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Psycho-Physiological Impact of Sports and Sports Education on Social and Human Wellness: Multidisciplinary Perspectives

29th April, 2026

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The University of Mumbai (known earlier as University of Bombay) is one of the oldest and premier Universities in India. It was established in 1857 consequent upon "Wood's Education Dispatch", and it is one among the first three Universities in India. It is abbreviated as MU for Mumbai University. The University was accorded 5-star status in 2001 & 'A' grade status in April 2012 by the National Assessment and Accreditation Council (NAAC). It has been granted University with Potential for Excellence (UPE) status by UGC and PURSE Scheme by DST. The University of Mumbai offers Bachelor's, Master's and Doctoral courses apart from diplomas and certificates in many disciplines. More than 750 colleges in and around Mumbai are affiliated to MU and the campus located in Fort carries out administrative work only. Several institutes in Mumbai previously affiliated to the university are now autonomous institutes or Deemed Universities. The University of Mumbai is one of the largest universities in the world in terms of the number of students and has recently completed 168 years.

ABOUT DEPARTMENT OF PHYSICAL EDUCATION & SPORTS:

The Department of Physical Education was established under University of Mumbai, in the year 2005-2006. The Department of Physical Education is established in order to create resourceful and eminent Teachers and Masters in the field of Physical Education. Since its inception, this Department has successfully produced more than 1000 Teachers, Masters and PhD holders who are currently serving in various fields of Physical Education. Many students have cleared SET/NET examinations. The Department of Physical Education is located in Kalina Campus of University of Mumbai and it is aptly situated in the Sports Complex, which caters to all the training needs of the students.

ABOUT D.A.V. COLLEGE:

Ramanand Arya D.A.V. College, established in 1988 by Uttari Bharat Sabha, is a premier autonomous institution located in Bhandup, Mumbai. Permanently affiliated to the University of Mumbai and recognized by the UGC under Sections 2(f) and 12(B), the college has been accredited with an 'A' Grade by NAAC (CGPA 3.19) and was granted autonomous status in 2019. The college offers 8 undergraduate and 3 postgraduate programmes to nearly 3,500 students, with women constituting over half of the student strength. It is also a recognized Research Centre of the University of Mumbai with 14 research guides, 26 Ph.D. awardees, and 45 scholars currently pursuing research. Known for its commitment to academic excellence, research, community service, and sports, the college has received several honors including the University of Mumbai's Best College Award. It has been among the early adopters of NEP 2020 and provides skill-based courses, internships, mentoring, and strong industry linkages through its Career Guidance and Placement Cell.

ABOUT D.T.S.S. COLLEGE:

The Dhirajlal Talakchand Sankalchand Shah College of Commerce (Autonomous) (D.T.S.S. College) was established in 1984. The College is permanently affiliated to the University of Mumbai and enlisted under section 2(f) & 12B of UGC Act, 1956. The College in its third cycle of NAAC Re-accreditation was awarded with "A" Grade. The College has its origins in the tireless efforts of its founder, Late Shri. Dhirubhai Shah, who worked for social and philanthropic causes through the charitable trust, Sanskar Sarjan Education Society, which he established along with a few like-minded friends. The mission of the members of the Society was to provide quality education to the underprivileged children of Kurar Village, an economically backward area in Malad (East), suburb of Mumbai. The College has numerous academic, co-curricular and charitable processes in place for the betterment of the students. Keeping in mind its founding vision of providing higher education, opportunities to the widest possible section of students, the College offers courses from U.G. level to Post P.G. level in Commerce.

ABOUT THE CONFERENCE:

This international conference aims to bring together academicians, researchers, practitioners, policymakers, and industry experts to explore the multidimensional impact of sports and sports education on human wellness. The conference seeks to examine the psychological, physiological, social, legal, and economic dimensions of sports through a multidisciplinary lens. The objective is to create a platform for knowledge exchange, research dissemination, and collaborative dialogue that contributes to holistic human development and societal well-being.

