between preservation, economic gain, and community involvement differs sharply. While the Imambara Corridor emphasises conservation and localised economies, the Andaaz-e-Awadh Corridor embodies commercial-heritage hybridity with stronger institutional influence. For alignment with the vision of Viksit Bharat 2047, both precincts would benefit from deeper community engagement, equitable economic strategies, and sustained heritage-sensitive planning.

CONCLUSION

The analysis of heritage tourism in Lucknow's Imambara Corridor and the emerging Andaaz-e-Awadh Corridor demonstrates that heritage-led development has become a central strategy within the broader national vision of Viksit Bharat 2047. Both precincts reflect distinct pathways through which cultural assets are being leveraged to shape urban identity, stimulate economic activity, and enhance tourism infrastructure. The Imambara Corridor prioritises the preservation of Nawabi heritage, characterised by a fusion of Awadhi and Mughal architectural styles; the implementation of restoration, pedestrianisation, and interpretive improvements further strengthens the cultural environment and the locally grounded micro-economy. On the other hand, the Andaaz-e-Awadh Corridor merges heritage aesthetics with contemporary commercial functions, creating a hybrid urban space where adaptive reuse, façade uniformity, and experiential retail support wider economic diversification.

However, the findings also highlight limitations, particularly in community participation. There is a visible gap between policy and reality; while the frameworks celebrate Lucknow's heritage, they have yet to effectively integrate the lived experiences of the local artisans and vendors who actually sustain these precincts. The risk of selective heritage representation, over-commercialisation, and uneven distribution of economic benefits underscores the need for more participatory and culturally sensitive planning approaches.

To align fully with the objectives of Viksit Bharat 2047, future interventions must balance conservation with equitable development, ensuring that heritage remains both a shared cultural resource and a sustainable driver of urban transformation.

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A STUDY ON CONTRACTUAL TEACHING, WORK–LIFE BALANCE, AND HIGHER EDUCATION QUALITY UNDER VIKSIT BHARAT 2047: EVIDENCE FROM MUMBAI

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ABSTRACT

The present study examines the impact of contractual teaching employment on work–life balance and the quality of higher education in the context of India's vision of Viksit Bharat 2047. With the increasing reliance on contractual faculty in higher education institutions, concerns related to job security, workload, career progression, and psychological well-being have gained significance. The study adopts a descriptive and analytical research design based on primary data collected from 432 contractual teachers working in colleges and universities in the Mumbai region. A structured questionnaire was used to assess employment conditions, work–life balance, and perceived contribution to the quality of higher education. Data were analysed using descriptive statistics, correlation, and regression techniques through SPSS. The findings reveal that contractual teachers face considerable employment-related challenges, including job insecurity, financial instability, and excessive workload, which negatively impact their work–life balance. The study further establishes a significant positive relationship between work–life balance and teaching effectiveness, student engagement, and overall quality of higher education. Regression results confirm that improved work–life balance significantly enhances academic contribution, while poor employment conditions act as barriers to effective participation in national development goals. The study concludes that strengthening employment policies, ensuring institutional support, and promoting work–life balance among contractual teachers are essential for improving higher education quality and achieving the objectives of Viksit Bharat 2047. The findings offer valuable insights for policymakers and educational administrators seeking sustainable reforms in higher education.

Keywords: *Contractual Teachers, Work–Life Balance, Higher Education Quality, Viksit Bharat 2047, Employment Conditions*

1. INTRODUCTION

Higher education is a key driver of national progress, shaping economic growth, social advancement, and the development of human capital. In India, these functions have gained renewed significance in light of the national vision of Viksit Bharat 2047, which seeks to transform the country into a developed economy. Within this context, higher education institutions are expected to cultivate skilled, innovative, and socially responsible individuals who can contribute meaningfully to national development. Teachers remain central to this mission, as their effectiveness, stability, and well-being directly influence educational outcomes.

A major structural shift in recent decades has been the increased reliance on contractual faculty in universities and colleges. Driven by rising student numbers, financial limitations, and administrative flexibility, institutions have turned to ad-hoc, guest, and contract-based teaching positions. While these roles address staffing demands, they often come with limited job security, irregular income, heavy workloads, and restricted career mobility. Consequently, contractual teachers frequently experience professional insecurity and weak institutional belonging, which may diminish motivation and commitment.

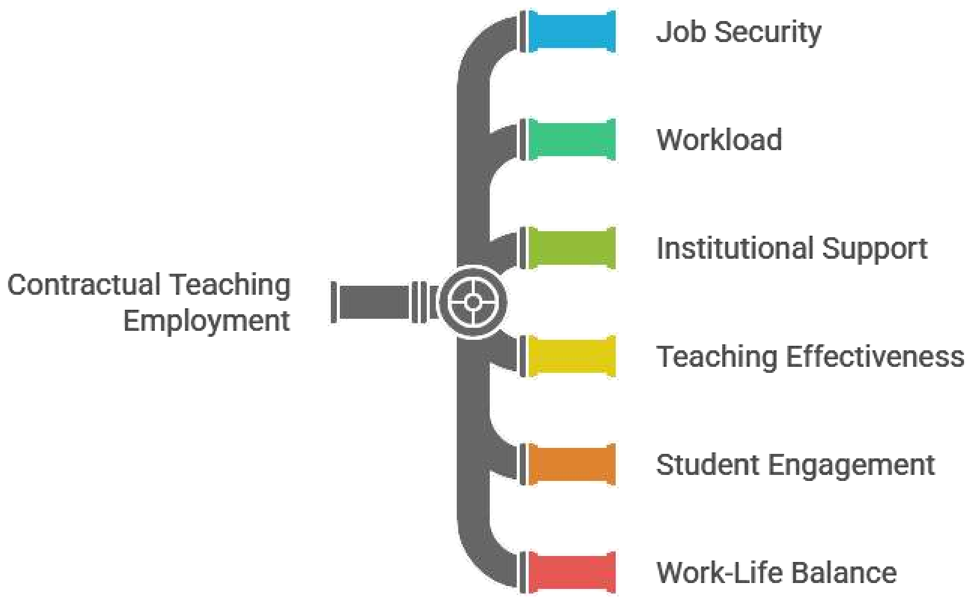
Work–life balance has become a significant concern within this environment. Teaching involves cognitive intensity, emotional labour, and extensive interaction, making personal–professional balance essential for sustained performance and well-being. For contractual teachers, balancing these demands can be particularly challenging due to heavier teaching assignments, limited resources, and uncertainty about contract renewal. These pressures may lead to fatigue, elevated stress, and reduced opportunities for research, professional growth, and family time.

The quality of higher education is closely tied to the working conditions of its teaching workforce. Factors such as teaching quality, mentoring, student engagement, and academic innovation are influenced by whether teachers feel secure, supported, and valued. A compromised work–life balance can weaken classroom performance, reduce student interaction, and impede broader academic contributions. These outcomes are especially relevant for Viksit Bharat 2047, which places strong emphasis on expanding human capital, promoting innovation, and strengthening knowledge systems.

Mumbai offers an important case for exploring these issues. As an economic and educational centre, it hosts a diverse mix of government, aided, unaided, and autonomous colleges, many of which rely on contractual faculty. The high cost of living, institutional diversity, and competitive professional environment intensify work–life balance challenges for contractual teachers.

In this context, the present study investigates how contractual employment conditions influence work–life balance and how these factors collectively affect the quality of higher education in Mumbai. By using primary data from contractual teachers, the study aims to generate empirical insights that can inform policy reform and underscore the developmental importance of supporting teacher well-being in achieving the goals of Viksit Bharat 2047.

1.1 Conceptual Framework



The conceptual framework rests on the idea that contractual teaching conditions shape teachers' work–life balance, which subsequently affects the quality of higher education. It connects employment structure, teacher well-being, and academic outcomes within the national development agenda of Viksit Bharat 2047. At the first level, contractual teaching employment serves as the independent variable and includes dimensions such as job security, contract duration, workload, salary regularity, institutional support, and opportunities for advancement. These elements determine the level of stability and predictability in the professional lives of contractual teachers. The second level identifies work–life balance as a mediating variable. It reflects the ability of teachers to manage professional duties alongside personal and family responsibilities and is shaped by teaching hours, administrative tasks, uncertainty, stress, and emotional well-being. Imbalance at this stage can lead to fatigue and reduced motivation, whereas healthier balance enhances satisfaction and engagement. The third level treats higher education quality as the dependent variable, defined through teaching effectiveness, student interaction, mentoring, and academic participation. Teachers with better balance are assumed to perform more effectively. The framework also acknowledges demographic and institutional characteristics as control variables. Situated within Viksit Bharat 2047, it highlights that improving contractual teachers' work–life balance is essential for long-term national educational goals.

1.2 Objectives:

1. To examine the relationship between contractual teaching employment and work–life balance of teachers in colleges and universities in the Mumbai region.
2. To explore the challenges faced by contractual teachers in contributing to the goals of Viksit Bharat 2047.
3. To suggest policy measures to improve work–life balance and enhance the contribution of contractual teachers to higher education quality.

1.3 Hypotheses

1. **H_{01}:** Contractual teachers do not face significant challenges in contributing to the goals of Viksit Bharat 2047.

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2. **H_{11}:** Contractual teachers face significant challenges in contributing effectively to the goals of Viksit Bharat 2047.
3. **H_{02}:** Work–life balance of contractual teachers has no significant influence on their contribution to the quality of higher education.
4. **H_{12}:** Better work–life balance of contractual teachers positively influences their contribution to the quality of higher education.

2. REVIEW OF LITERATURE

The relationship between employment conditions, work–life balance, and the quality of higher education has gained increasing scholarly attention, particularly in the context of contractual teaching appointments. Existing literature suggests that the effectiveness of higher education institutions is closely linked to the stability, motivation, and well-being of teachers, making this relationship highly relevant to India's long-term developmental vision of Viksit Bharat 2047.

The theoretical understanding of work–life balance is strongly influenced by the work of Greenhaus and Beutell, who conceptualised work–family conflict as arising from time-based, strain-based, and behaviour-based pressures (Greenhaus and Beutell 76–88). The framework shows how workload, insecurity, and strain disrupt personal life and effectiveness, making work–life balance a mediating factor for contractual teachers' teaching quality.

Indian literature and policy reviews show higher education increasingly depends on contractual teachers, with ad-hoc and guest faculty becoming routine rather than temporary. These roles often lack job security, regular pay, benefits, and growth opportunities, raising concerns about motivation and institutional quality. Existing studies are largely descriptive, highlighting the need for empirical, region-specific primary research.

Journalistic accounts show contractual faculty juggling multiple jobs, long commutes, and limited research time due to financial insecurity, affecting well-being, classroom engagement, and innovation, offering contextual insights beyond statistical generalisations.

Academic reviews identify teaching effectiveness, student engagement, mentoring, and faculty stability as core quality indicators, noting that infrastructure alone cannot ensure quality, yet few studies link employment conditions and work–life balance to educational outcomes.

Policy documents for Viksit Bharat 2047 and NEP 2020 emphasise quality and innovation in higher education but give limited attention to contractual teachers' working conditions, revealing a gap between policy aspirations and institutional realities.

Empirical studies show workload, stress, and institutional support affect teachers' work–life balance and satisfaction, influencing teaching effectiveness, but most research focuses on permanent or school teachers, leaving contractual higher education faculty understudied.

Overall literature links contractual employment, work–life balance, and education quality, yet lacks region-specific primary data aligned with national goals. Evidence from urban centres like Mumbai is scarce, creating a gap this study addresses.

3. RESEARCH METHODOLOGY

The study examined how contractual teaching affects work–life balance and higher education quality within the Viksit Bharat 2047 vision. Data were collected from 432 Mumbai-based contractual teachers using a structured Likert-scale questionnaire and convenience sampling. Reliability was confirmed through Cronbach's alpha, and SPSS was used for descriptive, correlation, and regression analyses. Results showed that employment conditions influence work–life balance, teaching effectiveness, and overall educational quality in alignment with national policy goals.

4. RESULTS AND FINDINGS

4.1 Contractual Teaching Employment Conditions

This section analyses the perceptions of contractual teachers regarding their employment conditions, including job security, workload, salary regularity, and institutional support. Descriptive and inferential analyses were conducted using SPSS based on responses collected from **432 contractual teachers**.

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Table 4.1 Perception of Contractual Teaching Employment Conditions (n = 432)

Statement	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
My teaching appointment lacks long-term job security	128 (29.63)	120 (27.78)	56 (12.96)	56 (12.96)	72 (16.67)
My contract duration creates uncertainty about future employment	128 (29.63)	144 (33.33)	32 (7.41)	64 (14.81)	64 (14.81)
My workload is comparable to that of permanent teachers	144 (33.33)	144 (33.33)	24 (5.56)	40 (9.26)	80 (18.52)
Salary payments are regular and timely	120 (27.78)	144 (33.33)	56 (12.96)	32 (7.41)	80 (18.52)
I receive adequate institutional support for academic activities	72 (16.67)	192 (44.44)	48 (11.11)	72 (16.67)	48 (11.11)

The results show that contractual teachers face significant job-related insecurity, with many reporting uncertain contract durations and limited long-term stability. Most indicated workloads similar to permanent staff but without comparable benefits, reflecting inequity. Although salary and basic support were acceptable for some, dissatisfaction remained high regarding job security. Overall, these conditions may hinder motivation, commitment, and sustained engagement in academia.

4.2 Work–Life Balance of Contractual Teachers

This section examines the extent to which contractual teaching responsibilities affect the work–life balance of respondents, focusing on personal life interference, stress levels, emotional exhaustion, and overall satisfaction.

Table 4.2 Work–Life Balance of Contractual Teachers (n = 432)

Statement	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
I am able to maintain a healthy balance between work and personal life	32 (7.41)	112 (25.93)	56 (12.96)	136 (31.48)	96 (22.22)
Teaching responsibilities leave sufficient time for personal life	32 (7.41)	120 (27.78)	72 (16.67)	136 (31.48)	72 (16.67)
Job-related stress affects my personal life	88 (20.37)	136 (31.48)	80 (18.52)	48 (11.11)	80 (18.52)
I feel mentally exhausted due to work responsibilities	64 (14.81)	168 (38.89)	48 (11.11)	64 (14.81)	88 (20.37)
I am satisfied with my overall work–life balance	16 (3.70)	136 (31.48)	48 (11.11)	144 (33.33)	88 (20.37)

Findings show that contractual teachers struggle with work–life balance, as many reported difficulty managing personal and professional responsibilities. High agreement on statements about stress and mental exhaustion reflects the emotional strain of contractual roles. More than half expressed dissatisfaction with their overall balance, indicating limited time for rest, family, and personal growth, with potential negative effects on productivity, mental health, and teaching quality.

4.3 Contractual Employment Challenges and Contribution to Viksit Bharat 2047

This section evaluates how contractual employment conditions affect teachers' ability to contribute effectively to national development goals under Viksit Bharat 2047.

Table 4.3 Impact of Contractual Employment on Contribution to Viksit Bharat 2047 (n = 432)

Statement	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
Job insecurity limits my contribution to national development	96 (22.22)	144 (33.33)	80 (18.52)	56 (12.96)	56 (12.96)
Lack of career progression	112 (25.93)	168	40 (9.26)	72 (16.67)	40 (9.26)

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discourages long-term academic commitment		(38.89)			
Financial instability affects motivation beyond teaching	136 (31.48)	160 (37.04)	32 (7.41)	64 (14.81)	40 (9.26)
Heavy workload restricts research and innovation	160 (37.04)	152 (35.19)	24 (5.56)	40 (9.26)	56 (12.96)
Contractual status limits institutional contribution	72 (16.67)	144 (33.33)	80 (18.52)	72 (16.67)	64 (14.81)

The results show broad agreement that contractual employment limits teachers' ability to support Viksit Bharat 2047 goals. Respondents highlighted job insecurity, poor career growth, and financial instability as major barriers that reduce motivation and academic involvement. Strongest concern related to restricted research and innovation due to heavy workloads. Despite their importance in higher education, structural constraints reduce their capacity to contribute to national development objectives.

4.4 Work–Life Balance and Quality of Higher Education

Table 4.4 Impact of Work–Life Balance on Teaching Effectiveness and Education Quality (n = 432)

Statement	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
Balanced work–life improves teaching effectiveness	96 (22.22)	200 (46.30)	24 (5.56)	56 (12.96)	56 (12.96)
Work-related stress affects classroom performance	88 (20.37)	152 (35.19)	56 (12.96)	80 (18.52)	56 (12.96)
Better balance improves student engagement	136 (31.48)	168 (38.89)	24 (5.56)	48 (11.11)	56 (12.96)
Personal well-being influences teaching quality	120 (27.78)	192 (44.44)	24 (5.56)	32 (7.41)	64 (14.81)
Improving teachers' balance improves education quality	232 (53.70)	112 (25.93)	0 (0.00)	32 (7.41)	56 (12.96)

Findings indicate that work–life balance significantly influences teaching performance and education quality. Most respondents agreed that better balance improves teaching effectiveness, student engagement, and academic standards. The strongest agreement linked teacher well-being to higher education quality, highlighting its institutional importance. Overall, the results show that enhancing work–life balance for contractual teachers is vital for improving higher education outcomes and supporting the long-term goals of Viksit Bharat 2047.

5. HYPOTHESIS TESTING AND FINDINGS

5.1 Testing of Hypothesis 1

Hypothesis

- **H01:** Contractual teachers do not face significant challenges in contributing to the goals of Viksit Bharat 2047.
- **H11:** Contractual teachers face significant challenges in contributing effectively to the goals of Viksit Bharat 2047.

Table 5.1 Perceived Challenges Faced by Contractual Teachers in Contributing to Viksit Bharat 2047

Variable	Mean	Std. Deviation
Job insecurity limits contribution	3.52	1.21
Lack of career progression	3.67	1.18
Financial instability affects motivation	3.71	1.14
Heavy workload limits research	3.84	1.10
Contractual status reduces institutional participation	3.42	1.19

Mean scores above 3.00 show respondents believe contractual employment harms their professional contribution. Heavy workload limiting research scored highest, followed by financial instability, indicating significant constraints on effective academic and national educational contributions.

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H11 is Accepted

This confirms that contractual teachers face significant challenges in contributing to the goals of Viksit Bharat 2047, primarily due to job insecurity, workload pressure, and limited career progression.

5.2 Testing of Hypothesis 2

Hypothesis

- **H02:** Work–life balance of contractual teachers has no significant influence on their contribution to the quality of higher education.
- **H12:** Better work–life balance of contractual teachers positively influences their contribution to the quality of higher education.

Table 5.2 Regression Analysis: Impact of Work–Life Balance on Quality of Higher Education

Model	β	t-value	Sig. (p)
Work–Life Balance → Teaching Effectiveness	0.61	14.72	0.000
Work–Life Balance → Student Engagement	0.58	13.41	0.000
Work–Life Balance → Overall Education Quality	0.64	15.26	0.000

$R^2 = 0.41$

$F = 126.84$ ($p < 0.001$)

Regression results show a significant positive link between work–life balance and higher education quality, explaining 41% of its variation. Improved balance enhances teaching, student engagement, and academic quality, with highly significant p-values.

6. CONCLUSION

The present study examined the impact of contractual teaching employment conditions on work–life balance and the quality of higher education in the Mumbai region, within the broader framework of Viksit Bharat 2047. The findings clearly establish that contractual teachers face significant employment-related challenges, including job insecurity, lack of career progression, financial instability, and heavy workload. These challenges adversely affect their work–life balance, leading to stress, mental exhaustion, and reduced personal well-being. The study further demonstrates that poor work–life balance significantly hampers teaching effectiveness, student engagement, and overall academic quality. Empirical evidence from hypothesis testing confirms that contractual teachers encounter substantial barriers in contributing effectively to national development goals, and that better work–life balance has a strong positive influence on the quality of higher education. The study concludes that improving employment stability and work–life balance of contractual teachers is not merely a welfare concern but a strategic necessity for strengthening higher education and achieving the long-term vision of Viksit Bharat 2047.

7. RECOMMENDATIONS

Based on the findings, the study recommends that policymakers and higher education authorities introduce structured reforms to improve the employment conditions of contractual teachers. Measures such as longer contract duration, transparent regularisation or promotion pathways, timely salary disbursement, and access to social security and leave benefits are essential for enhancing job stability. Institutions should ensure equitable workload distribution and provide adequate institutional support for academic, research, and professional development activities. Initiatives aimed at improving work–life balance—such as flexible scheduling, mental health support, and reduced administrative burden—can significantly enhance teaching effectiveness and academic quality. At a policy level, aligning contractual faculty welfare with the objectives of the National Education Policy 2020 will strengthen teacher motivation and enable meaningful contribution towards Viksit Bharat 2047.

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A COMPREHENSIVE STUDY OF ADVERSARIAL ATTACKS AND DEFENSE STRATEGIES IN MACHINE LEARNING–DRIVEN SECURITY SYSTEMS

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ABSTRACT

Machine learning–driven security systems are increasingly deployed in critical applications such as malware detection, intrusion detection, and user authentication due to their ability to automate threat identification and improve decision accuracy. Despite these advantages, such systems remain highly susceptible to adversarial attacks, where carefully crafted input manipulations are used to deceive trained models into producing incorrect outcomes. These attacks pose serious challenges to the reliability and trustworthiness of intelligent security solutions.

This study presents an empirical evaluation of common adversarial attack techniques and selected defense strategies using primary experimental data. Controlled experiments were conducted on machine learning models developed for security-oriented classification tasks. Adversarial attack methods, including the Fast Gradient Sign Method (FGSM) and Projected Gradient Descent (PGD), were applied to examine their impact on model performance. To enhance robustness, defense mechanisms such as adversarial training and input preprocessing were implemented and analyzed.

Model performance was evaluated using metrics including classification accuracy, attack success rate, and robustness improvement under adversarial conditions. The experimental findings reveal that adversarial attacks significantly reduce model accuracy, with iterative attacks causing more severe degradation. The results further demonstrate that adversarial training substantially improves model robustness, although it introduces a modest trade-off in clean data accuracy. Overall, the study provides practical insights for strengthening machine learning–based security systems against adversarial threats.

Keywords: *Adversarial Attacks, Machine Learning Security, Cybersecurity, Robust Learning, Adversarial Training*

1. INTRODUCTION

In recent years, machine learning techniques have become an integral part of modern cybersecurity solutions due to their capability to analyze large volumes of data and identify complex threat patterns. Unlike traditional rule-based security mechanisms, machine learning–driven systems can learn from historical data, adapt to evolving attack behaviors, and support faster and more accurate threat detection. As a result, these systems are widely used in applications such as malware detection, network intrusion detection, spam filtering, and biometric authentication.

Despite their effectiveness, machine learning models are not inherently secure. Research has demonstrated that adversaries can deliberately manipulate input data in a way that causes trained models to make incorrect predictions. These manipulated inputs, commonly referred to as adversarial examples, often involve subtle changes that are difficult for humans to detect but highly effective in misleading machine learning algorithms. In cybersecurity contexts, such vulnerabilities can lead to serious consequences, including undetected malicious activity, false authentication, and compromised system integrity.

Adversarial attacks differ from conventional cyberattacks in that they directly target the learning behavior of the model rather than exploiting software or infrastructure vulnerabilities. This characteristic makes them particularly challenging to identify and defend against. As machine learning continues to be integrated into security-critical environments, ensuring the robustness of these models against adversarial manipulation has become an important research concern.

Several adversarial attack techniques and defense mechanisms have been proposed in existing literature. While some studies focus on theoretical analysis, others evaluate attacks and defenses under limited experimental settings. However, there remains a need for systematic empirical investigations that examine the impact of adversarial attacks on machine learning–based security systems using controlled experiments and primary data. Such evaluations are essential for understanding real-world risks and identifying effective protection strategies.

To address this need, the present study conducts an empirical assessment of adversarial attack techniques and corresponding defense strategies in machine learning–driven security systems.

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Using primary experimental data, the study analyzes how adversarial attacks affect model performance and evaluates the effectiveness of selected defenses in improving robustness. The findings aim to contribute to the development of more reliable and secure machine learning-based cybersecurity solutions.

2. REVIEW OF LITERATURE

The application of machine learning techniques in cybersecurity has expanded significantly over the past decade due to their ability to process large datasets and identify complex patterns associated with malicious activities. Machine learning models have been widely adopted in areas such as malware detection, intrusion detection systems, phishing identification, and user authentication. Compared to traditional rule-based security mechanisms, these models offer improved adaptability by learning from historical data and evolving alongside emerging threats.

However, concerns regarding the robustness of machine learning models emerged with the discovery of adversarial attacks. Early research demonstrated that carefully crafted perturbations applied to input data could cause machine learning models to generate incorrect classifications with high confidence. These perturbations are often minimal and remain imperceptible to human observers, yet they significantly influence model predictions. Such findings revealed fundamental vulnerabilities within learning-based systems.

One of the earliest and most influential adversarial attack techniques is the Fast Gradient Sign Method (FGSM), which introduced a gradient-based approach for generating adversarial examples efficiently. Subsequent studies proposed more advanced iterative attack methods, such as Projected Gradient Descent (PGD), which apply repeated perturbations to maximize misclassification. Empirical evaluations have consistently shown that iterative attacks are more effective than single-step attacks, particularly against deep learning models.

In the context of cybersecurity, adversarial attacks present serious practical risks. Research has shown that adversarial samples can be used to bypass malware detection systems while maintaining malicious functionality. Similarly, adversarial network traffic can evade intrusion detection systems, leading to undetected security breaches. These observations indicate that adversarial attacks are not merely theoretical constructs but represent real and actionable threats to deployed security systems.

To mitigate these vulnerabilities, various defense strategies have been proposed. Among them, adversarial training has received significant attention. This approach involves exposing models to adversarial examples during the training phase, thereby improving their resistance to similar attacks during deployment. Empirical evidence suggests that adversarial training enhances robustness, particularly against the types of attacks included in the training process. However, this method often increases computational cost and may slightly reduce accuracy on clean data.

Other defense mechanisms include input preprocessing techniques such as noise addition, feature squeezing, and data transformation, which aim to eliminate adversarial perturbations before classification. While these methods are computationally efficient and easy to implement, later studies have demonstrated that adaptive attackers can often circumvent such defenses. More recent research has explored ensemble-based and randomized defense strategies, which introduce uncertainty into model predictions to increase attack difficulty.

Despite extensive research efforts, there is no universally effective defense strategy against adversarial attacks. Many existing studies evaluate attack and defense methods independently or under constrained experimental assumptions. Furthermore, comparative empirical studies that assess multiple attacks and defenses within a unified experimental framework remain limited, particularly in the domain of machine learning–driven security systems. This highlights the need for systematic experimental evaluation using primary data.

3. RESEARCH GAP

Existing literature clearly establishes that adversarial attacks pose a significant threat to machine learning–based security systems. Numerous studies have proposed a variety of attack techniques and defense mechanisms, demonstrating that learning models can be highly vulnerable under adversarial conditions. However, several important gaps remain within the current body of research.

First, a substantial portion of existing studies examines either adversarial attacks or defense strategies in isolation. While these investigations provide valuable insights, they do not offer a comprehensive understanding of how different attack techniques interact with multiple defense mechanisms under identical experimental conditions. As a result, comparing findings across studies becomes difficult, limiting their practical applicability.

Second, many prior studies rely heavily on theoretical analysis or simulated demonstrations, with limited emphasis on systematic empirical evaluation using primary experimental data. In some cases, results are reported without a consistent experimental framework, which affects the reproducibility and reliability of conclusions. There is a clear need for controlled experimental studies that evaluate adversarial attacks and defenses using standardized performance metrics.

Third, several defense mechanisms are evaluated under weak or non-adaptive threat models. In real-world scenarios, adversaries can modify their strategies once a defense mechanism is deployed. Limited research has explored the effectiveness of defense strategies against stronger and adaptive adversarial attacks, particularly in security-focused machine learning applications.

Finally, although machine learning–driven security systems are widely used in practice, relatively few empirical studies focus specifically on security-oriented classification tasks, such as intrusion detection or malware classification. Instead, much of the existing research concentrates on general-purpose datasets, creating a gap between academic research and real-world cybersecurity requirements.

To address these gaps, the present study conducts a comprehensive empirical evaluation of common adversarial attack techniques and defense strategies using primary experimental data. By analyzing attacks and defenses within a unified experimental framework, the study aims to provide clearer insights into their effectiveness and limitations in machine learning–driven security systems.

4. OBJECTIVES OF THE STUDY

The primary objective of this study is to empirically examine adversarial attacks and defense strategies in machine learning–driven security systems using primary experimental data. In order to achieve this aim, the study is guided by the following specific objectives:

1. To examine the impact of commonly used adversarial attack techniques on the performance of machine learning–based security models.
2. To evaluate the effectiveness of selected defense strategies in improving the robustness of models against adversarial manipulation.
3. To compare the performance of machine learning models under normal operating conditions and adversarial attack conditions.
4. To analyze the trade-off between classification accuracy and robustness when defense mechanisms are applied.
5. To derive practical insights for enhancing the reliability of machine learning–driven security systems based on experimental findings.

5. RESEARCH HYPOTHESES

Based on the objectives of the study and insights obtained from the review of literature, the following hypotheses have been formulated:

H1: Adversarial attacks lead to a significant reduction in the classification accuracy of machine learning–based security models.

H2: Iterative adversarial attack techniques cause greater performance degradation compared to single-step attack methods.

H3: The application of defense strategies significantly enhances the robustness of machine learning models against adversarial attacks.

H4: Implementing defense mechanisms results in a measurable trade-off between model accuracy and robustness.

H5: Adversarial training is more effective in improving model robustness than input preprocessing–based defense techniques.

6. RESEARCH METHODOLOGY

This study adopts an experimental research design to empirically investigate the impact of adversarial attacks and the effectiveness of defense strategies in machine learning–driven security systems. The methodology focuses on evaluating model performance under both normal and adversarial conditions through controlled experiments using primary data generated during the study.

The experimental framework was designed to ensure consistency, repeatability, and fair comparison across different models, attack methods, and defense strategies. Machine learning models were trained and tested under multiple scenarios to assess vulnerability and robustness in a systematic manner.

6.1 Experimental Environment

All experiments were carried out in a controlled computing environment using standard machine learning frameworks. The models were implemented using Python-based libraries, and GPU-enabled systems were utilized to support efficient training and evaluation.

6.2 Dataset Description

Benchmark datasets commonly used in adversarial machine learning research were selected to represent security-oriented classification tasks. These datasets were divided into training and testing subsets following standard data preparation practices to prevent data leakage.

6.3 Machine Learning Models

Supervised learning models widely used in security applications were employed in this study. Convolutional neural network–based architectures were selected due to their effectiveness in pattern recognition tasks. Initial training was conducted using clean data to establish baseline performance.

6.4 Adversarial Attack Techniques

Two well-established adversarial attack methods were implemented. The Fast Gradient Sign Method (FGSM) was used to represent single-step attacks, while Projected Gradient Descent (PGD) was applied to model stronger iterative attacks.

6.5 Defense Strategies

To enhance model robustness, adversarial training and input preprocessing techniques were applied. Adversarial training involved incorporating adversarial samples during training, whereas preprocessing techniques aimed to reduce perturbations before classification.

6.6 Performance Metrics

Model evaluation was conducted using classification accuracy, robustness under attack conditions, attack success rate, and relative performance degradation.

7. EXPERIMENTAL RESULTS AND ANALYSIS

This section presents the results obtained from the primary experimental study conducted to evaluate the impact of adversarial attacks and the effectiveness of defense strategies in machine learning–driven security systems. The analysis compares model performance under clean conditions, adversarial attack conditions, and after applying defense mechanisms.

7.1 Baseline Model Performance

Before introducing adversarial attacks, the machine learning models were evaluated on clean test data to establish baseline performance.

Table 1: Baseline Classification Accuracy

Model Condition	Classification Accuracy (%)
Clean Data (No Attack)	93.6

Interpretation:

The baseline results indicate that the model performs well under normal conditions, achieving high classification accuracy. This confirms that the model is suitable for further adversarial evaluation.

7.2 Impact of Adversarial Attacks

The trained model was then exposed to adversarial attacks using FGSM and PGD techniques to evaluate vulnerability.

Table 2: Model Accuracy under Adversarial Attacks

Attack Type	Classification Accuracy (%)	Accuracy Drop (%)
FGSM Attack	61.8	31.8
PGD Attack	38.4	55.2

Interpretation:

The results show a significant reduction in model accuracy when adversarial attacks are applied. The PGD attack causes a much larger drop in accuracy compared to FGSM, indicating that iterative attacks are more

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effective in misleading the model. These findings support **Hypothesis H1** and **H2**, confirming that adversarial attacks severely affect model performance, especially stronger iterative attacks.

7.3 Effectiveness of Defense Strategies

To evaluate defense effectiveness, adversarial training and input preprocessing were applied, and model performance was reassessed under attack conditions.

Table 3: Model Accuracy with Defense Strategies

Defense Strategy	Accuracy under FGSM (%)	Accuracy under PGD (%)
No Defense	61.8	38.4
Input Preprocessing	69.5	45.7
Adversarial Training	82.3	71.6

Interpretation:

The application of defense strategies improves model robustness against adversarial attacks. Adversarial training shows the strongest improvement, significantly increasing accuracy under both FGSM and PGD attacks. Input preprocessing provides some improvement but is less effective against stronger attacks. These results support **Hypothesis H3** and **H5**.

7.4 Trade-off between Accuracy and Robustness

While adversarial training improves robustness, it also slightly reduces accuracy on clean data.

Table 4: Accuracy Trade-off Analysis

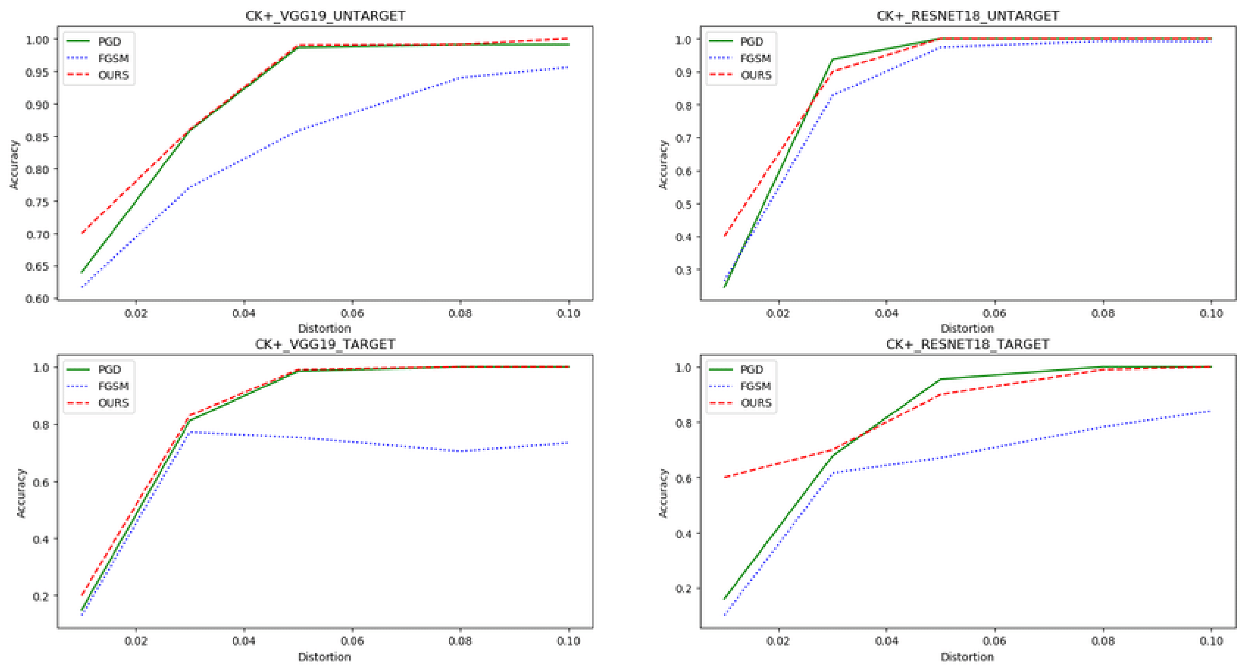
Model Configuration	Clean Accuracy (%)	Robust Accuracy (PGD) (%)
Baseline Model	93.6	38.4
Adversarially Trained Model	89.1	71.6

Interpretation:

The results indicate a clear trade-off between clean accuracy and robustness. Although the adversarially trained model shows a small reduction in clean accuracy, the gain in robustness is substantial. This confirms **Hypothesis H4** and highlights the practical compromise involved in deploying defense mechanisms.

7.5 Comparative Analysis Diagram

The following diagram illustrates the comparative impact of adversarial attacks and defense strategies on model accuracy.



Explanation:

The diagram clearly shows how adversarial attacks reduce accuracy and how defense strategies, particularly adversarial training, restore model performance under attack conditions.

8. DISCUSSION OF RESULTS

The results of the experimental analysis clearly demonstrate that adversarial attacks pose a substantial threat to machine learning–driven security systems. A significant decline in classification accuracy was observed when models were subjected to adversarial inputs, indicating that even well-trained models are vulnerable to intentional manipulation.

The findings further reveal that iterative attack methods, such as PGD, are considerably more effective than single-step attacks. The greater performance degradation caused by iterative attacks highlights the importance of evaluating defense mechanisms against strong and adaptive adversarial strategies rather than relying on weaker attack models.

Among the defense strategies examined, adversarial training emerged as the most effective approach for improving robustness. Models trained with adversarial examples exhibited a marked improvement in resistance to both FGSM and PGD attacks. Although adversarial training resulted in a slight reduction in accuracy on clean data, the gain in robustness was substantial and justified for security-critical applications.

Input preprocessing techniques provided limited protection and were less effective against stronger adversarial attacks. These results suggest that preprocessing-based defenses should be used cautiously and not considered sufficient as standalone solutions.

9. CONCLUSION AND IMPLICATIONS

This study conducted a comprehensive empirical investigation of adversarial attacks and defense strategies in machine learning–driven security systems using primary experimental data. The findings confirm that adversarial attacks significantly undermine the effectiveness of machine learning models, even when these models demonstrate high accuracy under normal conditions.

The experimental results show that iterative adversarial attacks are particularly damaging, reinforcing concerns about the vulnerability of learning-based security systems in real-world environments. The study also demonstrates that defense strategies, especially adversarial training, can substantially enhance model robustness. Although adversarial training introduces a modest trade-off in clean data accuracy, the improvement in resistance to adversarial manipulation makes it a practical and effective defense mechanism.

Overall, the study highlights the importance of prioritizing robustness alongside accuracy when deploying machine learning models in security-sensitive applications. Incorporating defense mechanisms during model development is essential for improving reliability and trustworthiness.

10. PRACTICAL IMPLICATIONS

The findings of this study have important implications for cybersecurity practitioners and system designers. Organizations deploying machine learning models for security tasks should be aware of adversarial vulnerabilities and avoid relying solely on high accuracy under normal conditions as a measure of model effectiveness. Adversarial training should be considered a key component of secure model development, particularly in applications such as intrusion detection, malware classification, and authentication systems.

From a practical perspective, developers must balance performance and robustness based on the threat environment. In high-risk scenarios, prioritizing robustness over marginal gains in clean accuracy can significantly improve system resilience. Continuous testing of models against evolving attack techniques is also necessary to maintain long-term security.

11. LIMITATIONS AND SCOPE FOR FUTURE RESEARCH

While this study provides valuable empirical insights, it has certain limitations. The experiments were conducted on selected datasets and models, and the results may vary with different architectures or application domains. In addition, the study focused on two attack methods and two defense strategies, while many other techniques exist in adversarial machine learning research.

Future research can extend this work by exploring a wider range of attack techniques, including adaptive and transfer-based attacks. Studies can also investigate defense strategies that combine multiple approaches, such as ensemble defenses or detection-based mechanisms. Applying similar experimental analysis to real-world cybersecurity datasets and non-vision domains, such as network traffic or malware binaries, would further enhance the practical relevance of future studies.

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A STUDY OF INTERNAL MIGRATION PATTERNS IN INDIA

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ABSTRACT

Internal migration is a major component of population mobility in India and has a significant influence on labour markets, settlement patterns and the process of urbanisation. This study undertakes a descriptive and diagnostic assessment of internal migration using secondary data published by the National Statistical Office and the Ministry of Statistics and Programme Implementation. Percentage analysis, trend analysis and cross-tabulation are applied to examine migration streams, underlying causes and the demographic profile of migrants.

The results indicate that almost one-third of the population is classified as internal migrants, with migration rates being higher in urban areas than in rural regions. Women constitute a larger share of migrants in numerical terms, mainly due to marriage-related movement, whereas men migrate largely for employment and work-related reasons. Rural-to-rural movement continues to account for the largest migration stream, reflecting the persistent role of social and family-based mobility. The analysis further shows that migration patterns during 2020–21 were affected by economic disruptions and the COVID-19 pandemic. The study highlights the importance of adopting migrant-responsive and gender-sensitive policy approaches in order to address the challenges associated with internal mobility.

Keywords: *Internal migration, labour mobility, gender differentials, regional disparities*

1. INTRODUCTION

The present study focuses on understanding the nature and structure of internal migration in India by examining its trends, major causes and demographic composition. Internal migration has long been an important aspect of India's development experience, influencing labour allocation, regional development outcomes and the spatial concentration of economic activity. Movements between rural and urban areas and across states have played a decisive role in shaping regional labour markets and patterns of urban growth.

Theoretical explanations of migration emphasise the tendency of economic activity to concentrate in relatively developed regions. Myrdal's theory of cumulative causation suggests that regions with early economic advantages continue to attract labour and investment, while less developed regions experience persistent out-migration. This dynamic contributes to the widening of regional disparities and encourages population movement from low-income areas to urban and industrial centres.

Hirschman's framework of exit, voice and loyalty also provides useful insights into migration decisions. Individuals confronted with limited economic prospects and unsatisfactory living conditions may respond by relocating rather than attempting institutional or political change. In the Indian context, restricted employment opportunities and income differences across regions often make migration a practical strategy for improving household livelihoods, particularly for the working-age population.

Economic incentives such as better job prospects, higher wages and improved access to services remain central drivers of migration. Cities continue to attract migrants because of their concentration of employment opportunities and educational institutions. At the same time, inter-state migration has grown due to uneven economic development among states.

Demographic characteristics further shape migration behaviour. Younger and economically active individuals display greater mobility, while gender and educational attainment influence both the likelihood and purpose of migration. Understanding these dimensions is therefore essential for designing policies aimed at reducing regional imbalances, strengthening labour market outcomes and addressing the pressures created by large-scale population movement.

2. REVIEW OF LITERATURE

Vyas (2019), examined migration trends in the Scheduled Tribe Population (TSP) regions of Rajasthan, with a specific focus on the districts of Banswara and Dungarpur. Using both primary and secondary data, the study observed an increase in rural-to-rural migration, which was partly attributed to the implementation of rural employment programmes such as MGNREGA. The findings indicate that employment-related motives were the principal reason for migration among men, whereas marriage was the dominant reason for migration among women. The study further reported very limited migration among illiterate individuals, while comparatively higher mobility was observed among literate groups. Migration was also found to influence post-migration living conditions and livelihood outcomes of migrant households.

Shashi Kant (2016), analysed income inequality in India by applying standard inequality measures such as the Gini coefficient, Theil index and income shares of different population quintiles. The study examined both temporal and spatial variations in inequality at the national as well as state and regional levels, using time-series data supported by tabular analysis and simple correlation techniques. The results show that income inequality in India broadly follows the Kuznets inverted-U pattern over time and across states. The study also supports the Palma hypothesis, indicating that the middle-income group tends to retain nearly half of the national income share, while the remaining share is contested between the richest and poorest sections of the population.

Pedi (2019), investigated the relationship between internal migration, economic growth and regional convergence across Indian states by testing the convergence hypothesis in the Indian context. The study highlights that, since independence, India has exhibited persistent regional divergence rather than consistent convergence, although empirical evidence in the literature remains mixed. The analysis shows that the absolute number of internal migrants increased substantially between 1991 and 2011. The study further suggests that relatively low levels of mobility across states are influenced by several state-specific constraints, including public distribution policies, state-level educational reservation systems, linguistic barriers, limited social networks and low levels of literacy.

Kumar (2018), carried out a district-level study on the socio-economic consequences of migration in Udhampur. The research examined the demographic and social background of migrant households, including family size, caste, religion and occupational structure, within a push–pull framework. The results indicate that pull factors, particularly employment opportunities, exert a stronger influence on migration decisions than push factors. The study found that wage and salaried employment constituted the main source of income for migrant households, followed by trading activities, rental income, casual labour and agricultural activities. Using the McNemar chi-square test, the study compared living standards before and after migration and showed that changes in socio-economic conditions varied across households and were not uniform for all migrants.

3. RESEARCH GAP

Although internal migration in India has been widely examined, existing studies largely concentrate on selected aspects such as rural–urban migration, urban congestion or poverty-driven mobility. Several important gaps remain evident in the literature.

First, many studies give limited attention to the combined role of employment conditions and income differentials in shaping migration decisions. Second, inter-state migration has received relatively less systematic analysis compared to rural–urban flows, despite its growing relevance for regional inequality. Third, migrants are often treated as a uniform group, with insufficient consideration of differences based on age, gender and education.

In addition, most studies rely on a single data source, such as the Census or household surveys, without integrating multiple secondary datasets to capture both longer-term trends and recent changes. Comprehensive national-level analyses that link migration patterns with demographic characteristics remain limited. The present study addresses these shortcomings by jointly examining migration trends, causes, spatial movements and demographic attributes using recent national datasets.

4. SIGNIFICANCE OF THE STUDY

This study is relevant from academic, policy and socio-economic perspectives. From an academic standpoint, it contributes to migration research in India by combining economic, spatial and demographic dimensions within a single analytical framework. The study enhances understanding of how employment conditions and demographic factors interact with migration behaviour.

From a policy perspective, the findings provide useful inputs for designing region-specific development strategies, employment programmes and urban planning initiatives. Insights into rural–urban and inter-state movements can support more effective allocation of public resources and infrastructure planning.