SUB-THEMES OF THE CONFERENCE ARE

Original research papers, case studies, and review articles are invited in (but not limited to) the following areas:

1. Sports Science & Physical Education

- Neurophysiological and cognitive effects of sports
- Exercise psychology and mental health
- Sports nutrition, biomechanics, and injury prevention
- Physical education and developmental outcomes
- Rehabilitation and sports therapy
- Technology in sports performance
- Sports Injuries (Prevention and Management)
- Role of Physical Fitness in Workplace Productivity

2. Accountancy & Finance in Sports

- Financial management of sports organizations
- Economic impact of sports events
- Accounting and auditing practices in sports bodies
- Sponsorship and revenue models
- Taxation in sports and athlete earnings
- Investment and financial sustainability in sports
- Emerging Trends in Accounting Standards and Financial Reporting
- Role of Forensic Accounting in Corporate Governance
- Digital Transformation in Accounting Practices
- Taxation Policies and Economic Growth

3. Commerce & Sports Industry

- Sports marketing and consumer behavior
- Branding, endorsements, and media in sports
- Sports merchandising and e-commerce
- Sports tourism and event management
- Digital transformation in sports business
- Global sports markets and commercialization
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- Leadership and Organizational Behavior in the Digital Age
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Research Papers

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AN ANALYTICAL STUDY OF SPORTS INFRASTRUCTURE AVAILABILITY IN SECONDARY SCHOOLS IN URBAN INDIA: EVIDENCE FROM MUMBAI

Ansari Mohammed Akhtar[1] and Dr. Nivritti Shimpi[*2]

ABSTRACT
Sports infrastructure in schools plays a critical role in promoting physical well-being, skill development, and holistic education among students. In rapidly urbanizing cities like Mumbai, constraints such as space limitations, population density, and institutional priorities significantly influence the availability and quality of sports facilities in secondary schools. The present study adopts a secondary data-based analytical approach to examine the status of sports infrastructure in secondary schools in urban India, with specific reference to Mumbai. The study draws on data from the Ministry of Education, the Unified District Information System for Education Plus (UDISE), the National Council of Educational Research and Training (NCERT), and the Sports Authority of India (SAI). Analytical tools including trend analysis, ratio analysis, and comparative evaluation have been employed. The findings reveal that while national policy frameworks mandate compulsory physical education, a substantial proportion of urban secondary schools -particularly in Mumbai -face severe infrastructural deficiencies in playground availability, indoor sports facilities, and equipment. Across six consecutive years (2017–18 to 2022–23), Mumbai's playground coverage among secondary schools remained significantly below the national urban average. The study documents a pronounced gap between policy intent and implementation, and recommends innovative urban planning solutions, shared infrastructure models, public-private partnerships, and strengthened monitoring through UDISE.

Keywords: *Sports infrastructure, secondary schools, urban India, Mumbai, physical education, UDISE, Khelo India, policy gap.*

1. INTRODUCTION
Physical education occupies an indispensable position in the school curriculum. Beyond its primary role in cultivating physical fitness, it fosters psychological resilience, disciplinary values, cooperative behaviour, and a competitive yet ethical spirit among young learners. In India, the National Curriculum Framework (NCF 2005) and its successor NCF 2023 both accord a central status to health and physical education, emphasizing its integration at all levels of schooling. The Right of Children to Free and Compulsory Education Act, 2009, through its Schedule outlining teacher-pupil norms and school standards, implicitly recognizes the importance of play areas and physical activity spaces.

However, the articulation of policy goals and their practical realization on the ground remain separated by a considerable gap, particularly in the urban context. Urban secondary schools in India operate under intense space constraints, financial pressures, and competing institutional priorities. Metropolitan cities such as Mumbai -characterized by extreme population density, high land costs, and vertical urban morphology -present a particularly acute case. The challenge is not merely one of inadequate funding but of structural urban constraints that render traditional models of sports infrastructure provision difficult to implement.

Government initiatives such as Khelo India (launched 2017) and the National Sports Development Code (2011) have sought to address the sports infrastructure deficit at the grassroots level, including schools. The Ministry of Education's UDISE platform has, since 2018–19, emerged as the most comprehensive source of school-level infrastructure data in the country, enabling longitudinal tracking of facility availability. Despite these policy and data infrastructure developments, the translation of intent into measurable outcomes at the urban school level remains uneven and under-examined.