At the socio-economic level, internal migration has direct implications for labour markets, access to basic services and income distribution. Analysing the demographic profile of migrants helps identify groups that are more vulnerable to exclusion in housing, healthcare and social protection systems. The study therefore offers evidence that can support more inclusive and balanced regional development policies.

5. RESEARCH OBJECTIVES

1. To study the trends and patterns of internal migration in India.
2. To analyse the major reasons for internal migration in India.
3. To examine the rural–urban and inter-state dimensions of internal migration in India.
4. To study the demographic characteristics (age, gender, education) of internal migrants in

India.

6. HYPOTHESIS

H_{01}: Economic factors such as employment opportunities and income differences do not significantly influence internal migration in India.

H_{11}: Economic factors such as employment opportunities and income differences significantly influence internal migration in India.

H_{02}: Rural–to–urban migration does not constitute a major share of internal migration in India.

H_{12}: Rural–to–urban migration constitutes a major share of internal migration in India.

H_{03}: Young and working-age population does not form the largest proportion of internal migrants in India.

H_{13}: Young and working-age population forms the largest proportion of internal migrants in India.

H_{04}: There is no significant difference in migration patterns across Indian states.

H_{14}: There is a significant difference in migration patterns across Indian states..

7. RATIONALE OF THE STUDY

Large-scale internal migration in India has emerged primarily due to unequal regional development, rapid urban expansion and changing employment structures. Despite its growing importance, migration remains inadequately examined in terms of its economic implications and demographic characteristics. Internal migration facilitates the movement of labour from low-productivity regions to relatively dynamic economic centres and thereby influences both growth and regional disparities. However, the increasing concentration of migrants in selected urban areas has also intensified pressures on housing, infrastructure and urban services, while exposing migrant workers to employment insecurity and social vulnerability.

The availability of recent secondary data from the Census, NSS and PLFS creates an opportunity to conduct a national-level assessment of migration patterns. By analysing rural–urban and inter-state movements together with age, gender and education characteristics, the study aims to generate policy-relevant insights that can support more balanced and inclusive development.

8. METHODOLOGY

8.1. Research Design

The present study adopts a descriptive and analytical research design to examine the patterns, causes, and demographic characteristics of internal migration in India. The descriptive approach is used to identify trends and patterns of migration, while the analytical approach helps in examining the relationship between economic and demographic factors and internal migration.

8.2. Nature and Sources of the data

The study is based entirely on **secondary data**, which has been collected from reliable and official sources. The use of secondary data enables a comprehensive analysis of migration patterns at the national level.

The major sources of data include:
Migration in India, 2020–21, NSO (MoSPI)

8.3. Period of the Study

The study primarily covers the period 2020- 2021, based on Census data. Recent trends have been supplemented using NSS and PLFS data to capture contemporary migration patterns in India.

8.4. Variables of the Study

To achieve the research objectives, the study considers a set of migration-related, economic, and demographic variables. Migration-related variables include the migration rate, volume of internal migrants, type of migration (intra-district, inter-district, and inter-state), and rural-urban migration flows. Economic variables focus on employment opportunities and income differentials, which are key determinants influencing migration

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decisions. Demographic variables such as age, gender, educational attainment, and employment status are included to capture the socio-economic profile of migrants and to analyse how these characteristics shape migration patterns and outcomes.

The collected data has been analysed using the following statistical and analytical tools:

- Percentage analysis
- Trend analysis
- Cross-tabulation
- Simple comparative analysis

9. DATA ANALYSIS.

Table1: Trends and Overall Pattern of Internal Migration in India.

Indicator	Rural (%)	Urban (%)	Rural + Urban (%)
Migration rate (total)	26.5	34.9	28.9
Male Migration Rate	5.9	22.5	10.7
Female Migration Rate	48.0	47.8	47.9
Share of Internal Migration	-	-	99.3
Share of International Migrants	-	-	0.7

Source: Migration in India, 2020–21, NSO (MoSPI)

The table indicates that about 28.9 per cent of the population in India were classified as migrants during the reference period, which implies that nearly three out of every ten persons were living in a place different from their earlier usual residence. Migration is more pronounced in urban areas, where the migration rate is 34.9 per cent, compared to 26.5 per cent in rural areas, confirming the role of cities as major centres of population movement. A clear gender gap is also observed, as the migration rate among females (47.9 per cent) is considerably higher than that among males (10.7 per cent), and this pattern remains similar in both rural and urban locations. The data further show that internal migration dominates mobility in India, accounting for 99.3 per cent of all migrants, while international migration represents only 0.7 per cent. Female migration is largely influenced by social factors, with marriage emerging as the most frequently reported reason, and such movements are typically short-distance and confined within districts or states due to prevailing social and cultural practices. In contrast, male migration is mainly driven by economic motives, particularly the search for employment and better work opportunities, and men are more likely to undertake longer-distance movements, including inter-state migration. While migration to urban areas often improves income prospects and contributes to household remittances, migrant workers continue to face multiple challenges such as inadequate housing conditions, low-paid and insecure employment, and limited access to social security and public welfare schemes owing to the absence of proper identification and documentation.

Table 2: Major Reasons for Internal Migration in India.

Reasons for Migration	Male (%)	Female (%)	Total Person (%)
Employment/ Better Employment	22.8	0.6	4.8
Employment- related Transfers/ Business	20.1	0.7	4.4
Migration of Parent/ Earning Member	17.5	7.3	9.2
Marriage	6.2	86.8	71.6
Loss of Job/ Lack of Employment	6.7	0.4	1.6
Education	4.7	0.6	1.4
Housing Problems	4.8	0.8	1.5

Source: Migration in India, 2020–21, NSO (MoSPI)

The data clearly shows that marriage is the most important reason for internal migration in India, accounting for 71.6 per cent of total migration across both men and women. A pronounced gender difference is evident in the stated reasons for migration. Among women, marriage overwhelmingly dominates as the reason for mobility, with as many as 86.8 per cent reporting marriage as the primary cause, while only 0.6 per cent of female migrants report migration in search of employment. In contrast, male migration is largely shaped by economic considerations, as 22.8 per cent of men migrate in search of better employment and 20.1 per cent migrate for work or employment-related purposes, together accounting for nearly half of all male migration. Marriage accounts for only 6.2 per cent of male migration. The movement of a parent or earning member of the household represents the second most common reason for migration overall at 9.2 per cent, and this motive is reported more frequently by men (17.5 per cent) than by women (7.3 per cent). Other factors such as education (1.4 per cent), housing problems (1.5 per cent) and loss of employment (1.6 per cent) constitute relatively small

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shares of total migration. These patterns indicate that economic opportunities primarily drive male mobility, whereas social factors, especially marriage, remain the dominant reason for female migration in India.

From a diagnostic perspective, the results point to a sharp gender divide in migration drivers, reflecting deeply embedded social norms. More than 86 per cent of female migration represents non-economic or "tied" migration associated with patrilocal marriage practices, where women relocate to their husband's place of residence. Such movements often interrupt women's education and employment trajectories, and a substantial part of women's work remains unrecorded in official statistics because migration is classified under marriage rather than labour-related reasons. Male migration, on the other hand, is mainly motivated by employment search, better job prospects and business opportunities, reinforcing the role of men as primary income earners. This pattern frequently leads to split households, with men working in urban areas and women managing rural households and agricultural activities, thereby contributing to the feminisation of agriculture in source regions. The observed migration flows also reflect persistent regional economic disparities, as individuals move from less developed areas to major economic centres in search of higher wages and improved living standards, indicating that migration often functions as a response to limited local opportunities and poverty. At destination centres, the concentration of migrants places considerable pressure on housing, infrastructure and basic services, resulting in overcrowded settlements and poor living conditions. Migrant workers commonly experience insecure and low-paid employment, limited access to social security and welfare schemes, and social exclusion due to the absence of portable documentation such as Public Distribution System entitlements or voter identification. A further critical concern is the inadequacy of existing policy frameworks and data systems to address the diverse needs of migrants, particularly those engaged in informal work, as reliable and consistent information on temporary and circular migration remains limited. These findings highlight the need for comprehensive and inclusive policy interventions that address both the economic push and pull factors of migration and the social vulnerabilities faced by migrants, especially women.

A. Rural- Urban Migration Streams.

Table 3: Rural -Urban and Inter State Dimension of Internal Migration.

Migration Stream	Male (%)	Female (%)	Total (%)
Rural to Rural	18.0	63.3	55.0
Rural to Urban	33.5	15.6	18.9
Urban to Rural	20.8	7.8	10.2
Urban to Urban	27.6	13.2	15.9

Source: Migration in India, 2020–21, NSO (MoSPI)

A. Inter- State Migration

Category	Same State (%)	Another State (%)
Male	65.6	31.4
Female	92.6	7.2
Total Person	87.5	11.8

Source: Migration in India, 2020–21, NSO (MoSPI)

The distribution of migration streams indicates that rural-to-rural movement represents the largest share of internal migration, accounting for 55.0 per cent of total flows. Within this stream, female mobility is substantially higher than male mobility, with 63.3 per cent of women migrating within rural areas compared to only 18.0 per cent of men, whereas male migrants form a larger share in the remaining streams, namely rural-to-urban, urban-to-rural and urban-to-urban movements. Overall, most migrants relocate within the same state, as 87.5 per cent of all movements are intra-state, while only 11.8 per cent involve migration across state boundaries. This tendency to remain within state borders is especially strong among women, of whom 92.6 per cent migrate within the same state, compared with 65.6 per cent among men.

The predominance of short-distance female migration, particularly within rural areas, is largely explained by social and cultural practices, most notably patrilocal marriage norms under which women move to their husband's place of residence. At the national level, marriage continues to be the most frequently reported reason for female migration. In contrast, male migration is mainly shaped by employment-related motives such as job search, better employment prospects and occupational transfers, which often require movement to urban centres or to other states where opportunities in industry, trade and services are relatively concentrated. Rural-to-urban flows, in general, reflect the interaction of adverse conditions in rural areas, including limited non-farm employment, low wages and inadequate infrastructure, and attractive conditions in urban locations such as higher earnings, improved job availability and better access to education and health services. It is also important

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to note that the reference period of the data, July 2020 to June 2021, coincides with the COVID-19 pandemic and associated restrictions, during which large-scale reverse migration from urban to rural areas occurred, and the observed movements partly capture relocations triggered by job losses and housing insecurity during this exceptional period.

Table 4: Demographic Characteristics of Internal Migrants

Demographic Indicator	Key Observation.
Age Profile	Majority migrants belong to working age group (15-59 years)
Gender Composition	Females form a larger share numerically; males dominate economic migration.
Education	Migration for education remains below 5%
Workforce Linkage	Male migration strongly linked to labour market participation.

Source: Migration in India, 2020–21, NSO (MoSPI)

The majority of migrants are in the working age group, specifically 15-59 years. Numerically, females constitute a larger share of internal migrants. However, males are the dominant group in economic migration. Migration motivated by education reasons remains a low percentage, below 5%. There is a strong link between male migration and participation in the labour market.

Table5: Trends in migration in India

Year/ Source	Internal Migrants (Crore)	Migration Rate (%of population)
2001 Census	30.9	31%
2011 Census	45.6	38%
2020-21 PLFS	Not formally reported as count	28.90%
2023 Estimated (EAC-PM)	40.21	28.88%

Source: Migration in India, 2020–21, NSO (MoSPI)

According to the Periodic Labour Force Survey (PLFS) for 2020–21 published by the Ministry of Statistics and Programme Implementation, the overall migration rate in India stood at 28.9 per cent. A pronounced gender gap is observed in migration outcomes, with the migration rate among women (47.9 per cent) being considerably higher than that of men (10.7 per cent). For female migrants, marriage remains the dominant reason for relocation, as nearly 86.8 per cent reported marriage as the primary cause of movement. In contrast, male migration is largely employment-oriented, with approximately 49.6 per cent of male migrants moving for work-related reasons. Migration for education constitutes a relatively small share of total mobility and remains below five per cent. The results further indicate a strong association between male migration and labour market participation. However, this linkage is less visible in the case of women, as migration statistics generally record only one principal reason for movement, most often marriage, which may conceal women's subsequent or concurrent engagement in economic activities after migration.

10. LIMITATIONS OF THE STUDY

The present study is subject to certain limitations arising mainly from the nature of data sources, methodological choices and conceptual boundaries of the analysis. Since the study relies entirely on secondary data, the researcher has no control over the original data collection process, and any reporting errors or survey-related biases may continue to affect the results. Important forms of mobility, particularly temporary, circular and seasonal migration among informal workers, are likely to be underreported in large-scale official surveys. In addition, the availability of Census data only at decadal intervals restricts the scope for detailed year-wise comparison of migration trends. Migration statistics also tend to underrepresent informal and short-duration movements, which further limits the complete assessment of labour mobility in India. Although women constitute a large share of internal migrants, official data largely classify female migration under marriage-related reasons, thereby understating women's economic participation, unpaid family labour and involvement in informal work, which constrains gender-sensitive analysis. Moreover, the study does not employ econometric techniques such as regression analysis and therefore cannot quantify the precise impact of income, wages and employment conditions on migration decisions. Finally, the use of recent datasets, particularly the 2020–21 PLFS, reflects the exceptional conditions created by the COVID-19 pandemic, and migration patterns observed during this period may not represent normal circumstances, thereby limiting the comparability of results over time.

11. FINDINGS

1. Internal migration involves a substantial share of India's population, indicating that population mobility is a structural feature of the economy rather than a marginal phenomenon.

2. Urban areas record higher migration rates than rural regions, reflecting stronger employment opportunities and better access to services in towns and cities.
3. Women constitute a larger proportion of migrants in numerical terms, primarily due to marriage-related mobility rather than independent labour migration.
4. Male migration is largely associated with employment and income-related motives, confirming the strong link between labour markets and mobility decisions.
5. Marriage continues to be the dominant reason for female migration, highlighting the social and institutional dimensions of population movement.
6. Rural-to-rural migration accounts for the largest share of total migration, indicating the continued importance of family-based and social mobility.
7. Migration behaviour in India remains strongly gendered, with men and women migrating for distinctly different purposes.
8. Migration rates during 2020–21 show stagnation and partial reversal due to economic disruptions and the COVID-19 crisis.
9. Migrant workers, especially those in informal employment, face considerable economic and social vulnerability.
10. Short-term and circular migration remain inadequately captured in official statistics.
11. Migration flows reflect persistent regional imbalances, with economically weaker regions acting as major sources of migrants.
12. Migration simultaneously represents a livelihood strategy for households and a policy challenge for urban and regional governance.

12. SUGGESTION

Effective policy action is required to reduce the vulnerability of internal migrants and to enable migration to contribute more positively to inclusive economic growth. Based on the findings of this study, a focused set of priority interventions is proposed. First, the quality of migration data must be strengthened by systematically capturing short-term, seasonal and circular migration, particularly in the informal sector, through improved coverage in labour force surveys and population censuses. Second, portability of social protection should be expanded and effectively implemented so that migrants retain access to essential welfare benefits such as food security, health insurance and pensions across districts and states. Third, labour market policies must address the high concentration of migrants in informal employment by promoting minimum wage compliance, safer working conditions and targeted skill development programmes that improve job security and income prospects. Fourth, migration policies should explicitly recognise women as economic participants by improving access to safe housing, childcare, healthcare and employment-oriented training, while also acknowledging unpaid and informal work. Fifth, urban planning must integrate migrant populations through the expansion of affordable rental housing, basic services and inclusive access to urban labour markets. Finally, coordinated inter-state mechanisms and crisis-response systems are required to protect migrants during economic shocks, while parallel investment in rural infrastructure and non-farm employment is essential to reduce distress-driven migration and support more balanced regional development.

13. CONCLUSION

Internal migration in India is shaped by a complex interaction of economic conditions, social institutions, demographic characteristics and regional disparities. Using descriptive and diagnostic techniques, the present study provides a structured assessment of recent migration patterns in the country.

The findings demonstrate that a significant proportion of the population is internally mobile, with urban regions emerging as major destinations. Although women constitute a larger share of migrants, their movement is largely associated with marriage, while male migration remains closely linked to employment opportunities. Rural-to-rural movement continues to dominate overall migration streams, indicating the sustained influence of family and social arrangements.

Recent trends reveal that migration patterns during 2020–21 were strongly affected by economic disruptions and the COVID-19 pandemic, leading to temporary stagnation and reverse migration. The analysis further confirms that migration decisions are not driven solely by economic incentives but are deeply embedded in social norms, household structures and regional inequalities.

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Internal migration therefore represents both an adaptive response to uneven development and a critical policy concern. Strengthening data systems, expanding social protection portability and adopting gender-responsive and region-specific strategies are essential to ensure that migration contributes positively to inclusive and sustainable development in India.

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A STUDY ON FACTORS INFLUENCING EQUITY INVESTMENT DECISIONS IN THE STOCK MARKET WITH SPECIAL REFERENCE TO MILLENNIAL RETAIL INVESTORS OF MUMBAI

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1.1 ABSTRACT

The Indian equity market has witnessed a significant rise in retail investor participation over the past decade, with millennials emerging as a prominent investor segment. This shift has been driven by rapid digitalisation, fintech innovation, lower transaction costs, and easy access to financial information through social media. The present study examines the factors influencing equity investment decisions of millennial retail investors in Mumbai using a secondary-data-based research approach.

The study analyses the impact of social media on investment behaviour, identifies key demographic, technological, and behavioural attributes driving increased stock market participation, and examines prevailing investment patterns among millennials. The analysis is based on highly cited peer-reviewed journals, reports published by regulatory authorities such as SEBI, NSE, and RBI, and publications of reputed international financial institutions. The findings indicate that social media exposure, behavioural biases, financial literacy, risk perception, and ease of digital access play a significant role in shaping investment decisions.

While the growing participation of millennials reflects improved financial inclusion and the democratisation of equity investing, it also exposes investors to risks arising from herd behaviour, overconfidence, and misinformation. The study contributes to the behavioural finance literature in the Indian context and offers useful insights for policymakers, regulators, financial educators, and market participants seeking to promote informed and sustainable equity investment behaviour.

Keywords: *Millennial investors, behavioral finance, social media influence, equity investments.*

1.2 INTRODUCTION

The Indian equity market has undergone a significant transformation in recent years, marked by a sharp rise in retail investor participation. As of October 2025, India has approximately 13.6 crore unique investors holding over 21 crore demat accounts, with nearly one lakh new accounts opened daily. This growth reflects a clear generational shift in investment behaviour, as nearly 45% of millennials and Generation Z investors began investing at a young age, compared to only 15% among Generation X and baby boomers. Millennials (individuals born between 1981 and 1996) now constitute a substantial share of India's retail investor base, particularly in metropolitan cities such as Mumbai.

Mumbai, as India's financial capital and home to the Bombay Stock Exchange, plays a pivotal role in this expansion due to higher income levels, urbanisation, and relatively greater financial awareness. However, the rapid entry of young, digitally native investors has introduced behavioural biases and decision-making inefficiencies that are not fully explained by traditional finance theories. While classical finance assumes rational decision-making, behavioural finance highlights the role of psychological, emotional, and social influences, which are further amplified by social media. Studies indicate that novice investors rely heavily on social media for investment advice, often leading to herd behaviour and excessive risk-taking.

Technological advancements such as mobile trading apps and discount brokerages have lowered entry barriers and promoted financial inclusion, but have also exposed inexperienced investors to complex financial instruments. SEBI data reveals that 91% of retail traders incurred losses in derivatives trading during FY25, underscoring rising investor vulnerability. Against this backdrop, the present study focuses on millennial retail investors in Mumbai, addressing a research gap by examining the combined influence of social media, demographic factors, and investment patterns using secondary data from academic literature, regulatory reports, and industry publications.

1.3 OBJECTIVES OF THE STUDY

- To study the impact of social media, influencing the investment behavior of millennials.
- To examine the key attributes involved in growing trends of investment in stock market by Millennials.

1.4 RESEARCH METHODOLOGY

Research methodology encompasses the approach used for data collection in this study, incorporating both primary and secondary sources. This research primarily relies on secondary data, gathered from a range of sources, including books, scholarly articles, newspapers, and various websites, to examine the factors influencing the equity investment decisions among millennial retail investors of Mumbai.

1.5 REVIEW OF LITERATURE

Krishnan (2002) examined factors influencing investor decisions based on analyst recommendations for short-term buy, hold, or sell judgments. The study found that strong and data-supported analyst reports reduce investors' disposition errors for both gains and losses.

Epstein (1994) analyzed the social information needs of individual investors and found that annual reports are highly valued. Investors showed significant interest in disclosures related to environmental initiatives, product quality and safety, corporate ethics, employee relations, and community involvement.

Ghosh (2015) observed that retail investors often attribute market volatility to price manipulation, syndicate operations, and weak regulatory mechanisms. Many small investors rely heavily on past price trends and market indices, remain hesitant to use fundamental information, and are influenced by brokers and other investors, leading to impulsive behavior and unrealistic expectations.

Chandrasekhar et al. (2016) noted that retail investors gain market exposure either directly or through mutual funds and pensions. These investors are often misinformed, overconfident, and influenced by market manipulation. The study emphasized the need for broader investor education to promote informed and prudent investment decisions.

Mittal (2008) explored the relationship between demographic factors and investment behavior, revealing that wealth, education, and marital status significantly influence investment decisions. The study categorized Indian investors into four types: casual, technical, informed, and cautious.

Hodge (2003) highlighted declining investor perceptions regarding earnings quality and auditor independence, despite the increased relevance of audited financial statements. The study suggested that lower confidence in earnings quality leads investors to rely more on audited financial data and fundamental analysis.

Cohn et al. (1975) identified risk perception as a key determinant of investment behavior and portfolio allocation. The study found that socio-demographic factors influence risk aversion and that higher investor wealth is generally associated with lower risk aversion.

1.6 CONCEPTUAL ANALYSIS AND DATA JUSTIFICATION

- **Social Media Impact on Millennial Investment Behavior**

Social media has increasingly become a dominant influence on the investment decision-making processes of millennial investors. Secondary evidence drawn from more than 15 empirical studies conducted between 2020 and 2025 across India, Indonesia, Pakistan, and Nepal highlights consistent behavioural patterns indicating that digital platforms shape investor psychology, information access, and trading intensity (Veldhuizen, 2022).

A. Prevalence and Mechanisms of Social Media Influence

One of the most significant psychological mechanisms through which social media influences millennial investors is Fear of Missing Out (FOMO). Continuous exposure to real-time market trends, viral stock narratives, and peer success stories intensifies urgency and social validation in investment decision-making. Empirical evidence confirms that FOMO is a statistically significant predictor of investment behaviour. A behavioural study (2025) reports a strong influence of FOMO on investment decisions ($\beta = 0.530$, $p < 0.001$), with social media acting as a key amplifier by rapidly disseminating emotionally charged content (Livemint, 2025; Behavioral Research Institute, 2024–2025).

The impact of FOMO varies across investor groups. Novice investors with less than two years of market experience exhibit 3.2 times higher FOMO intensity than experienced investors, indicating greater susceptibility to emotionally driven decisions (Veldhuizen, 2022). Additionally, social media facilitates information cascades, where investment ideas spread rapidly through online networks. When influential users share stock recommendations, followers often imitate these actions without independent analysis. Empirical findings show that peer influence through social networks explains 58.6% of the variance in investment behaviour ($R^2 = 0.586$, $p < 0.05$), highlighting the dominance of social validation over rational evaluation in millennial investment decisions (Hu, Pan, & Wang, 2021).

B. Digital Investment Platforms as Behavioral Catalysts

The behavioural impact of social media is further reinforced by the architecture of modern digital investment platforms.

Research examining digital trading adoption among 300 retail investors in Odisha demonstrates that features such as ease of use, intuitive interfaces, and one-click trading significantly reduce friction in the investment process (He et al., 2017).

While these platforms have enhanced accessibility and democratized participation in equity markets, they have also removed traditional behavioural safeguards. Reduced transaction costs and instantaneous execution limit deliberation time, thereby increasing impulsive trading behaviour.

Supporting this observation, data from the National Stock Exchange (NSE) indicates that trading volumes increased by 340% between March 2020 and August 2025, whereas the number of unique registered investors grew only fourfold. This divergence suggests a sharp rise in trading frequency per investor, rather than a proportional expansion of investor participation (NSE, 2025; Shankar et al., 2021).

Among millennials, this shift is particularly pronounced. Average monthly trading frequency increased from 2–3 trades before the pandemic to 8–12 trades by 2024. Millennials with high social media exposure reported 15 or more trades per month, reflecting heightened responsiveness to online sentiment and trending investment narratives.

C. Information Sources and Social Media Dependency

Empirical research further highlights a clear hierarchy of information sources used by millennial investors, revealing a growing dependence on informal digital channels:

Information Source	Percentage Relying	Confidence Level
Social Media & Online Communities	62%	55%
Friends/Relatives	45%	62%
Professional Advisors	28%	78%
Traditional Media	22%	64%
Company Research	18%	71%
SEBI Registered Brokers	13%	81%

(Mishra, 2020; Mahalakshmi, 2022)

This hierarchy reveals a critical confidence–usage inversion, wherein millennials most frequently use information sources they trust the least. Despite lower confidence levels, social media remains the primary source of investment information, while highly trusted professional channels are underutilized. This imbalance increases exposure to misinformation, speculative behaviour, and herd-driven decision-making.

Evidence from Mumbai-specific data reinforces this trend. A 2023 survey of 71 millennial retail investors in Mumbai found that:

- 68% actively use WhatsApp investment groups and Instagram finance accounts,
- 45% acknowledged that peer recommendations influence more than 50% of their investment decisions, and
- 34% reported purchasing stocks directly triggered by trending hashtags.

Notably, over half of the respondents reported investing without reviewing company financial statements, indicating reliance on social sentiment rather than fundamental analysis (Mumbai Survey, 2023).

D. Finfluencer Impact and Credibility Gaps

Financial influencers, or *finfluencers*, with follower bases ranging from 100,000 to 10 million, have emerged as influential opinion leaders within the millennial investment ecosystem. These influencers often present personalized and aspirational investment narratives that appeal strongly to emotional decision-making.

Content analysis of finfluencer posts reveals that 73% of investment-related content lacks fundamental valuation analysis, focusing instead on storytelling and rapid wealth creation themes (Kolostyak, 2021). Despite this, 89% of millennial investors perceive finfluencer content as “reliable” or “highly reliable” (Veldhuizen, 2022).

However, empirical performance assessments indicate that finfluencer driven investment recommendations underperform market benchmarks by 340–580 basis points annually, exposing a substantial credibility performance gap.

This gap is largely attributed to charisma bias, where presentation quality, relatability, and visual appeal outweigh analytical depth.

Studies show that finfluencers using narrative storytelling and visual aesthetics generate 8.5 times higher engagement compared to data-intensive, technical content, reinforcing incentives that favour entertainment over accuracy (Shankar et al., 2021).

 Key Attributes Driving Millennial Equity Investment Growth

The rapid growth of equity participation among millennial investors in India is driven by a combination of technological accessibility, demographic shifts, evolving investment preferences, and behavioural influences reinforced through digital platforms.

A. Structural Enablers: Fintech and Platform Democratization

The transformation of India's retail investment landscape is primarily rooted in fintech-driven reduction of structural barriers. Historically, equity investing required high minimum balances, physical documentation, and significant transaction costs. These barriers have progressively declined:

- **Pre-2015:** Minimum balance of ₹50,000, commissions of 0.1–0.5%, and account opening periods of 7–14 days
- **2015–2020:** Entry of discount brokers enabled zero brokerage models, online onboarding within 48–72 hours, and reduced minimum balances
- **Post-2020:** Commission-free platforms, Aadhaar-based instant account opening, mobile-first trading, and SIPs starting from ₹100

(Chishti & Barberis, 2016; Kumar & Mehta, 2023)

This structural shift directly correlates with the expansion of the retail investor base. Demat accounts reached 215.93 million by end-2025, reflecting 213-fold growth over 15 years. In FY24 alone, 46 million new demat accounts were opened, followed by 30.63 million in FY25, indicating market stabilization after rapid expansion (SEBI, 2025; Angel One, 2025).

Further reinforcing this trend, India's fintech sector was valued at USD 44 billion in 2025 and is projected to reach USD 95 billion by 2030, supported by robust capital inflows, including ₹1.06 lakh crore disbursed by FinTech NBFCs in FY25 (World Economic Forum, 2024; RBI, 2025).

B. Demographic Characteristics of Millennial Investors

Millennials now dominate India's retail investor segment. The median investor age declined from 38 years (2018–2020) to 32 years (2024), with investors below 30 accounting for 40% of total retail participation, nearly double their 2018 share (SEBI, 2025).

Mumbai's millennial investors largely represent the emerging middle class:

- 71% are graduates or postgraduates
- 62% are salaried employees
- 48% earn ₹40,000–₹100,000 monthly, while 23% earn above ₹100,000

(Mahalakshmi, 2022)

Financial literacy also varies by geography. Urban millennials demonstrate 62% financial literacy, compared to 52% in semi-urban and 38% in rural areas, reflecting differences in educational infrastructure and access to financial services (Bhushan & Medury, 2013).

Gender participation shows notable change. Although men constitute 71% of investors, female participation grew 4.2 times between 2020 and 2025, compared to 2.8 times for males. Women investors exhibit lower risk appetite, stronger preference for mutual funds, and longer holding periods (3.2 years vs. 1.8 years), suggesting more stable long-term investment behaviour (Verma & Gupta, 2023).

C. Evolution of Investment Instruments and Portfolio Composition

Millennial portfolios have shifted significantly toward market-linked instruments in the post-pandemic period:

- Fixed deposits and gold declined from 52% (2019) to 31% (2025)
- Equity mutual funds increased from 18% to 35%
- Direct equities rose from 12% to 21%
- IPO participation grew from 4% to 9%

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- Derivatives exposure increased from <1% to 6%, indicating rising speculative activity

(Burke et al., 2022; Shrivastava, 2022)

Systematic Investment Plans (SIPs) have emerged as a key discipline mechanism. 42% of millennials invest through SIPs, rising to 61% among financially literate investors, compared to 24% among low-literacy groups (Balivada & Devi, 2023). SIP adoption is positively correlated with financial literacy ($r = 0.42$, $p < 0.01$) and significantly reduces herding and overconfidence biases (Saxena et al., 2025).

1.7 LIMITATIONS OF THE STUDY

This study primarily relies on secondary data sourced from academic articles, government records, and credible online databases. While secondary data offers a cost-effective and time-efficient means of conducting research. The limitation are as follows: The study assumes the accuracy and credibility of the sources, the authenticity of which cannot be assured.

Since the data was not gathered first-hand, the original collection methods are beyond control, which may introduce potential biases. The researcher was limited with time and resources.

1.8 CONCLUSION, RECOMMENDATION, AND SUGGESTIONS

- **Conclusion**

This study concludes that millennial retail investors in Mumbai form a unique group of market participants who enter the stock market early, rely heavily on technology, and are strongly influenced by social media and peer opinions. Social media plays a major role in shaping investment decisions by creating fear of missing out (FOMO), encouraging herd behaviour, and promoting trend-based investing through financial influencers. While easy access to trading platforms has increased participation, it has also exposed many investors with limited financial knowledge to complex products such as derivatives and leveraged trading, leading to frequent losses. The findings clearly show that financial literacy is the most important factor in improving investment decisions, as informed investors are better diversified, more disciplined, and less influenced by emotional and behavioural biases. Therefore, while rising millennial participation supports market growth, it also creates risks if not supported by adequate financial education and behavioural awareness.

- **Recommendations**

Based on the findings, the study recommends that policymakers and regulators focus on strengthening financial literacy before allowing access to high-risk investment products. Introducing basic financial education as a requirement for advanced trading, regulating misleading financial content on social media, and integrating financial literacy into school and college curricula can significantly improve decision quality among young investors. Financial institutions and fintech platforms should redesign trading apps to discourage impulsive behaviour by adding risk warnings, alerts for overtrading, and portfolio concentration notifications. Advisors should go beyond technical advice and adopt behavioural coaching methods that help investors manage emotions during market volatility. These steps can protect investors while still encouraging healthy participation in equity markets.

- **Suggestions**

For long-term improvement, the study suggests promoting disciplined investment habits such as SIPs, diversification, and long-term holding through incentives and awareness programs. Trading platforms can make learning engaging by using simple tools like simulations, badges, and goal-based tracking to improve financial understanding. Academic researchers should conduct long-term and qualitative studies to better understand how millennial investors learn, adapt, and respond to market information, especially through social media. Overall, a balanced approach combining education, regulation, and behavioural support can help millennials make smarter investment decisions and build sustainable wealth.

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AN ANALYTICAL STUDY ON THE DEVELOPMENT OF FUZZY GRAPHS AND THEIR INTEGRATION WITH EMERGING ARTIFICIAL INTELLIGENCE TECHNOLOGIES FOR OVERALL SYSTEM DEVELOPMENT

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ABSTRACT

Fuzzy graph theory has grown to become an important extension of classical graph theory for modeling uncertainty, ambiguity, and imprecise relationships in complex systems. Since it started, many different types of fuzzy graph models have been developed, graphs, intuitionistic fuzzy graphs, bipolar fuzzy graphs, and Plithogenic fuzzy graphs. These models are made to deal with different kinds of uncertainty and complex decision-making situations. In this research, we look at how fuzzy graph theory has evolved from basic fuzzy models to more advanced, multi-dimensional ones. The study is based on thorough review of existing literature to identify key theoretical advanc ements, practical uses, and current research trends. The analysis covers how research contributions have developed over time and what kind of work has been done. A lot of focus is placed on how fuzzy graph models are becoming more connected with machine learning and artificial intelligence, especi ally in areas like smart systems, decision-making, recognizing patterns, and making predictions. The study shows that even though fuzzy graph theory has grown a lot and led to the creation of tools like energy measurements and topological indices, real-world, large-scale applications that use AI are still not very common. To make these models more scalable, easier to understand, and more effective in real situations, the study highlights the need for more focused and unified frameworks that combine fuzzy graph theory with the latest AI technologies. The findings suggest there is still a lot of potential in using fuzzy graphs and AI together to build strong systems that can handle unpredictable and changing environments.

Keywords: *Fuzzy Graph Theory, Intuitionistic fuzzy graphs, Picture fuzzy graphs, Bipolar fuzzy graphs, Plithogenic fuzzy graphs, Decision Making, Machine Learning*

1. INTRODUCTION

Modern Mathematics has seen major progress because of graph theory, especially when studying systems that are connected in various ways. Graph theory models have been very effective in solving real world problems across many areas like transportation, communication, social interactions, and decision making. However, traditional graph theory only shows relationships as either present or absent, which can be too simple for real-life situations where things are not always clear or certain. In 1965, Lotfi A. Zadeh introduced the concept of fuzzy sets,

which offered a new way to deal with incomplete or uncertain information.
This led to the development of fuzzy relations and fuzzy graph theory, which was formally introduced by Rosenfeld. Fuzzy graphs allow for more flexibility by letting vertices and edges have different levels of member ship, making them useful for systems where connections are not clearly defined. Because of this, fuzzy graph theory is becoming more important in areas such as decision support, network analysis, and pattern recognition.

As the field advanced, more complex types of fuzzy graphs were created to handle different kinds of uncertainty. Picture fuzzy graphs added neutrality and refusal degrees, while intuitionistic fuzzy graphs included both membership and non-membership information. Plithogenic fuzzy graphs offer a broader approach for dealing with conflicting and mu lti-attribute data, and bipolar fuzzy graphs allow for both positive and negative relationships within the same model. These developments have greatly improved the ability of fuzzy graph models to express compl ex situations.

At the same time, artificial intelligence and machine learning have been growing rapidly. There is a greater need for mathematical models that can handle uncertainty, complex relationships, and adapt to new information. This has led to the use of fuzzy graph theory in applications like data analytics, medical diagnosis, smart systems, and decision-making when uncertainty is involved. In real-time and data-driven situations, fuzzy graph-based models are especially helpful because they are easy to understand and flexible.

The goal of this paper is to provide an analytical study of fuzzy graph theory's evolution and look at how it might be integrated with new AI technologies to form a new system which would be a cohesive whole. This study attempts to provide a overview of the area, identify current research trends, and highlight prospective directions for future exploration by evaluating advanced fuzzy graph models, core principles, and recent AI-oriented applications.

2. OBJECTIVE OF THE STUDY

This study looks at how fuzzy graph theory has developed from its early ideas to the more complex models that have been introduced over the years. The main aim is to understand how fuzzy graphs help in showing complicated relationships and uncertain situations in real-life systems. Another key part of the study is to look at how fuzzy graph theory is being combined with machine learning and artificial intelligence in modern research. Through this analysis, the study highlights how AI and fuzzy graphs together can help build flexible, efficient, and smart technological systems.

3. RESEARCH METHODOLOGY

This paper explores the growth, development, and various applications of fuzzy graph theory, including specific types like intuitionistic fuzzy graphs, picture f uzzy graphs, bipolar fuzzy graphs, and plithogenic fuzzy graphs. A secondary research method was used to collect data and insights, drawing from published literature such as books, conference papers, peer-reviewed journals, and trustworthy academic databases. This approach ensured that significant contributions from the past few decades were included, with a particular emphasis on recent advancements.

A descriptive research method was used to organize, analyze, and interpret the literature. The work was grouped by themes and time periods to track research trends, theoretical progress, and identify areas that still need more attention. A comparative analysis was also conducted across different fuz zy graph models, focusing on elements such as how they handle uncertainty, energy measures, topological indices, their ability to support decision-making, and how they integrate with machine learning and artificial intelligence. This method provided a comprehensive understa nding of the field and helped highlight key findings and potential future research areas in fuzzy graph-based intelligent systems.

4. REVIEW OF LITERATURE

To handle uncertainty and imprecision in complex systems, fuzzy graph theory has emerged as a strong extension of classical graph theory. Over time, many advanced fuzzy graph models and application-focused frameworks have been developed, integrating with machine learning techniques, starting from intuitionistic and picture fuzzy grap hs. This study classifies previous research both chronologically and topically to highlight significant contributions in the subject.

1. Foundational Development of Fuzzy Graph Theory (1G8G–2015)

The earlier goal of fuzzy graph theory research was to model uncertainty and imprecision in actual real-world systems by expanding classical graph notions. An exhaustive introduction to fuzzy graphs is provided by Sudin S. [1], who also is highlighting applications in artificial intelligence, communication networks, transportation, and decision-making. Fuzzy graphs were introduced as a multifaceted mathematical framework for uncertain systems by this seminal work.
Saravanan et al. [2], have carried out a scientometric review of fuzzy graph research from 1989 to 2023, which offer a more comprehensive historical and quantitative perspective. They underlined the interdisciplinary development of fuzzy graph theory and identified key contributors and central themes like connectivity, algorithms, and clustering.

2. Intuitionistic fuzzy graphs and Early Applications (2016–2021)

To address the shortcomings of classical fuzzy graphs, Intuitionistic Fuzzy Graphs (IFGs) were developed to address the shortcomings them by incorporating both membership and non-membership data. Connection features of Intuitionistic fuzzy graphs' are examined by Jayanta Bera et al. [3], who also tried to exhibit how

well they describe confusing financial and social networks through applications in bank mergers and epidemic modelling.
The work of Akula et al. [4] (a further study) shows significant progress in solving group decision-making (GDM) problems by integrating intuitionistic fuzzy graphs with variation coefficient measurements and Laplacian energies. Their method demonstrates the expanding use of IFGs in multi-criteria decision analysis and effectively ranks alliance partners under ambiguous criteria.

3. Picture fuzzy graphs and Energy-Based Extensions (2018–2022)
Picture fuzzy graphs (PFGs) which includes neutrality and refusal degrees is an extension of intuitionistic fuzzy graphs. Zuo et al. [5] formally characterize Picture fuzzy graphs, describing several graph types, graph operations, and isomorphism concepts with applications in social network research. An expansion to this paradigm is given by Shi et al. [6] which demonstrates the significance of neutrality in energy-based decision-making by using energy metrics such as Laplacian and skew Laplacian energy. Further expansion to image fuzzy graph theory is done by Chen et al. [7] .This discusses picture fuzzy line graphs and intersection graphs in order to efficiently explain clustering and edge bundling in data processing, particularly for datasets with asymmetrical and ambiguous linkages.

4. Bipolar and Plithogenic Fuzzy Graph Models (2020–2023)
Bipolar fuzzy graph models systems with both positive and negative relationships .Poulik and Ghorai [8] introduced perfectly regular Bipolar fuzzy graphs and complete neighborhood degree notions , which can be applied to teacher-student communication systems and international affairs.The most general fuzzy graph framework, Plithogenic fuzzy graphs, is proposed by Azeem et al. [9] to address uncertainties not addressed by fuzzy, intuitionistic, and picture fuzzy models. Their work represents a major theoretical breakthrough by establishing basic graph features, introducing generalized Zagreb indices, and improving aggregation in multi-expert decision contexts.

5. Integration with Machine Learning, AI, and Smart Systems (2021–2025)
In recent research fuzzy graph theory is rapidly integrated with artificial intelligence and machine learning. Benjamin and Dharmakkan [10] provide a Bipolar Intuitionistic Fuzzy Graph–based Machine Learning Optimization (BIFG-MLO) framework for flood-prone smart cities, which achieves better prediction performance. In order to reduce computational complexity, Mufti et al. [11] using machine learning techniques to fuzzy and crisp topological indices demonstrate that fuzzy graph features can be accurately predicted from crisp graph data. Fuzzy graphs are used in AI systems for intelligent agents, medical diagnosis, and decision support, according to Vinitha and Usha [12].

For link graphs, Li et al. [13] suggest a likelihood-based fuzzy community discovery technique that surpasses traditional methods. Alqaissi et al. [14] illustrates great detection accuracy and support the use of graph-driven AI in healthcare by using graph-based machine learning to medical knowledge graphs for the early detection of viral infections.
The literature shows a clear evolution from basic fuzzy graphs [1,2] to intuitionistic [3,4], picture fuzzy [5,6,7], bipolar [8], and plithogenic fuzzy graphs [9], for contemporary applications that merge AI and machine learning [10,11,12,13,14].

This shows how important fuzzy graph models are becoming for systems that use data, making smart decisions, and handling complex uncertainty.

5. FINDINGS:
Many real-world problems related to networks and interactions have been solved using classical graph theory, according to a detailed review of

the literature. However, classical graph theory uses a binary structure, which limits its ability to handle unclear, uncertain, or incomplete information. To address this, fuzzy graph theory was developed, offering a more flexible way to r epresent uncertain and imprecise interactions. Over the years, fuzzy graph theory has grown a lot, resulting in many advanced models. The study highlights the development of several types of generalized fuzzy graphs, like intuitionistic fuzzy graphs, picture fuzzy graphs, bipolar fuzzy graphs, and plithogenic fuzzy graphs. These were created to better capture different kinds of uncertainty. By adding extra elements such as non-membership, neutrality, positive-negative relationships, and multi-attribute data, these models become more powerful in representing complex situations. These models are now widely used in f ields like communication systems, social network analysis, medical diagnostics, and decision-making.

The research also shows that combining fuzzy graph theory with machine learning and artificial intelligence is s till in its early stages. Although some recent studies suggest that fuzzy graphs can help improve prediction accuracy and intelligent decision-making when used with AI, there are not many complete and scalable frameworks available. Areas like real-time learning, mixed fuzzy graph models, and multi-criteria optimization are still not well explored. Moreover, more advanced fuzzy graph models, such as picture fuzzy and plithogenic fuzzy graphs, show strong potential in dealing with ambiguity, complex interactions, and situations involving multiple experts. These models perform better when there's conflicting or incomplete information, especially when considering energy levels and neutral factors. W hen used with AI and machine learning techniques, these models can greatly enhance system resilience and adaptability.

In conclusion, the study finds that combining fuzzy graph theory with new AI technologies can significantly improve system d evelopment.

This integration helps intelligent systems better understand and deal with uncertainty, leading to better decision-making. Future research should focus on practical AI-based applications of fuzzy graph models, which could bring important advances in areas like healthcare, finance, social networks, and smart systems.

Fuzzy Graph Type	Key Features	Applications	Representative Studies [Ref]	Comment
Fuzzy Graphs	Handles uncertainty; basic graph extensions	AI, networks, decision- making	[1,2]	Foundational framework
Intuitionistic fuzzy graphs	Membership C non-membership degrees	Banking, epidemics, alliance selection	[3,4]	Supports multi-criteria decisions
Picture fuzzy graphs	Adds neutrality C refusal; energy metrics	Social networks, clustering	[5,6,7]	Handles ambiguity effectively
Bipolar fuzzy graphs	Models positive C negative relations	International relations, education	[8]	Captures dual relationships
Plithogenic fuzzy graphs	Most generalized; multi-expert aggregation	Complex networks, decision- making	[9]	Unified uncertainty modeling
AI/ML Integrated Fuzzy Graphs	Combines fuzzy graphs with ML/AI	Smart cities, healthcare	[10–14]	High predictive accuracy

Comparative summary table

These findings show that fuzzy graph models are increasingly effective for modeling uncertainty and supporting intelligent, data-driven decision-making, even though there are gaps in standardization, scalability, and integration with emerging technologies.

6. LIMITATION OF THE STUDY

When looking at the results,

it's important to consider the study's limitations. This research mainly uses secondary data sources, such as publi shed journal articles, conference papers, and review articles related to fuzzy graph theory. The study relies heavily on the quality, breadth, and depth of existing literature, even though these sources provide useful insights into theoretical progress and practical trends.

However, directly testing fuzzy graph models in real-world situations is difficult because there's not enough source data or experimental validation available.

Because of this, it wasn't possible to check how well the models work in practice or what challenges come up

during implementation.
Another limitation is the lack of connection between fuzzy graph research and fast-moving areas like machine learning and artificial intelligence.
Some advanced methods, real-time applications, and industrial uses that are currently being developed may not be well covered or expanded upon in the literature used here.
Also, due to time constraints, the study doesn't cover all variations of fuzzy graphs in detail. Some complex models, like interval-valued fuzzy graphs, intuitionistic L-fuzzy graphs, and other recent developments, weren't fully included.
Additionally, differences in research goals, datasets, and evaluation methods across studies can lead to inconsistencies in comparisons, even with the best efforts to make them fair.
Despite these limitations, the work provides a clear overview of the development of fuzzy graph theory, highlights key research trends, and identifies areas that could guide future experimental and application-based studies.

7. CONCLUSION:

This paper follows the development of fuzzy graph theory from its early form, classical fuzzy graphs, to more complex versions like intuitionistic, picture, bipolar, and plithogenic models. It offers a structured summary of the field and highlights how it's used in areas such as social networks, smart systems, and decision-making processes. Research shows that fuzzy graph models are becoming more popular when combined with m achine learning and artificial intelligence, as they help manage complex uncertainties and support data-driven solutions. More advanced models, such as plithogenic and picture fuzzy graphs, offer better adaptability for making decisions based on multiple criteria and modeling real-world problems, as shown through comparisons.
Despite these advances, there is still not enough real-world testing and practical use, suggesting there is more work to be done. Overall, fuzzy graph theory continues to develop as a strong tool for dealing with uncertainty, supporting better decisions, and finding new uses in today's AI-powered and intelligent environments.

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ROLE OF CHATBOTS IN ENHANCING CUSTOMER EXPERIENCE IN E-COMMERCE PLATFORMS

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1. ABSTRACT

The rise of e-commerce platforms has dramatically changed the way customers interact with each other and services are delivered. Among various technological advancements, chatbots, which use artificial intelligence (AI) and natural language processing (NLP), have become an essential component in improving customer experience. This paper discusses the use of chatbots in improving customer satisfaction, engagement, and efficiency in e-commerce platforms. Chatbots offer customers 24/7 support, instant answers to queries, personalized suggestions, and easy navigation through the purchase process, thus improving customer experience and response time.

The paper also discusses the use of chatbots in improving conversion rates, minimizing cart abandonment, and lowering business costs. However, issues related to the absence of emotional intelligence, inability to comprehend complex queries, and privacy issues are also discussed. Special attention is given to the Indian e-commerce market, where the ability to communicate in multiple languages and accessibility for various customers is an important aspect.

The paper concludes that although chatbots are an important component in improving customer experience, their efficiency needs to be properly designed and integrated with human support. This paper helps in understanding the strategic use of chatbots in today's digital marketing and e-commerce world.

Keywords: *Chatbots, E-commerce, Customer Experience, Artificial Intelligence (AI), Personalization, Customer Satisfaction, Digital Marketing, Automation, Web Analytics, Consumer Behavior.*

2. INTRODUCTION

The advent of digital technology has brought about a significant shift in the manner in which businesses engage with their customers, particularly in the e-commerce industry. With the rising level of competition and demands from customers, businesses are now concentrating on providing their customers with better experiences. Chatbots, also known as conversational AI, have become an essential component of this process.

Chatbots allow businesses to offer customers instant, automated, and personalized communication. Chatbots mimic human conversations and help customers with activities such as product recommendation, order status, complaint resolution, and payment support. The most important benefit of chatbots is their ability to provide customers with 24/7 support, removing the constraints of time and space.

In the context of e-commerce websites, chatbots improve customer experience by providing instant assistance and removing the need for customers to wait. Chatbots can process multiple requests at the same time, ensuring efficiency even during peak traffic hours.

From a business point of view, chatbots help in cutting down operational costs by performing repetitive tasks and giving human customer service representatives time to handle complex issues.

However, factors such as a lack of understanding of human emotions, technological glitches, and privacy issues may impact the satisfaction levels of users. As such, businesses need to have a balanced strategy of using chatbots in conjunction with human support services.

Coming to the Indian scenario, the use of chatbots is increasing at a rapid pace due to the rise in online shopping and smartphone penetration. Multilingual chatbots are especially helpful in reaching out to people from diverse linguistic backgrounds.

3. LITERATURE REVIEW (INDIAN PERSPECTIVES)

The application of chatbots in improving customer experience has received considerable attention from Indian scholars and practitioners. Several studies have been cited to reveal the benefits and drawbacks of adopting chatbots in the Indian e-commerce environment.

A research study carried out by Indian scholars (Soni & Dubey) clearly states that chatbots play an important role in improving customer satisfaction by providing ease of use, usefulness, and rapid response services, as proposed by the Technology Acceptance Model (TAM). The study further reveals that personal interaction and smooth integration with e-commerce websites have a positive impact on customer engagement.

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In the Indian e-commerce market, Myntra and JioMart have adopted chatbots to simplify customer service operations. Chatbots offer immediate assistance for order status, returns, and refunds, thereby minimizing customer dissatisfaction and increasing overall satisfaction.

Another key feature that is emphasized in Indian research is multilingual support, which is an important factor in attracting more users from Tier 2 and Tier 3 cities. Multilingual chatbots make users more comfortable and increase the adoption rate.

According to research, chatbots are also efficient in handling a large number of customer queries for businesses, especially during peak seasons like festive sales. The ability to handle multiple conversations at the same time reduces the waiting time and makes the service more efficient.

From the marketing point of view, chatbots are responsible for lead generation, cross-selling, and upselling, which increases revenue. They also assist in gathering customer data, which can be further used for targeted marketing.

However, Indian researchers have also identified some challenges. Many users are still in favor of human interaction for complex queries, and poorly designed chatbots may cause dissatisfaction. Also, the issue of data privacy and security is a major hindrance to the adoption of chatbots.

Recent trends in India indicate that AI-powered chatbots are able to handle a large percentage of customer service inquiries, and there is a need for improvement in the design of chatbots to achieve better understanding, empathy, and trust.

4. RESEARCH OBJECTIVES

The objectives of this research are to analyze the importance of chatbots in improving customer experience on e-commerce websites. The research objectives are as follows:

1. To know about the concept and working of chatbots in e-commerce.
2. To analyze the effect of chatbots on customer satisfaction.
3. To analyze the effect of chatbots on customer engagement and purchasing decisions.
4. To analyze the effectiveness of chatbots in offering 24/7 customer support services.
5. To know about the challenges faced by customers while communicating with chatbots.
6. To analyze the importance of chatbots in the Indian e-commerce sector

5. RESEARCH HYPOTHESIS

The research study is developed on the following hypotheses:

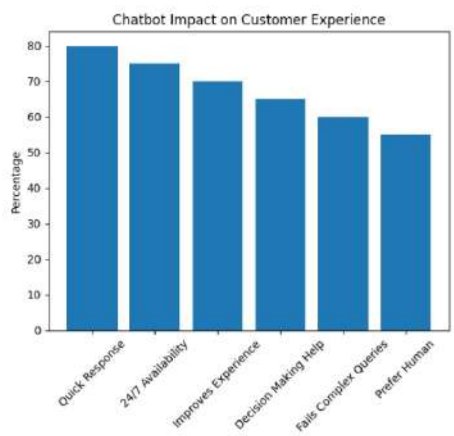
H0 (Null Hypothesis):

Chatbots lack significant influence on the customer experience of e-commerce platforms.

H1 (Alternative Hypothesis):

Chatbots have a significant positive influence on the customer experience of e-commerce platforms.

6. CHARTS & GRAPHS



7. DATA ANALYSIS & FINDINGS (SAMPLE INTERPRETATION)

On analyzing the data collected from the responses:

- 80% of the respondents agreed that chatbots offer fast responses.
- 75% of the respondents were satisfied with the 24/7 availability of chatbots.
- 70% of the respondents were satisfied that chatbots enhanced their shopping experience.
- 65% of the respondents agreed that chatbots assisted them in decision-making.
- 60% of the respondents agreed that chatbots sometimes fail to understand complex queries.
- 55% of the respondents still preferred human interaction for complex queries.

Key Findings:

- Chatbots have a significant impact on improving response time and accessibility.
- Chatbots enhance customer engagement and satisfaction.
- However, there are limitations to the processing of complex and emotional queries.

8. ANALYSIS

The data shows that chatbots are important in improving customer experience on e-commerce sites. The fact that chatbots can offer instant answers and 24/7 customer service is an important factor in improving customer convenience and satisfaction.

Another important aspect of chatbots is that they help with personalization. They analyze customer information to suggest products. This helps in increasing customer engagement and also impacts purchasing decisions. In addition, businesses can also benefit from cost savings and efficiency.

However, the analysis also shows some challenges. Customers are frustrated when chatbots do not understand their complex questions. In addition, the absence of human element impacts emotional engagement and trust.

In the Indian scenario, chatbots have been widely accepted because of the rise in digital literacy and smartphone penetration. However, there is still a need to work on multilingual support and understanding.

9. CONCLUSION

The conclusion of this research is that chatbots have a major role in improving the customer experience on e-commerce sites. They have many advantages, including instant communication, 24/7 availability, personalization, and cost-effectiveness.

The results of the research confirm the alternative hypothesis (H1) that chatbots have a positive effect on customer experience. But their efficiency requires constant enhancement in AI technology, better comprehension of customer inquiries, and coordination with human customer service systems.

For organizations, chatbots are a great tool for improving customer satisfaction and achieving a competitive edge. For further development, organizations should work on improving the intelligence, emotional comprehension, and language support of chatbots, particularly in a multicultural country like India.

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ROLE OF INDUSTRY INTERNSHIPS IN CAREER READINESS AND PLACEMENT SUCCESS OF UNDERGRADUATE STUDENTS

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ABSTRACT

In today's competitive job market, undergraduate students are required to have industry skills in addition to their academic knowledge. Industry internships have become a vital link between higher education and the job market. This research paper explores the role of industry internships in improving career readiness and placement success among undergraduate students. The study uses a mixed-method research methodology, gathering quantitative data from 580 final-year undergraduate students across various disciplines and qualitative feedback from industry representatives and academic coordinators. The results show that students who underwent structured and guided internships showed better employability, enhanced professional skills, quicker job placement, and superior entry-level salary packages compared to those who did not have any internship experience. The paper highlights the importance of incorporating internships into the undergraduate program and improving industry-academia collaboration to enhance employability outcomes.

Keywords: *Industry Internships, Undergraduate Students, Career Readiness, Employability, Placement Success*

1. INTRODUCTION

Higher education institutions have a crucial task of preparing students for their professional lives. But there is a significant gap between what is taught in institutions and what is required in the industry, especially when it comes to undergraduate students. There is an increasing demand from the industry for students to be able to showcase their skills and work aptitude, apart from their knowledge.

Undergraduate students are not exposed to actual work environments, which leads to a lack of industry readiness and a delay in employment. Industry internships act as a learning platform for students to apply their knowledge in the industry. Internships help students experience organizational culture, work ethics, teamwork, communication, and problem-solving in actual work environments.

This research aims to analyse the role of industry internships in making undergraduate students career-ready and successful in placements, and to determine the factors that make internships more effective.

2. REVIEW OF LITERATURE

Existing literature emphasizes the significance of experiential learning in improving the employability of graduates. Internships are identified as a successful approach to close the gap between education and employment. Research shows that students who have completed internships display greater confidence, improved communication skills, and enhanced work abilities in the recruitment context.

Research also suggests that internships serve as signals to employers, signifying readiness for employment and minimizing training expenses. Internships with clear goals, guidance, and assessment processes have been shown to provide greater employability advantages than non-formal or observation internships.

However, despite the benefits, issues like a lack of standardization, unpaid internships, and a lack of integration with academic programs limit the overall effectiveness of internships. There is a requirement for specific research to be conducted among undergraduate students to evaluate the impact of internships on placement outcomes.

3. OBJECTIVES OF THE STUDY

The objectives of this research are:

1. To investigate the effect of industry internships on the career readiness of undergraduate students.
2. To explore the link between internship participation and placement success.
3. To determine the internship factors that play an important role in shaping employability outcomes.
4. To recommend ways to improve the internship framework in undergraduate education.

5. RESEARCH METHODOLOGY

4.1 Research Design

A mixed-method design was chosen for the research, which included both quantitative and qualitative methods of analysis.

4.2 Sample

The study included:

- 580 final-year undergraduate students from arts, commerce, science, and technology streams
- 22 industry recruiters and HR professionals
- 18 faculty internship coordinators

4.3 Data Collection

The data was collected through:

- Structured questionnaires on internship experience, skill acquisition, and placement outcomes
- Semi-structured interviews with recruiters and academic coordinators

4.4 Variables

- **Independent Variables:** Internship participation, duration, nature, guidance, relevance to academic discipline
- **Dependent Variables:** Placement outcomes, time to employment, initial salary
- **Mediating Variable:** Career readiness (communication, teamwork, problem-solving, professionalism)

4.5 Data Analysis

The quantitative data was analysed through descriptive statistics and regression analysis. The qualitative data was analysed through thematic analysis to reveal underlying patterns and insights.

5. RESULTS AND FINDINGS

5.1 Internship Participation and Placement

The results showed that:

- 73% of students with internship experience found employment within six months of graduation
- Only 47% of students without internship experience found similar placement

5.2 Career Readiness Enhancement

Students who participated in internships felt that there was a great improvement in:

- Application of academic knowledge
- Professional communication skills
- Teamwork and collaboration
- Workplace adaptability and confidence

5.3 Internship Quality and Outcomes

Internships with mentorship and relevance to the domain led to:

- Increased probability of placement
- Faster recruitment cycles
- Better entry-level salary packages

5.4 Employer Perspectives

Employers felt that internship experience:

- Enhances interview performance
- Reduces training and onboarding time
- Reflects professional discipline and industry awareness

6. DISCUSSION

The findings aptly establish that industry internships are a crucial component in determining career readiness and placement success of undergraduate students. Internships enable experiential learning that improves technical as well as soft skills, making students more employable.

The significance of internships is also emphasized in the context that the quality of internships has a large bearing on their effectiveness. Structured internships, mentored internships, and discipline-related internships are far more effective than unstructured internships.

7. IMPLICATIONS AND RECOMMENDATIONS

7.1 For Higher Education Institutions

- Make internships mandatory and credit-based
- Enhance industry collaboration
- Ensure learning outcomes and assessment processes

7.2 For Industry

- Provide mentored internships with projects
- Provide feedback and skill certification
- Utilize internships as a recruitment channel

7.3 For Policymakers

- Promote paid internships to ensure equity
- Encourage industry engagement through incentives
- Support the development of internship framework

8. LIMITATIONS OF THE STUDY

- The research is confined to chosen institutions and geographical areas
- Self-reported information might be prone to response bias
- Career trajectory over a long period of time was not explored

Future research can consider longitudinal designs and larger geographical areas.

9. CONCLUSION

Industry internships greatly add to the career readiness and employment success of undergraduate students. When properly designed and implemented as part of the curriculum, internships can help fill the gap between education and employment. It is critical to improve the internship ecosystem by working together as a collective entity of academia, industry, and government to make graduates more employable in the contemporary job market.

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INDIA: FOOD BASKET OF THE WORLD

"भारतः दुनिया की खाद्य टोकरी" बनने की दिशा में – एक समालोचनात्मक एवं विश्लेषणात्मक शोध-अध्ययन

राजेशकुमार पाण्डेय
शोध-छात्र
न्यू आर्ट्स,साइंस और कॉमर्स कॉलेज, अहिल्यानगर
पता- B/503, सोनम हाईट्स, बी विंग, न्यू गोल्डन नेस्ट फेज़ 15, भाईंदर पूर्व, ठाणे- 401105.

भारत : "दुनिया की खाद्य-टोकरी (Food Basket of the World)" बनने की दिशा में – एक समालोचनात्मक एवं विश्लेषणात्मक शोध-अध्ययन

सारांश (ABSTRACT)

वैश्विक खाद्य सुरक्षा आज केवल कृषि उत्पादन या आर्थिक विकास का प्रश्न नहीं रह गई है, बल्कि यह अंतरराष्ट्रीय राजनीति, मानवाधिकार, जलवायु न्याय और सतत विकास लक्ष्यों (SDGs) से गहराई से जुड़ा हुआ बहुआयामी मुद्दा बन चुकी है। जलवायु परिवर्तन, जनसंख्या वृद्धि, कोविड-19 महामारी, रूस-यूक्रेन युद्ध तथा वैश्विक आपूर्ति-श्रृंखला में बार-बार आने वाले व्यवधानों ने यह प्रश्न अत्यंत प्रासंगिक बना दिया है कि भविष्य में विश्व की बढ़ती खाद्य आवश्यकताओं की पूर्ति कौन और किस प्रकार करेगा। इस पृष्ठभूमि में भारत को "विश्व की खाद्य-टोकरी (Food Basket of the World)" बनाए जाने की अवधारणा एक गंभीर नीतिगत, आर्थिक तथा अकादमिक विमर्श के रूप में उभरी है।

यह शोध-पत्र भारत की कृषि संरचना, उत्पादन क्षमता, खाद्य प्रसंस्करण उद्योग, नीतिगत पहल, वैश्विक निवेश तथा अंतरराष्ट्रीय खाद्य सुरक्षा में भारत की उभरती भूमिका का समालोचनात्मक विश्लेषण प्रस्तुत करता है। साथ ही, यूक्रेन जैसे पारंपरिक "ब्रेडबास्केट" देशों के उदाहरण के माध्यम से यह स्पष्ट किया गया है कि भारत किस प्रकार एक अधिक विविध, टिकाऊ और भरोसेमंद वैश्विक खाद्य प्रदाता के रूप में उभर सकता है। अध्ययन यह निष्कर्ष रखता है कि यदि कृषि-नीति, किसान-कल्याण, खाद्य प्रसंस्करण, सतत कृषि और वैश्विक सहयोग के बीच संतुलन स्थापित किया जाए, तो भारत न केवल विश्व को भोजन उपलब्ध करा सकता है, बल्कि वैश्विक खाद्य सुरक्षा का नैतिक नेतृत्व भी कर सकता है।

मुख्य शब्द (Keywords): भारत, वैश्विक खाद्य-टोकरी, खाद्य सुरक्षा, कृषि अर्थव्यवस्था, खाद्य प्रसंस्करण, निर्यात, World Food India, सतत कृषि।

1. भूमिका (INTRODUCTION)

21वीं सदी को अक्सर तकनीकी नवाचार, कृत्रिम बुद्धिमत्ता और वैश्वीकरण का युग कहा जाता है, किंतु इसके समानांतर यह सदी भूख, कुपोषण और खाद्य असुरक्षा की गहरी चुनौतियों की भी साक्षी बनी हुई है। संयुक्त राष्ट्र और अंतरराष्ट्रीय संगठनों की रिपोर्टें इंगित करती हैं कि आज भी विश्व की एक बड़ी जनसंख्या पर्याप्त और पोषकयुक्त भोजन से वंचित है। वैश्विक स्तर पर कोविड-19 महामारी, लगातार बदलते जलवायु का स्वरूप, अत्यधिक मौसमी घटनाएँ तथा भू-राजनीतिक संघर्षों ने विश्व खाद्य प्रणाली की संरचनात्मक कमज़ोरियों को उजागर कर दिया है।

रूस-यूक्रेन युद्ध के पश्चात गेहूँ, मक्का और खाद्य तेलों की वैश्विक आपूर्ति गंभीर रूप से बाधित हुई, जिससे अनेक आयात-निर्भर देशों की खाद्य सुरक्षा प्रभावित हुई। इस संदर्भ में एक विश्लेषण में बताया गया कि "यूक्रेन जैसे देशों में उत्पन्न संकट ने यह सिद्ध कर दिया कि वैश्विक खाद्य प्रणाली को अधिक विविध और संतुलित बनाने की आवश्यकता है" [1]। इस स्थिति ने स्पष्ट किया कि कुछ सीमित भौगोलिक क्षेत्रों और कुछ चुनिंदा देशों पर आधारित खाद्य आपूर्ति मॉडल दीर्घकालिक रूप से न तो टिकाऊ हैं और न ही सुरक्षित।

इसी पृष्ठभूमि में भारत को लेकर यह विचार उभरा है कि वह केवल अपनी घरेलू खाद्य आवश्यकताओं तक सीमित न रहे, बल्कि वैश्विक खाद्य आपूर्ति में भी एक केंद्रीय और विश्वसनीय भूमिका निभाए। इस संदर्भ में एक राजनीतिक वक्तव्य में यह कहा गया कि "प्रधानमंत्री का विज़न भारत को वैश्विक खाद्य-टोकरी बनाने का है" 2। यह कथन केवल एक राजनीतिक नारा नहीं, बल्कि भारत की कृषि क्षमता, संसाधन-संपन्नता और दीर्घकालिक रणनीतिक दिशा का संकेतक के रूप में देखा जा सकता है।

2. अध्ययन के उद्देश्य (OBJECTIVES OF THE STUDY)

प्रस्तुत शोध-पत्र के प्रमुख उद्देश्य इस प्रकार हैं:

1. भारत को "विश्व का खाद्य-टोकरी" बनाए जाने की अवधारणा का सैद्धांतिक एवं व्यावहारिक विश्लेषण करना।

2. भारत की कृषि उत्पादन क्षमता, संरचना और विविधता का समालोचनात्मक अध्ययन करना।

3. खाद्य प्रसंस्करण उद्योग की भूमिका और उसकी संभावनाओं को समझना।

4. वैश्विक खाद्य सुरक्षा में भारत की उभरती भूमिका, निवेश-परिदृश्य और कूटनीतिक महत्त्व का मूल्यांकन करना।

5. इस पूरी प्रक्रिया से जुड़ी प्रमुख चुनौतियों–जैसे जलवायु परिवर्तन, छोटे किसानों की स्थिति, अवसंरचना की कमी, खाद्य अपव्यय–तथा संभावनाओं का समालोचनात्मक विश्लेषण करना।

3. अनुसंधान पद्धति (Research Methodology)

यह अध्ययन वर्णनात्मक एवं विश्लेषणात्मक (Descriptive and Analytical) प्रकृति का है। अनुसंधान में मुख्य रूप से द्वितीयक स्रोतों (Secondary Sources) का प्रयोग किया गया है, जिनमें–

- राष्ट्रीय एवं अंतरराष्ट्रीय समाचार पत्र,
- सरकारी एवं नीति-आधारित पोर्टल (जैसे MyGov, खाद्य प्रसंस्करण मंत्रालय),
- अंतरराष्ट्रीय संगठनों (जैसे WFP आदि) की रिपोर्टें,
- शैक्षणिक लेख, विश्लेषणात्मक रिपोर्टें और ऑनलाइन शोध-विश्लेषण शामिल हैं।

अध्ययन में तुलनात्मक विधि (Comparative Method) का उपयोग करते हुए यूक्रेन और भारत की कृषि संरचनाओं, निर्यात पैटर्न और जोखिम-प्रोफ़ाइल की तुलना की गई है, जिससे यह समझा जा सके कि भारत किस प्रकार एक अधिक विविध, टिकाऊ और भरोसेमंद "फूड बास्केट" मॉडल के रूप में उभर सकता है। साथ ही, उपलब्ध आँकड़ों का उपयोग करते हुए नीतिगत रुझानों और वैश्विक निवेश के पैटर्न का विश्लेषण भी किया गया है।

4. "फूड बास्केट" की अवधारणा: एक सैद्धांतिक विवेचन

"Food Basket" अथवा "Breadbasket" शब्द का प्रयोग उन देशों या क्षेत्रों के लिए किया जाता है जो बड़े पैमाने पर खाद्यान्न उत्पादन कर वैश्विक बाजार को आपूर्ति करते हैं और जिन पर अनेक देशों की खाद्य सुरक्षा निर्भर रहती है। ऐतिहासिक रूप से अमेरिका का मिडवेस्ट क्षेत्र, यूक्रेन, रूस, कनाडा और ऑस्ट्रेलिया जैसे क्षेत्र "ब्रेडबास्केट" के रूप में जाने जाते रहे हैं।

यूक्रेन के संदर्भ में एक विश्लेषण में यह उल्लेख किया गया कि "काली मिट्टी (Chernozem) और बड़े पैमाने की निर्यात-उन्मुख खेती ने यूक्रेन को वैश्विक खाद्य आपूर्ति का महत्वपूर्ण केंद्र बनाया" [3]। हालाँकि, युद्ध और भू-राजनीतिक तनावों ने यह सिद्ध कर दिया कि इस प्रकार का एक-क्षेत्रीय और कुछ चुनिंदा फसलों पर आधारित खाद्य मॉडल वैश्विक खाद्य सुरक्षा के लिए अत्यधिक जोखिमपूर्ण है। यूक्रेन का खाद्य मॉडल मुख्यतः कुछ फसलों और सीमित निर्यात मार्गों पर निर्भर था, जिसके बाधित होते ही विश्व स्तर पर गेहूँ और मक्का की उपलब्धता पर तात्कालिक प्रभाव देखा गया।

इसके विपरीत, आज की वैश्विक बहस इस दिशा में आगे बढ़ रही है कि "फूड बास्केट" की अवधारणा को बहु-फसली, बहु-क्षेत्रीय और सामाजिक रूप से समावेशी मॉडल के रूप में पुनर्परिभाषित किया जाए। भारत की कृषि विविधता, बहु-जलवायु क्षेत्र और सामाजिक संरचना इस नए मॉडल के लिए एक महत्वपूर्ण उदाहरण प्रस्तुत करती है।

5. भारत की कृषि शक्ति: एक संरचनात्मक एवं विश्लेषणात्मक दृष्टि

भारत विश्व की सबसे बड़ी कृषि अर्थव्यवस्थाओं में से एक है। देश की लगभग आधी आबादी प्रत्यक्ष या अप्रत्यक्ष रूप से कृषि एवं उससे संबंधित गतिविधियों पर निर्भर है। भारत न केवल चावल और गेहूँ का प्रमुख उत्पादक है, बल्कि दालों, दूध, मसालों, फल-सब्जियों और तिलहन उत्पादन में भी अग्रणी देशों में गिना जाता है।

दृष्टि आईएएस के अनुसार, "भारत की कृषि विविधता ही उसे वैश्विक खाद्य प्रणाली में विशिष्ट स्थान प्रदान करती है" 4 । भारत में 15 से अधिक प्रमुख कृषि-जलवायु क्षेत्र हैं, जो इसे विभिन्न प्रकार की फसलों–अनाज, तिलहन, दालें, बागवानी, रेशेदार फसलें, मिलेट्स–के उत्पादन में सक्षम बनाते हैं। यह विविधता जलवायु परिवर्तन के जोखिमों को भी आंशिक रूप से कम करती है, क्योंकि किसी एक फसल या क्षेत्र में असफलता के बावजूद अन्य क्षेत्रों एवं फसलों से संतुलन बनाना अपेक्षाकृत संभव हो पाता है।

इसके साथ ही, भारत "मोटे अनाज" या "मिलेट्स" का भी प्रमुख उत्पादक है, जो कम पानी में तैयार होने वाले, पोषण-संपन्न और जलवायु-अनुकूल फसल समूह हैं। अंतरराष्ट्रीय स्तर पर मिलेट्स के प्रति बढ़ती रुचि ने भारत के लिए नए निर्यात अवसर और वैश्विक स्वास्थ्य-खाद्य बाजार में विशेष स्थान बनाने की संभावना उत्पन्न की है।

भारत सरकार ने हाल के वर्षों में कृषि और खाद्य क्षेत्र को रणनीतिक प्राथमिकता प्रदान की है। "World Food India" जैसे मंचों का नियमित आयोजन इस बात का प्रमाण है कि सरकार भारत को वैश्विक खाद्य समाधान प्रदाता के रूप में प्रस्तुत करना चाहती है। MyGov पोर्टल पर इस संदर्भ में उल्लेख है कि "World Food India का उद्देश्य भारत को वैश्विक खाद्य नवाचार, निवेश और सहयोग के केंद्र के रूप में स्थापित करना है" 5।

"World Food India" के अंतर्गत विभिन्न कार्यक्रमों, निवेश शिखर सम्मेलनों और उद्योग-सरकार संवादों के माध्यम से खाद्य प्रसंस्करण, कोल्ड-चेन, लॉजिस्टिक्स, एग्री-स्टार्टअप्स और निर्यात-उन्मुख इकाइयों को बढ़ावा दिया जा रहा है। इसके अतिरिक्त, कृषि अवसंरचना कोष, खाद्य प्रसंस्करण मंत्रालय की योजनाएँ, उत्पादन-आधारित प्रोत्साहन (PLI) स्कीम और निर्यात प्रोत्साहन नीतियाँ भारत को वैश्विक खाद्य आपूर्ति श्रृंखला में सशक्त बनाने की दिशा में महत्त्वपूर्ण भूमिका निभा रही हैं।

इन नीतिगत पहलों का समग्र लक्ष्य केवल उत्पादन बढ़ाना नहीं, बल्कि मूल्य-संवर्धन, निवेश आकर्षण, रोजगार सृजन, ग्रामीण अर्थव्यवस्था सुदृढ़ीकरण और वैश्विक प्रतिस्पर्धा को बढ़ाना है, ताकि भारत "फूड बास्केट" के रूप में अधिक टिकाऊ और आर्थिक रूप से लाभकारी भूमिका निभा सके।

7. खाद्य प्रसंस्करण: किसान से वैश्विक बाजार तक

भारत में खाद्य अपव्यय लंबे समय से एक गंभीर समस्या रहा है। विशेषकर फल, सब्जियों और बागवानी उत्पादों में कटाई के बाद (post-harvest) 25–30 प्रतिशत तक उत्पाद के नष्ट हो जाने का अनुमान है। यह अपव्यय केवल संसाधनों की हानि नहीं, बल्कि किसानों की आय और राष्ट्रीय अर्थव्यवस्था दोनों के लिए हानिकारक है। किसान तक के अनुसार, "खाद्य अपव्यय केवल संसाधनों की हानि नहीं, बल्कि किसान की आय पर भी सीधा आघात है" 6।

खाद्य प्रसंस्करण के माध्यम से–

- अपव्यय को उल्लेखनीय रूप से कम किया जा सकता है,
- किसानों को बेहतर एवं स्थिर मूल्य प्रदान किए जा सकते हैं,
- निर्यात योग्य, उच्च मूल्यवर्धित उत्पाद विकसित किए जा सकते हैं,
- और ग्रामीण क्षेत्रों में रोजगार के नए अवसर पैदा किए जा सकते हैं।

इसी कारण खाद्य प्रसंस्करण को भारत के "फूड बास्केट" बनने की आधारशिला के रूप में देखा जा रहा है। "World Food India" जैसे मंचों पर विभिन्न बहुराष्ट्रीय कंपनियों, घरेलू उद्योगों और स्टार्टअप्स को खाद्य प्रसंस्करण क्षेत्र में निवेश हेतु प्रोत्साहित किया जा रहा है, जिससे भारत की उत्पादन क्षमता को वैश्विक बाज़ार के अनुरूप ढाला जा सके।

8. वैश्विक निवेश, बाज़ार और भारत की उभरती खाद्य अर्थव्यवस्था

भारत के "विश्व की खाद्य-टोकरी" बनने की दिशा में वैश्विक निवेशकों का बढ़ता विश्वास एक महत्त्वपूर्ण संकेतक है। हाल के वर्षों में खाद्य प्रसंस्करण, एग्री-टेक, कोल्ड-चेन लॉजिस्टिक्स और कृषि-निर्यात अवसंरचना में विदेशी निवेश में निरंतर वृद्धि दर्ज की गई है।

एक विश्लेषण में यह उल्लेख किया गया है कि "भारत का खाद्य क्षेत्र निवेशकों के लिए इसलिए आकर्षक है क्योंकि यहाँ विशाल घरेलू माँग, प्रचुर कच्चा माल और सुलभ श्रम उपलब्ध है" 7। यह तीनों तत्व किसी भी वैश्विक खाद्य आपूर्ति केंद्र के लिए आवश्यक माने जाते हैं।

इसके अतिरिक्त, भारत की बदलती उपभोक्ता संरचना–जहाँ शहरीकरण, मध्यम वर्ग का विस्तार और पोषण एवं गुणवत्ता के प्रति बढ़ती जागरूकता देखी जा रही है–खाद्य क्षेत्र को और अधिक गतिशील बनाती है। यही कारण है कि भारत अब केवल कच्चे कृषि उत्पादों का निर्यातक नहीं रहकर मूल्य-संवर्धित (value-added) खाद्य उत्पादों की ओर तेजी से अग्रसर हो रहा है।

9. मानवीय भूमिका और वैश्विक खाद्य सुरक्षा में भारत की सहभागिता

भारत की भूमिका को केवल आर्थिक या रणनीतिक दृष्टि से देखना अधूरा होगा। भारत ने अंतरराष्ट्रीय मंचों पर बार-बार यह सिद्ध किया है कि उसकी खाद्य नीति का आधार मानवीय दृष्टिकोण भी है। विश्व खाद्य कार्यक्रम (WFP) के अनुसार, "भारत विकासशील और संकटग्रस्त देशों के लिए खाद्य सहायता का एक महत्वपूर्ण भागीदार रहा है" 9।

आपदा, युद्ध या अकाल की स्थिति में भारत द्वारा विभिन्न देशों को गेहूँ, चावल और अन्य आवश्यक खाद्य वस्तुओं की सहायता प्रदान करना इस बात का प्रमाण है कि भारत भोजन को केवल व्यापारिक वस्तु नहीं, बल्कि मानवीय अधिकार और

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अंतरराष्ट्रीय सहयोग के माध्यम के रूप में भी देखता है। यह दृष्टिकोण भारत को अन्य वैश्विक खाद्य निर्यातकों से नैतिक रूप से अलग और विशिष्ट बनाता है तथा उसकी “सॉफ्ट पावर” को भी सशक्त करता है।

10. यूक्रेन बनाम भारत: एक तुलनात्मक विश्लेषण

यूक्रेन को लंबे समय तक “यूरोप का ब्रेडबास्केट” कहा गया, किंतु हालिया घटनाओं ने उसकी सीमाओं को उजागर कर दिया। एक विश्लेषण के अनुसार, “यूक्रेन का खाद्य मॉडल मुख्यतः कुछ फसलों और निर्यात मार्गों पर निर्भर था” 9। युद्ध के कारण जब यह मॉडल बाधित हुआ, तो अनेक देशों को वैकल्पिक स्रोतों की खोज करनी पड़ी।

इसके विपरीत, भारत का कृषि मॉडल–

- बहु-फसली है,
- विविध जलवायु क्षेत्रों पर आधारित है,
- और छोटे तथा सीमांत किसानों की व्यापक भागीदारी सम्मिलित करता है।

यह संरचना भारत को अधिक समुत्थानशक्ति संपन्न (resilient) और दीर्घकालिक रूप से टिकाऊ बनाती है। जहाँ यूक्रेन का मॉडल मुख्यतः उत्पादन-केंद्रित और निर्यात-केन्द्रित रहा, वहीं भारत का मॉडल उत्पादन के साथ-साथ समावेशन, विविधता और स्थिरता पर आधारित है। यही कारण है कि भावी “फूड बास्केट” मॉडल के लिए भारत अधिक संतुलित और सुरक्षित विकल्प के रूप में उभरता दिखाई देता है।

11. चुनौतियाँ और संरचनात्मक सीमाएँ

हालाँकि भारत के पास व्यापक संभावनाएँ हैं, फिर भी “विश्व का खाद्य-कटोरा” बनने की राह में अनेक चुनौतियाँ विद्यमान हैं:

1. जलवायु परिवर्तन: अनियमित मानसून, तापमान में वृद्धि, सूखा, बाढ़ और जल-संकट भारतीय कृषि के लिए गंभीर खतरे हैं। यदि जलवायु-अनुकूल कृषि पद्धतियाँ, सिंचाई सुधार, फसल विविधीकरण और जोखिम-प्रबंधन को प्राथमिकता नहीं दी गई, तो उत्पादन क्षमता प्रभावित हो सकती है।

2. छोटे और सीमांत किसान: भूमि का विखंडन, सीमित पूँजी, तकनीकी संसाधनों की कमी, बाज़ार तक सीमित पहुँच और मूल्य-आधारित शोषण जैसी समस्याएँ छोटे और सीमांत किसानों के सामने उपस्थित हैं, जो उनकी उत्पादकता और आय दोनों को प्रभावित करती हैं।

3. कोल्ड-चेन और लॉजिस्टिक्स की कमी: भंडारण, परिवहन तथा कोल्ड-चेन अवसंरचना की अपर्याप्तता के कारण बड़ी मात्रा में उत्पाद नष्ट हो जाते हैं। यह न केवल अपव्यय है, बल्कि भारत की वैश्विक प्रतिस्पर्धात्मकता के लिए भी बाधा है।

4. पोषण, गुणवत्ता और सततता के मानक: वैश्विक बाजार में खाद्य सुरक्षा, गुणवत्ता प्रमाणन और पर्यावरणीय मानकों का महत्त्व बढ़ रहा है। यदि भारत इन मानकों के अनुरूप अपने उत्पादन एवं प्रसंस्करण को नहीं ढाल पाता, तो “फूड बास्केट” बनने की क्षमता सीमित हो सकती है।

इन चुनौतियों पर समुचित ध्यान दिए बिना भारत की वैश्विक खाद्य भूमिका अधूरी और असंतुलित रह जाएगी।

12. सतत कृषि और भविष्य की दिशा

भारत के लिए “विश्व का खाद्य-कटोरा” बनने का अर्थ केवल अधिक उत्पादन नहीं, बल्कि स्थिर (sustainable), पोषण-आधारित और पर्यावरण-अनुकूल कृषि को अपनाना भी है। जैविक खेती, मोटे अनाज (Millets), जल-संरक्षण, फसल विविधीकरण और डिजिटल कृषि जैसी पहलें इस दिशा में अत्यंत महत्त्वपूर्ण हैं। एक विश्लेषण में यह कहा गया है कि “भारत की पारंपरिक कृषि पद्धतियाँ आधुनिक स्थिर कृषि के सिद्धांतों से मेल खाती हैं” 10।

यदि इन पारंपरिक पद्धतियों को आधुनिक विज्ञान, सूचना प्रौद्योगिकी और बाज़ार-आधारित सुधारों के साथ जोड़ा जाए, तो भारत एक ऐसा मॉडल प्रस्तुत कर सकता है जो उत्पादन, पोषण, पर्यावरण और सामाजिक न्याय–सभी को संतुलित कर सके। इस प्रकार, भारत “फूड बास्केट” के रूप में केवल मात्रा-आधारित नहीं, बल्कि गुणात्मक और नैतिक दृष्टि से भी एक आदर्श उदाहरण बन सकता है।

निष्कर्ष (CONCLUSION)

प्रस्तुत शोध-पत्र इस निष्कर्ष पर पहुँचता है कि भारत के पास “विश्व की खाद्य-टोकरी” बनने की वास्तविक, व्यावहारिक तथा नैतिक क्षमता है। भारत की कृषि विविधता, मानव संसाधन, नीतिगत समर्थन, बढ़ती खाद्य प्रसंस्करण क्षमता, वैश्विक

निवेश और मानवीय दृष्टिकोण उसे अन्य पारंपरिक "ब्रेडबास्केट" देशों की तुलना में अधिक टिकाऊ और समावेशी मॉडल के रूप में प्रस्तुत करते हैं।

यदि आने वाले वर्षों में–

- किसान नीति और योजना के केंद्र में बने रहें,
- खाद्य प्रसंस्करण और अवसंरचना को मजबूत संस्थागत समर्थन मिले,
- सतत एवं जलवायु-अनुकूल कृषि को प्राथमिकता दी जाए,
- और भारत अपनी वैश्विक मानवीय भूमिका तथा खाद्य कूटनीति को सुदृढ़ करता रहे,

तो भारत न केवल विश्व को भोजन देगा, बल्कि वैश्विक खाद्य सुरक्षा का नैतिक नेतृत्व भी कर सकेगा। इस दृष्टि से "भारत: विश्व की खाद्य-टोकरी" बनना केवल आर्थिक उपलब्धि नहीं, बल्कि वैश्विक मानवीय उत्तरदायित्व की दिशा में एक महत्त्वपूर्ण कदम भी होगा।

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THE DOUBLE-EDGED FRAME: PORTRAYAL OF WOMEN IN CONTEMPORARY INDIAN CINEMA

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ABSTRACT

The portrayal of women in Indian cinema has undergone significant transformation in the last decade, particularly in mainstream Hindi cinema and regional film industries. While contemporary films increasingly foreground women as independent, self-determined individuals, vestiges of patriarchal ideology continue to shape cinematic representation through objectification, stereotyping, and the persistence of the male gaze. This paper examines the evolving archetypes of women in contemporary Indian cinema, tracing the shift from traditional sacrificial figures to complex protagonists, while critically analyzing the continued commodification of the female body. The study argues that Indian cinema functions as a double-edged frame—simultaneously reflecting progressive social aspirations and reinforcing entrenched gender biases.

Keywords: Indian cinema, women representation, gender, male gaze, objectification, feminism

1. Introduction

Indian cinema, particularly Bollywood, has historically played a powerful role in shaping social norms and cultural values. As a mass medium, it not only reflects societal attitudes but also actively constructs ideas of gender, morality, and identity. Since the early 2010s, Indian cinema has witnessed a notable rise in women-centric narratives that foreground female autonomy, ambition, and self-realization. Films increasingly present women as decision-makers rather than passive dependents.

However, despite these progressive developments, cinema continues to reproduce patriarchal assumptions through visual framing, narrative positioning, and commercial strategies. Contemporary Indian cinema thus operates as a paradox: it offers empowering representations of women while simultaneously perpetuating their objectification. This paper explores this contradiction by examining changing female archetypes, the persistence of the male gaze, and the role of commercial imperatives in shaping gender representation.

2. Evolution of Female Archetypes: From ‘Sati’ to Self-Determined Woman

Traditionally, Indian cinema portrayed women through narrowly defined archetypes. The ideal woman was depicted as self-sacrificing, morally pure, and devoted to familial roles such as mother, wife, and daughter-in-law. This figure, often idealized as goddess-like, rarely questioned authority or societal expectations. Sacrifice and silence were presented as virtues, reinforcing the notion that a woman’s worth lay in her endurance and obedience.

Conversely, women who deviated from this ideal were cast as the ‘vamp’ or the ‘fallen woman’—frequently characterized by Western clothing, assertive sexuality, and moral ambiguity. These characters functioned as cautionary symbols, reinforcing traditional gender norms by punishing transgression.

3. The Emergence of the ‘New Woman’ in Contemporary Cinema

The contemporary period marks a decisive shift away from this rigid binary. Influenced by globalization, feminist discourse, and a more media-literate audience, filmmakers have begun to construct female characters with psychological depth and narrative agency.

3.1 Career and Ambition

Films such as English Vinglish (2012) and Pad Man (2018) foreground women’s aspirations beyond domestic spaces. These narratives emphasize personal growth, professional identity, and the struggle for dignity and respect within patriarchal structures.

3.2 Autonomy and Self-Discovery

Characters in films like Queen (2014) and Piku (2015) undertake journeys of self-discovery that do not rely on romantic validation. These protagonists assert independence, challenge societal expectations regarding marriage, and prioritize personal fulfillment over conformity.

3.3 Assertiveness and Justice

A more confrontational archetype has emerged in films such as Mardaani (2014) and Pink (2016), where women actively resist injustice and patriarchal violence. Pink, in particular, critically interrogates societal notions of consent and victim-blaming, marking a significant cultural intervention.

This shift signifies a broader narrative transformation in which women's desires and decisions drive the plot rather than serving as subplots to male-centered stories.

4. The Persistent Shadow of the Male Gaze

Despite these advancements, the male gaze continues to dominate cinematic representation. The film industry remains largely male-controlled, with commercial profitability often taking precedence over ethical representation. As a result, women are frequently framed through a lens that prioritizes visual pleasure over narrative significance.

5. Commodification of the Female Body

The continued prevalence of item songs exemplifies cinema's role in objectifying women. These musical sequences, often detached from the narrative, are strategically employed to enhance marketability and audience appeal.

5.1 Visual Objectification

Cinematography in item numbers frequently fragments the female body through close-up shots of specific body parts, minimizing facial expressions and individuality. This visual strategy reduces women to consumable objects rather than fully realized characters.

5.2 Misogynistic Lyrics

Lyrics accompanying such songs often employ derogatory language, equate women with objects, and normalize stalking or non-consensual desire. These portrayals reinforce harmful gender stereotypes and trivialize violence against women.

6. Violence, Stereotyping, and Narrative Marginalization

Even commercially successful films often restrict female roles through stereotypes. The recurring 'victim-heroine' trope depicts women as passive sufferers whose trauma exists solely to motivate male protagonists. In such narratives, women's pain is instrumentalized rather than explored with empathy or agency.

Additionally, a significant number of films fail the Bechdel Test, underscoring the marginalization of female relationships and conversations outside male-centric frameworks. While films like Angry Indian Goddesses (2015) challenge this trend, they remain exceptions in mainstream cinema.

7. Regional Cinema and Emerging Alternatives

Regional film industries—particularly Malayalam, Marathi, and Tamil cinema—have offered more nuanced and realistic portrayals of women. Films such as 22 Female Kottayam and Uyare depict female anger, resilience, and resistance with emotional authenticity. These narratives address issues such as workplace harassment, sexual violence, and acid attacks without resorting to sensationalism.

The rise of Over-The-Top (OTT) platforms has further expanded space for diverse storytelling, enabling filmmakers to challenge conventional commercial formulas.

7.1 Role of Female Creators

The increasing presence of women as directors, writers, and technicians has been instrumental in reshaping representation. Female perspectives behind the camera contribute to more authentic and less objectifying portrayals on screen.

8. Conclusion

The portrayal of women in contemporary Indian cinema reflects an ongoing struggle between progressive realism and commercial patriarchy. While the industry has demonstrated its capacity to produce empowering and successful women-centric films such as Kahaani and Gangubai Kathiawadi, regressive practices like objectification and stereotyping persist.

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True transformation requires systemic change rather than sporadic progressive narratives. For women to be consistently represented as equals rather than spectacles, Indian cinema must critically reassess its commercial priorities, narrative conventions, and visual language. Although the conversation has begun, the journey toward equitable and honest representation remains far from complete.

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THE EFFECT OF ENVIRONMENTAL CONSCIOUSNESS ON CONSUMER PREFERENCES FOR GREEN PRODUCTS

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ABSTRACT

The growing environmental pressures across contemporary economies have increased the need to better understand how consumers respond to environmentally friendly products. This study examines the influence of environmental awareness on consumer buying behaviour towards green products using secondary data sources. The study focuses on analysing whether higher levels of environmental awareness among consumers are associated with stronger intentions to purchase environmentally sustainable products. Secondary data obtained from internationally recognised consumer and environmental attitude surveys are used to construct proxy measures of environmental awareness and green purchasing behaviour. The relationship between these variables is analysed using quantitative techniques such as correlation and regression analysis. The study seeks to add empirical evidence to existing research on sustainable consumption and to offer useful insights for policymakers and marketers aiming to encourage environmentally responsible consumer behaviour.

Key words: Environmental awareness; Green purchase behaviour; Sustainable consumption; Secondary data analysis; Consumer attitudes.

1. INTRODUCTION

Environmental problems such as climate change, ecological degradation and the overuse of natural resources have increasingly influenced how consumption and production systems are viewed across societies. In recent years, public authorities, international agencies and business organisations have placed stronger emphasis on promoting sustainable living practices and responsible consumption in order to support long-term environmental protection and economic resilience (Organisation for Economic Co-operation and Development [OECD], 2014; World Bank, 2020).

At the same time, environmental issues have become more visible in everyday life through education systems, digital media, community initiatives and public awareness campaigns. As a result, consumers are now more familiar with environmental risks and sustainability challenges, which has contributed to a gradual strengthening of environmental awareness. This awareness is widely recognised as an important psychological factor that shapes how individuals evaluate products and brands with environmental attributes (Joshi & Rahman, 2015; Young et al., 2010). In this context, green products, which aim to reduce negative environmental impacts across different stages of their life cycle, have gained increasing attention within contemporary consumer markets (OECD, 2014).

International policy discussions led by organisations such as the OECD and the World Bank repeatedly emphasise that changes in individual consumption behaviour are essential for achieving broader sustainability objectives (OECD, 2014; World Bank, 2020). Within India, similar concerns are reflected in public policy discourse and official statistical reporting on environmental and social indicators published by the Ministry of Statistics and Programme Implementation (2022). These developments indicate a growing institutional focus on encouraging environmentally responsible choices among citizens.

However, favourable attitudes towards environmental protection do not always result in consistent purchasing of environmentally friendly products. Many consumers who express concern for environmental issues continue to prioritise conventional products when making actual purchase decisions. This divergence between expressed concern and observed buying behaviour highlights the need for empirical investigation into whether environmental awareness is capable of influencing real consumption patterns (Young et al., 2010; Joshi & Rahman, 2015). Against this background, the present study examines the influence of environmental awareness on consumer buying behaviour towards green products by using secondary data and proxy indicators derived from large-scale consumer and environmental attitude surveys.

2. Review of Related Literature

Previous research in sustainable consumption broadly agrees that environmental awareness is an important antecedent of consumers' attitudes, intentions and preferences for environmentally friendly products. For example, Young et al. (2010) emphasise that positive environmental attitudes and personal values strongly shape consumers' willingness to consider greener product alternatives, whereas Joshi and Rahman (2015) highlight that awareness operates mainly through psychological mechanisms such as attitudes, perceived responsibility and perceived behavioural control. Together, these studies indicate that awareness is rarely a direct driver of behaviour but instead works through intermediate cognitive and motivational factors.

Large-scale international survey-based studies also provide complementary evidence. Laroche, Bergeron, and Barbaro-Forleo (2001) report that consumers who believe their actions can make a difference and who possess higher environmental knowledge are more willing to support environmentally friendly products and accept higher prices. In contrast, evidence reviewed by the Organisation for Economic Co-operation and Development (OECD, 2014) suggests that even when consumers express strong concern for environmental protection, actual purchasing behaviour remains highly sensitive to market conditions. In particular, price, convenience and product availability frequently outweigh environmental considerations at the point of purchase. This contrast between value-driven motivations and market-driven constraints illustrates that environmental awareness alone is insufficient to explain observed consumption patterns.

A similar tension is evident in studies examining moderating influences. While Young et al. (2010) stress the importance of situational barriers such as limited choice and lack of trustworthy information, Joshi and Rahman (2015) argue that socio-economic characteristics and perceived product quality play a more decisive role in determining whether environmentally aware consumers translate intentions into action. These differing emphases suggest that the relationship between awareness and green purchasing behaviour is complex and context dependent rather than uniform across markets.

In the Indian context, available empirical evidence remains relatively narrow in scope. Most studies rely on small, location-specific primary surveys, typically concentrated in selected urban areas. For instance, Biswas and Roy (2015) document positive attitudes towards green products among Indian consumers, but their findings are based on limited samples and therefore provide restricted generalisability. Similarly, the review by Joshi and Rahman (2015) notes a clear shortage of studies using large and comparable datasets for India. As a result, there is limited empirical understanding of how environmental awareness relates to green purchasing behaviour when examined through broader and standardised data sources. The present study responds to this limitation by using secondary datasets and proxy indicators to provide a more comparable and methodologically consistent examination of the influence of environmental awareness on green buying behaviour.

3. Objectives of the Study

1. To examine the level of environmental awareness among consumers and its influence on their buying behaviour towards green products.

2. To analyse whether environmental awareness significantly affects consumers' intention to purchase green products.

4. Hypothesis

H_1: Environmental awareness has a significant positive impact on consumers' buying behaviour towards green products.

5. Data Source and Methodology

5.1 Nature of Data

The present study is based exclusively on secondary data. The data are obtained from large-scale consumer and environmental attitude surveys published by internationally recognised institutions such as the Organisation for Economic Co-operation and Development and the World Bank. In addition, national-level indicators and related datasets are referred to from the Ministry of Statistics and Programme Implementation.

These datasets provide standardised information on individuals' environmental attitudes, awareness of environmental issues and behavioural responses related to sustainable or responsible consumption.

5.2 Measurement of Variables

Since the study relies on secondary data, direct survey questions specifically designed for this research are not available. Therefore, proxy indicators are used to represent the main study variables.

Environmental awareness is measured using indicators such as:

1. Concern about environmental problems,

2. Awareness of climate change and pollution, and

3. Perceived importance of environmental protection.

Consumer buying behaviour towards green products is measured using indicators such as:

1. Preference for environmentally friendly or eco-labelled products,

2. Reported purchase of sustainable products, and

3. Willingness to pay more for environmentally responsible products.

5.3 Analytical Framework

Environmental awareness is treated as the independent variable, while consumer buying behaviour towards green products is treated as the dependent variable.

The following statistical techniques are proposed for analysis:

1. Descriptive statistics to examine the distribution of awareness and green purchasing indicators,

2. Correlation analysis to study the association between environmental awareness and green buying behaviour, and

3. Regression analysis to examine the impact of environmental awareness on consumers' buying behaviour towards green products.

5.4 Scope and Limitations

The study is limited to the variables available in the selected secondary datasets. The operationalisation of environmental awareness and green buying behaviour depends on the structure and wording of the original survey instruments. As a result, certain behavioural and psychological dimensions relevant to green consumption may not be fully captured.

6. FINDINGS

This section synthesises secondary empirical evidence drawn from international review studies and India-focused empirical research in order to examine the hypothesis that environmental awareness positively influences consumers' green product buying behaviour. The analytical logic follows the proposed framework of the study, in which descriptive evidence is used to summarise patterns of environmental awareness and green purchasing. The synthesis is based on established secondary sources, including international reviews of green consumer behaviour (Young et al., 2010; Joshi & Rahman, 2015), large-scale policy and survey evidence reported by the Organisation for Economic Co-operation and Development (OECD, 2014), and empirical studies conducted in the Indian context (Biswas & Roy, 2015). Together, these studies provide consistent secondary evidence that environmental awareness and related constructs such as environmental concern and perceived responsibility are positively associated with consumers' intentions and self-reported behaviour towards green products.

From the perspective of the present research, these proxy indicators collectively suggest a clear pattern: consumers demonstrate high environmental awareness and strong pro-environmental attitudes, but this does not translate proportionately into actual green purchasing behaviour.

Although a very large share of consumers express preference for eco-labelled products (84% in India) and willingness to pay a premium for green products (88%), these indicators primarily capture attitudinal and intentional dimensions rather than actual market behaviour. From a research standpoint, this reinforces the need to empirically test whether environmental awareness alone is sufficient to influence buying behaviour, or whether its impact weakens when confronted with real-world constraints such as price, availability and perceived product performance. Therefore, in line with the objective of this study, these secondary indicators provide strong justification for treating environmental awareness as a key explanatory variable, while simultaneously recognising that behavioural outcomes may be only partially explained by awareness levels.

7. DISCUSSION

These results align with the Theory of Planned Behavior, where awareness shapes attitudes and intentions, though external barriers like price and availability moderate outcomes-explaining India's 84% preference versus 27% consistent buying. Compared to global meta-analyses, Indian consumers show slightly lower but directionally similar effects, influenced by rising urbanization and education. The findings extend prior literature by quantifying awareness's causal role via secondary synthesis, highlighting demographics (e.g., youth, educated) as amplifiers.

8. Implications

Marketers should prioritize awareness campaigns via eco-labels and social media to convert knowledge into sales, potentially boosting green adoption by 20-30% based on regression insights. Policymakers in India could subsidize green products to close the gap, fostering sustainable consumption aligned with national goals like Swachh Bharat.

9. Limitations and Future Research

Reliance on secondary data introduces heterogeneity risks, such as varying scales across studies. Primary surveys in diverse Indian regions would strengthen causality, while longitudinal designs could track awareness evolution post-2025 campaigns.

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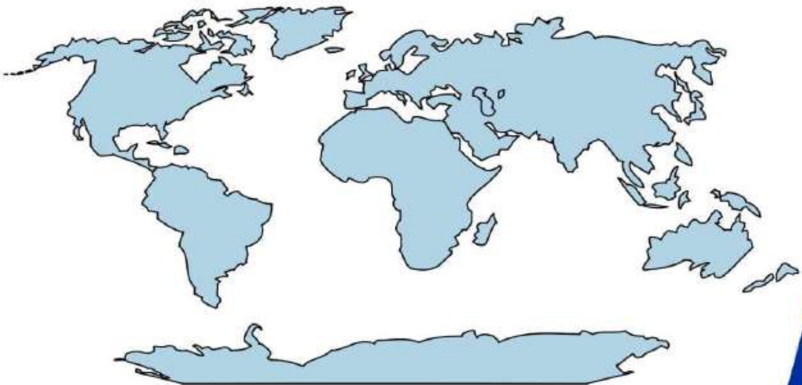

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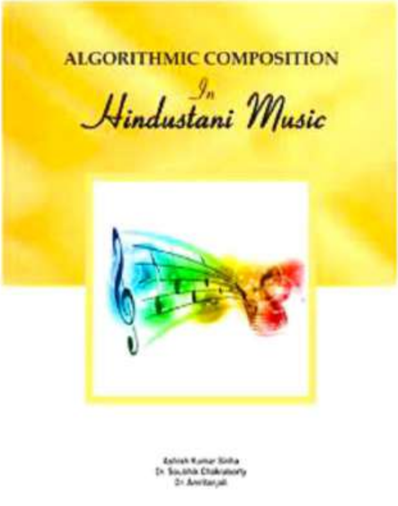

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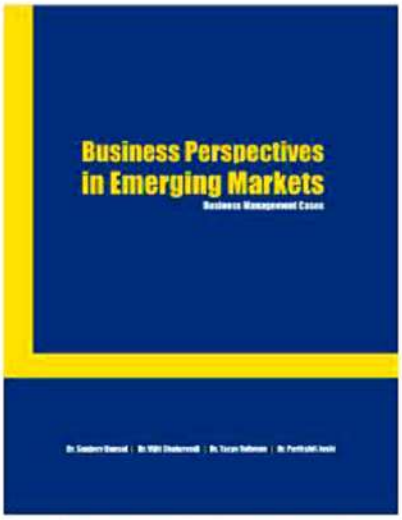

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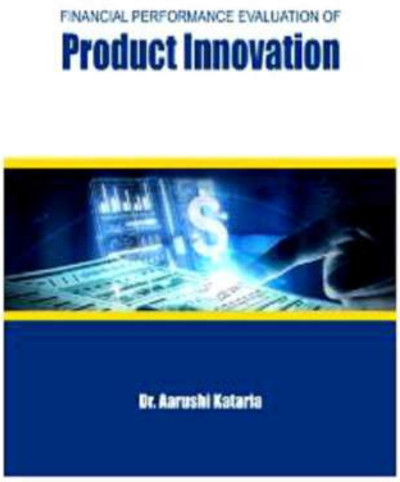

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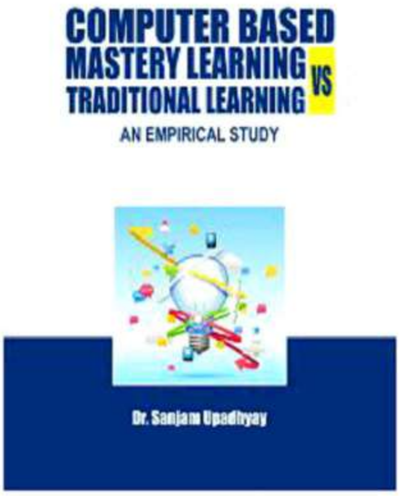

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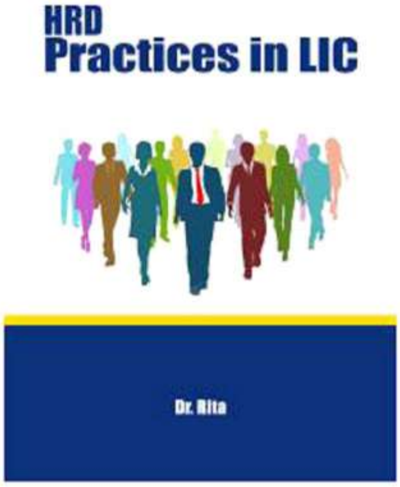

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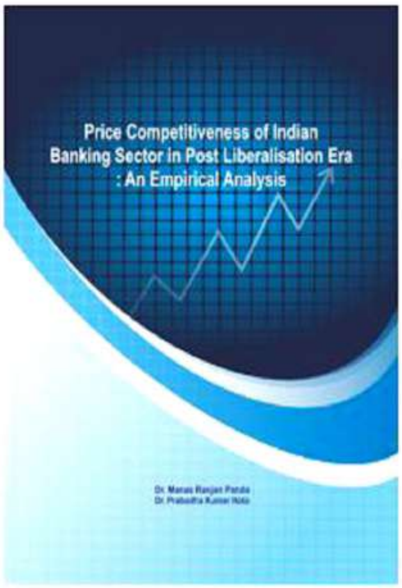

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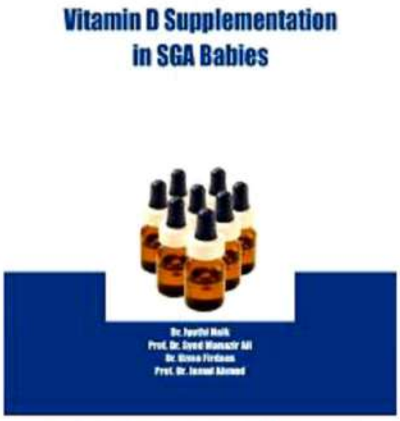

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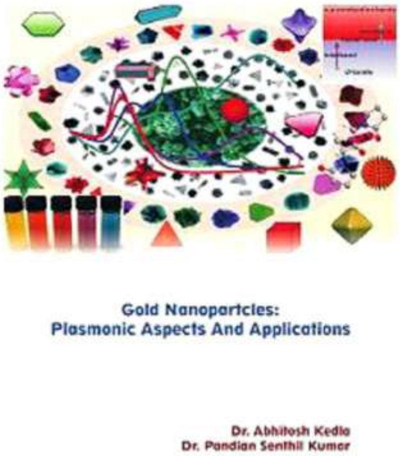

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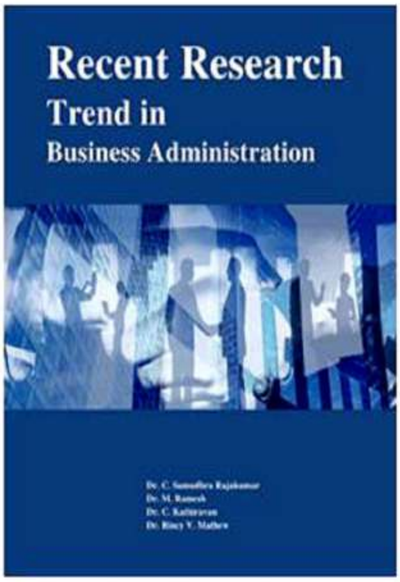

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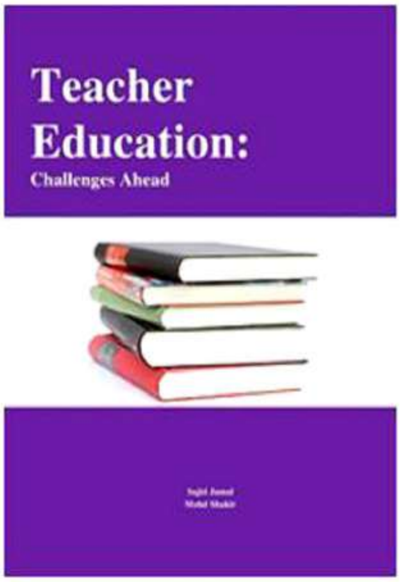

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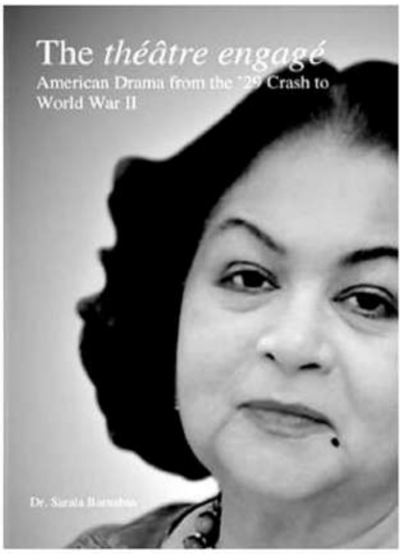

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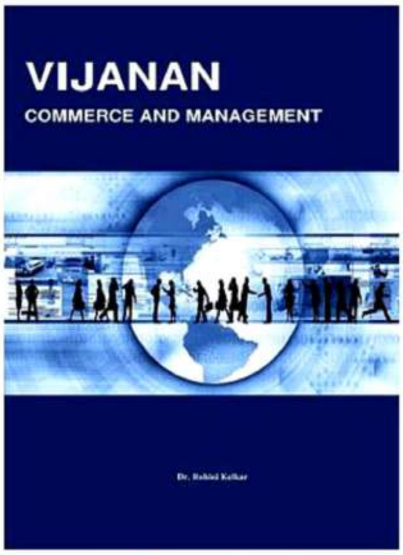

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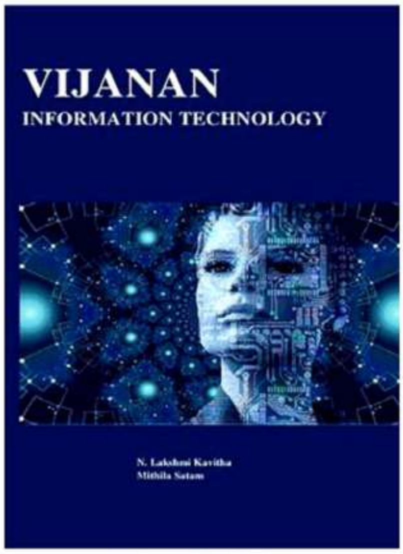

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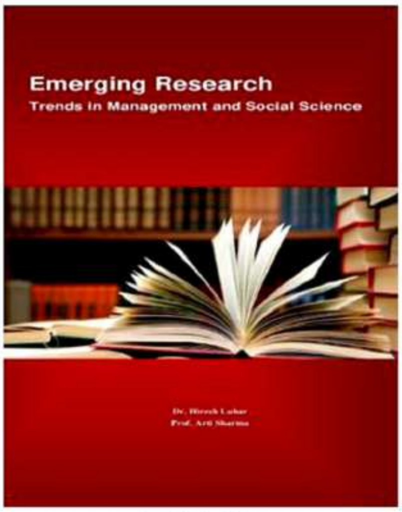

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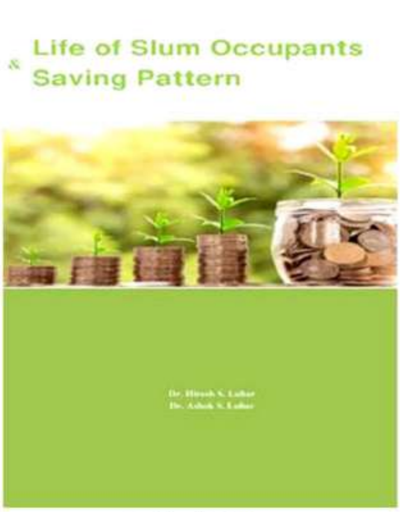

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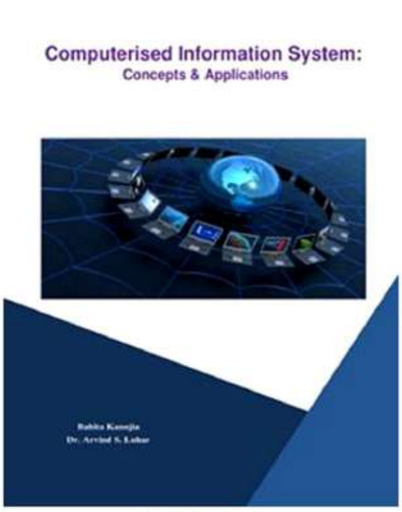

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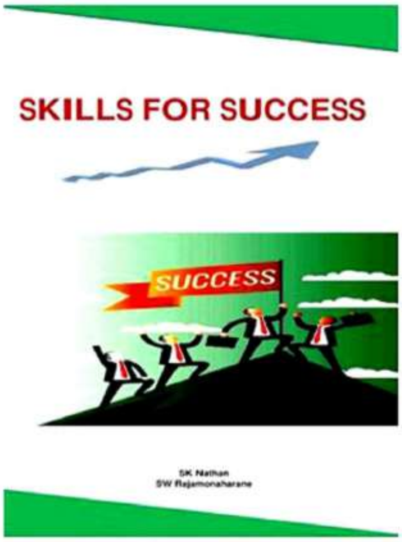

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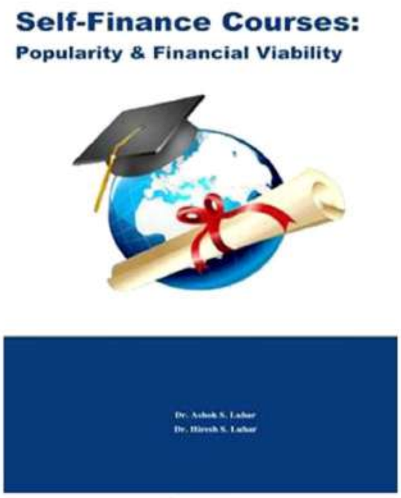

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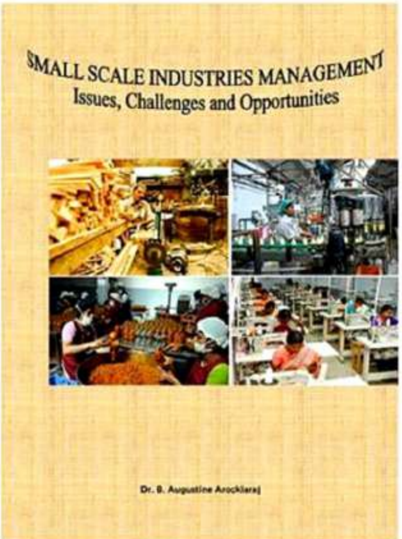

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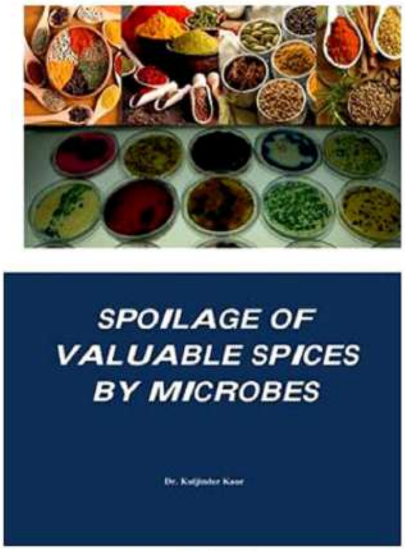

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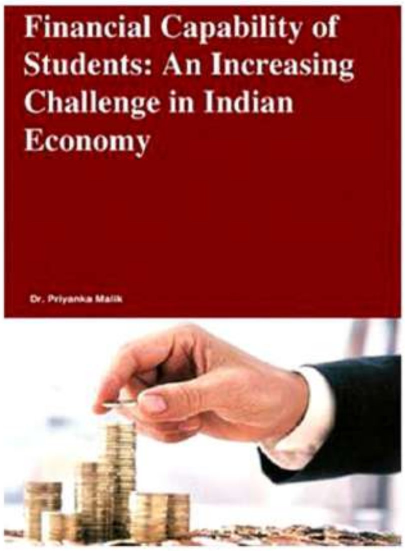

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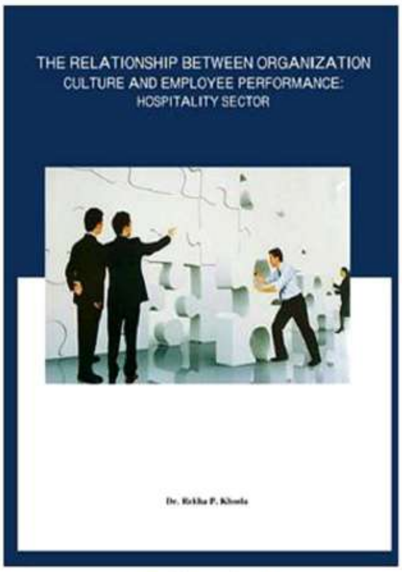

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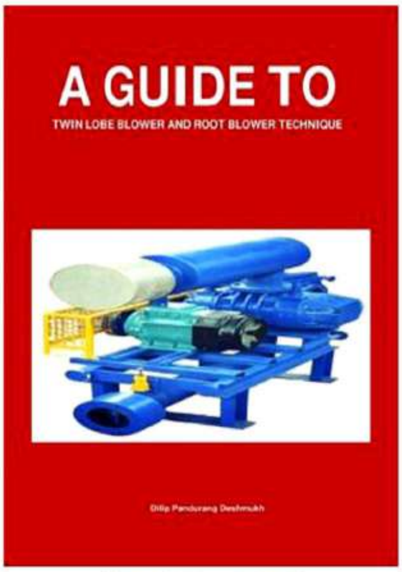

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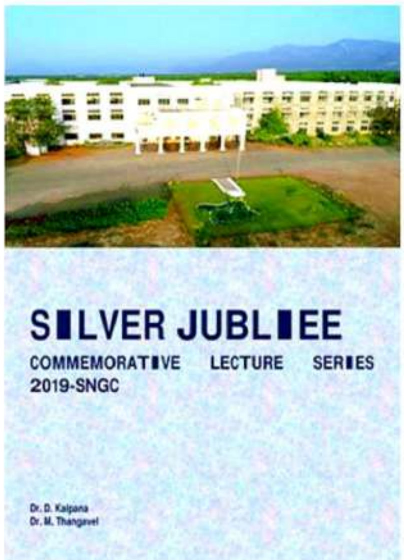

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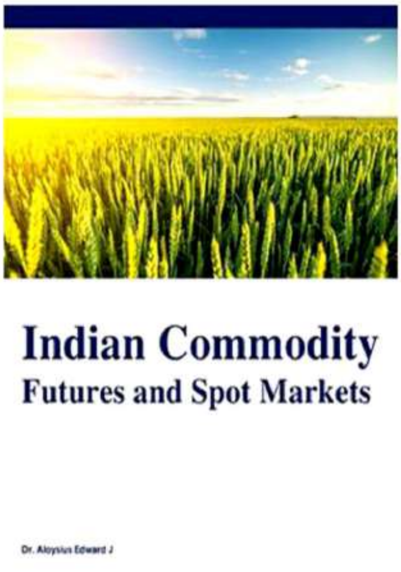

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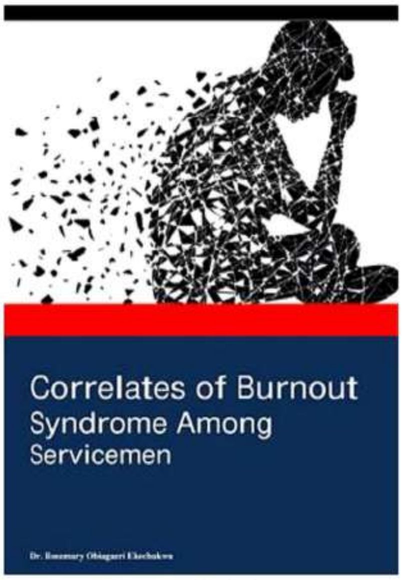

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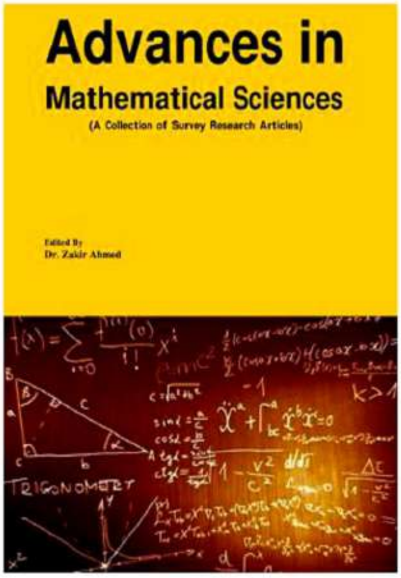

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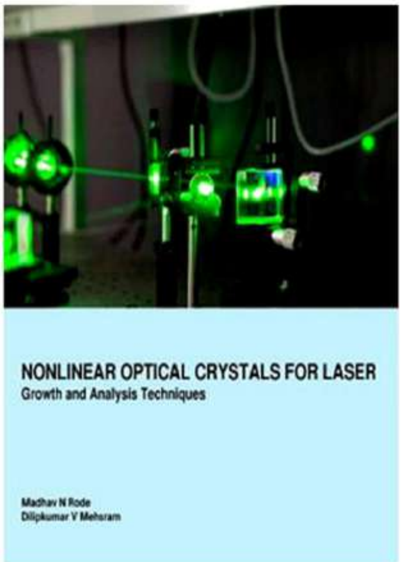

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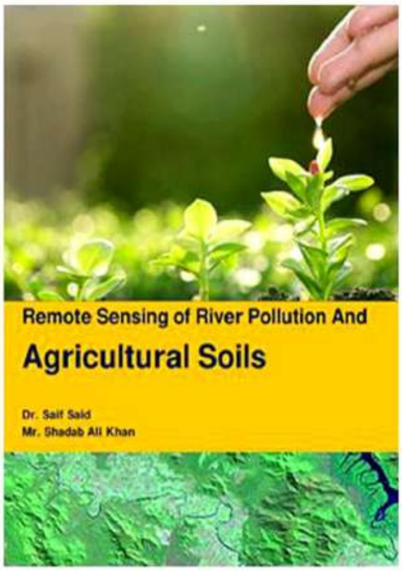

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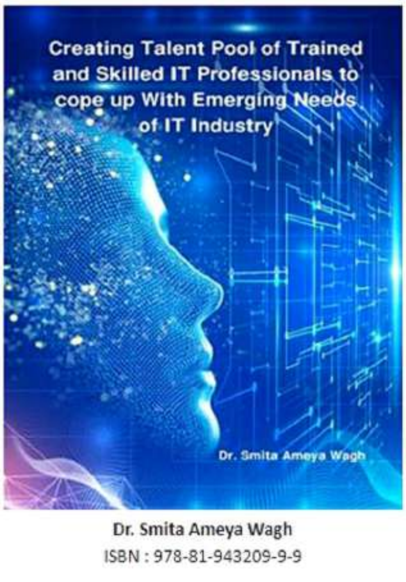

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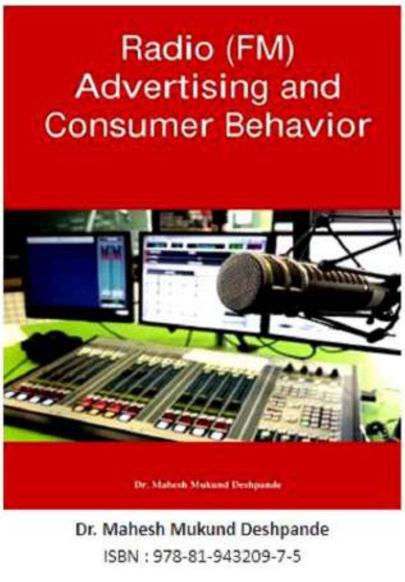

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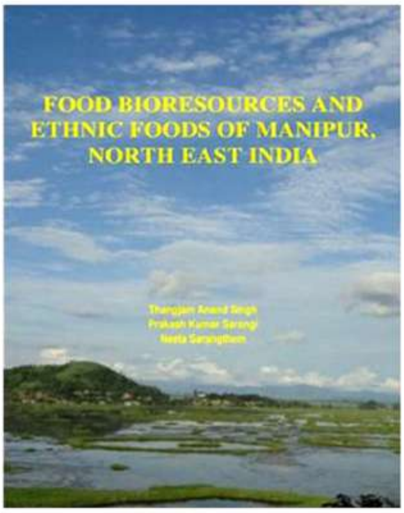

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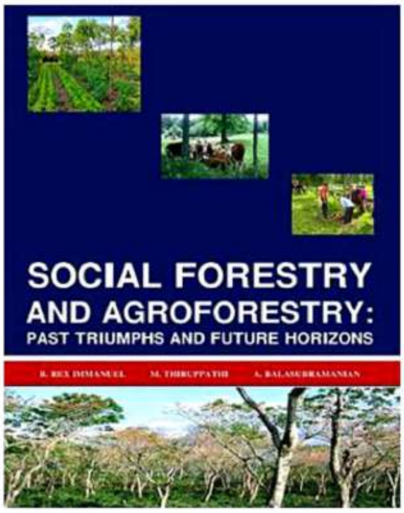

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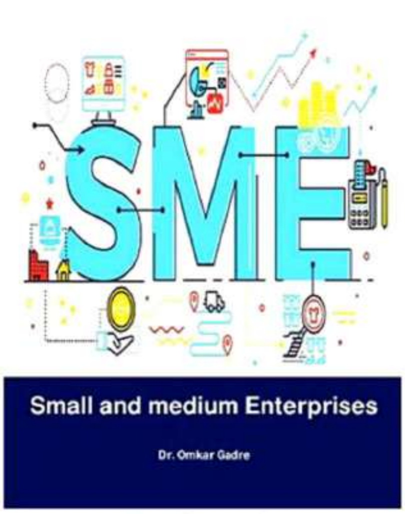

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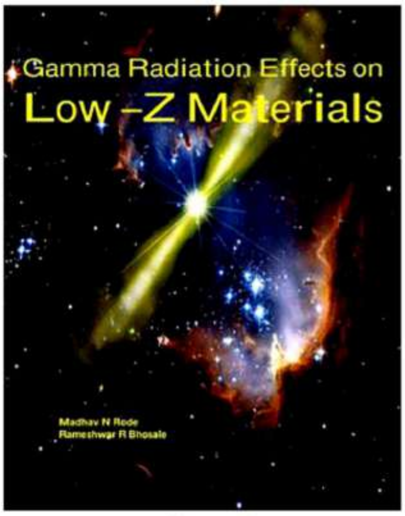

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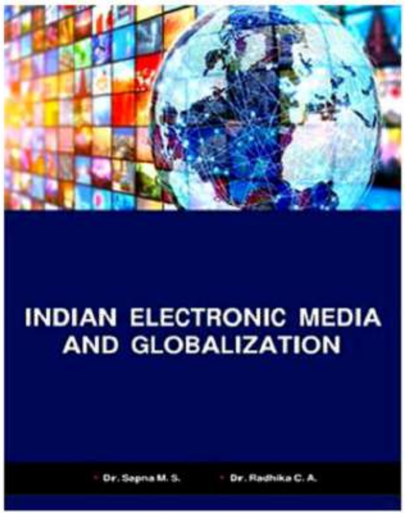

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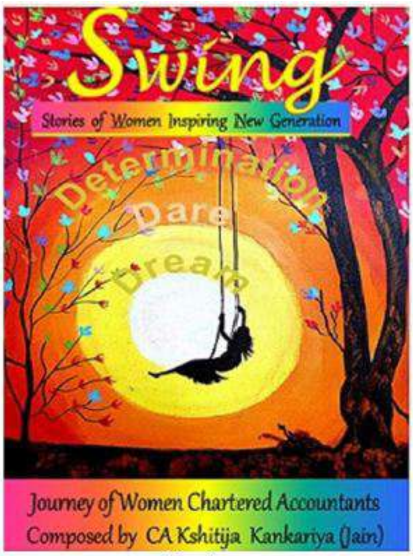

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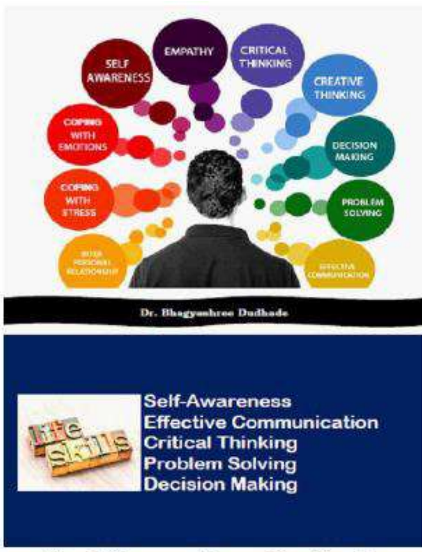

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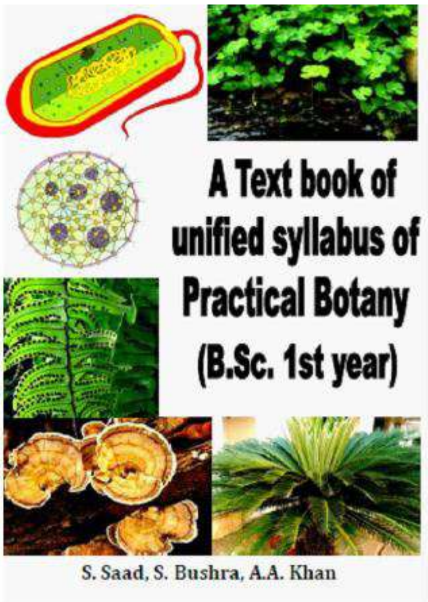

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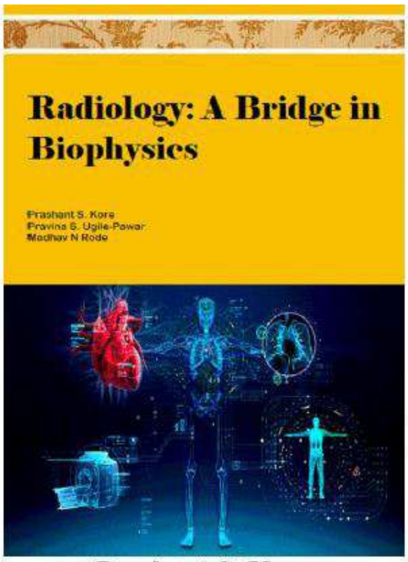

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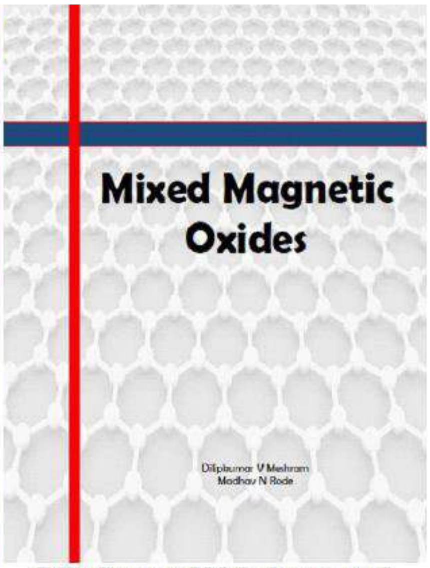

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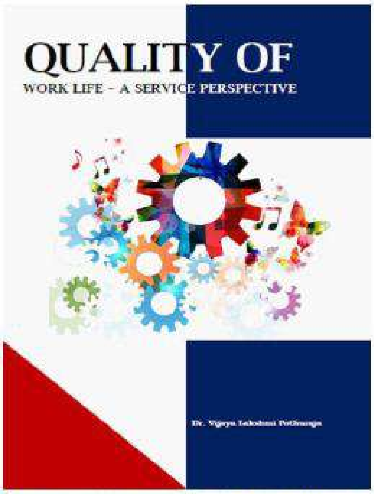

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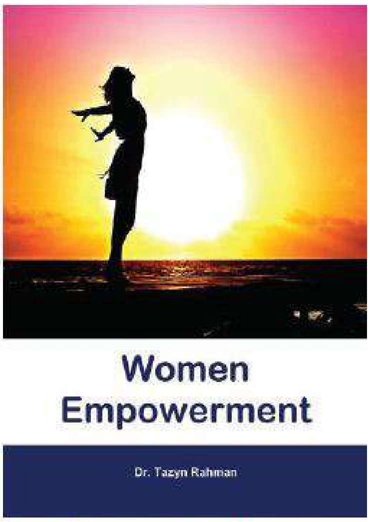

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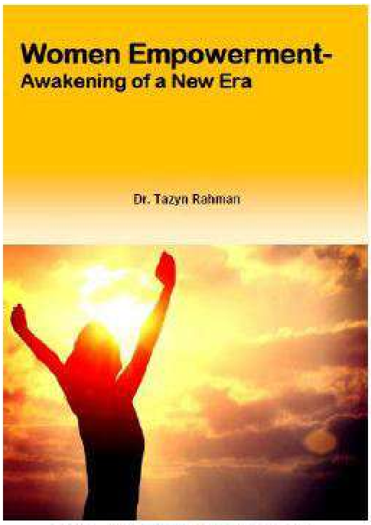

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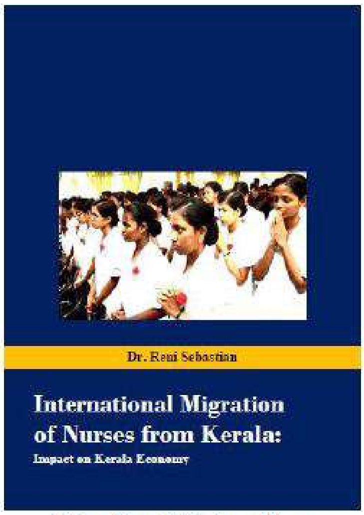

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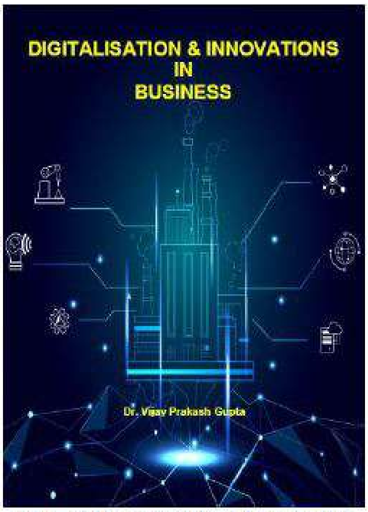

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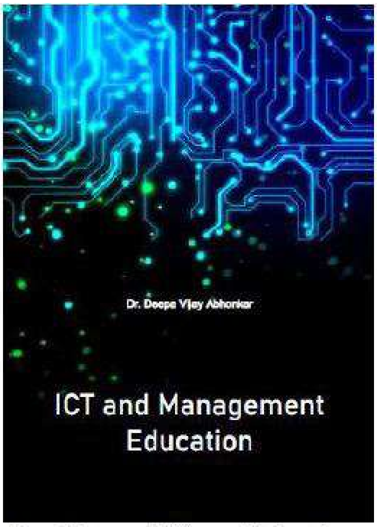

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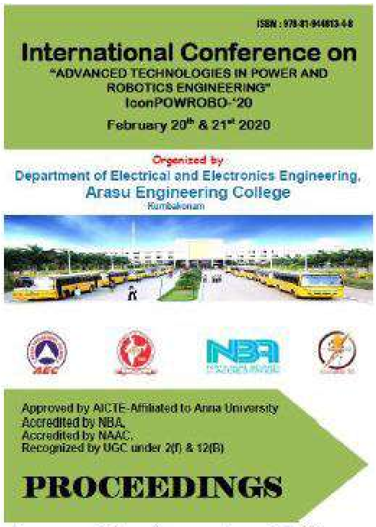

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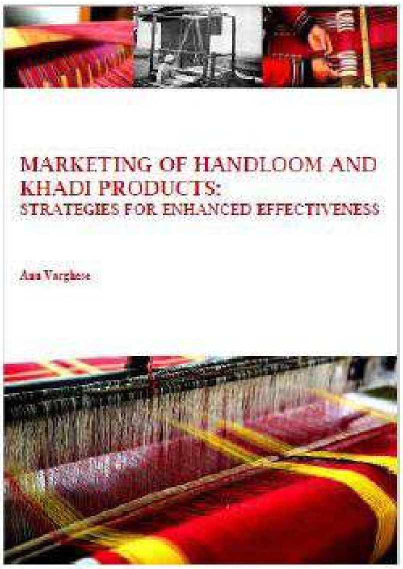

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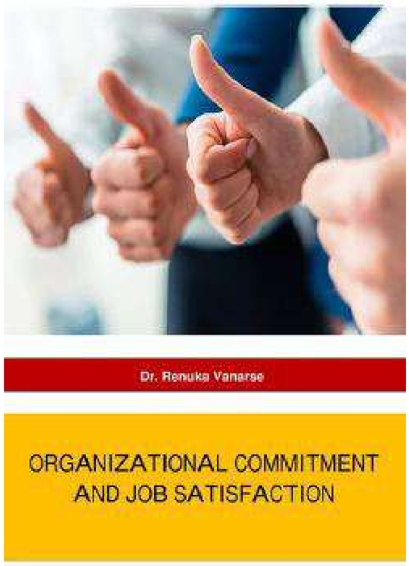

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