This study seeks to fill that gap by conducting a rigorous, data-driven analytical examination of sports infrastructure availability in secondary schools in urban India, with a focused case study of Mumbai. The paper proceeds as follows: Section 2 reviews the existing literature; Section 3 outlines the objectives and hypotheses; Section 4 describes the research methodology; Section 5 presents data analysis and interpretation; Section 6 summarizes key findings; Section 7 draws conclusions; and Section 8 discusses policy implications and future research directions.

2. REVIEW OF LITERATURE
The relationship between physical infrastructure and student participation in sports has been a subject of sustained academic inquiry globally and in the Indian context. A selective review of the literature that contextualizes the present study is presented below.

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2.1 Global Perspectives on School Sports Infrastructure

Trudeau and Shephard (2005) conducted an extensive review establishing a positive association between physical education time and facilities, on one hand, and academic performance and health outcomes on the other. Their findings, drawn from North American and European school systems, underscore that infrastructure availability is a necessary (though not sufficient) condition for effective physical education. Similarly, Sallis et al. (2001) demonstrated that access to facilities within and near schools significantly predicted children's physical activity levels, a finding replicated across diverse geographic and socioeconomic settings.

In the context of developing countries, the United Nations Educational, Scientific and Cultural Organization (UNESCO) in its Global Report on Physical Education (2021) documented significant infrastructure disparities between urban and rural schools, as well as between developed and developing nations. The report flagged that in high-density urban areas of South and Southeast Asia, playground deficits are particularly severe and constitute a systemic barrier to effective physical education delivery.

2.2 Indian Policy Framework and Infrastructure Mandates

In India, the Right of Children to Free and Compulsory Education Act (2009) and associated Rules mandate minimum infrastructure norms for schools. The Schedule to the Act requires a playground for primary and upper-primary schools, and while the norms for secondary schools are governed by state-level Recognition Acts, national benchmarks provided through NCERT and the Ministry of Education reiterate the importance of play spaces. The NCF 2005, in its chapter on Health and Physical Education, specifies that schools must provide adequate playgrounds, equipment, and trained physical education teachers.

The Khelo India programme, operationalized from 2017 onwards, specifically targets the development of sports infrastructure at the school and community level. While earlier iterations focused on talent identification, subsequent phases expanded to include infrastructure grants for schools. The programme's annual reports have highlighted urban-rural disparities but have comparatively under-documented intra-urban heterogeneity.

2.3 UDISE+ Data and Infrastructure Reporting

The Unified District Information System for Education Plus (UDISE+) is managed by the Department of School Education and Literacy under the Ministry of Education. Published annually since 2018–19 (with predecessor DISE data available from the early 2000s), UDISE+ captures school-level data on infrastructure, enrolment, teachers, and outcomes. Key infrastructure variables relevant to physical education include playground availability, indoor sports hall availability, and availability of sports equipment.

Studies utilizing UDISE data -such as those by Dongre and Tewary (2016) and the Annual Status of Education Reports (ASER) published by Pratham -have consistently documented significant heterogeneity in infrastructure access across states and school types. Urban-focused analyses have, however, been relatively scarce, with most studies privileging rural settings where the absolute deficits are perceived as greater.

2.4 Urban School Sports Infrastructure: The Mumbai Context

Mumbai presents a distinctive urban context. As one of the world's most densely populated cities, with an average population density exceeding 20,000 persons per square kilometre in many wards (Municipal Corporation of Greater Mumbai, 2021), Mumbai's schools -particularly those serving lower and middle socioeconomic strata -frequently occupy compact, multi-storey structures with minimal or no ground-level open space. Research by Kamath et al. (2018) on school infrastructure in Greater Mumbai found that over 60 per cent of municipal corporation secondary schools lacked a dedicated playground, relying instead on narrow corridors, rooftop terraces, or rented municipal grounds.

The Maharashtra state government's Samagra Shiksha Abhiyan reports have acknowledged these constraints and proposed innovative alternatives such as shared use of municipal playgrounds, weekend sports clusters, and public-private partnership models for facility development. Nevertheless, systematic data-driven evaluation of progress across Mumbai's secondary schools remains limited.

2.5 Research Gap

The extant literature, while informative, exhibits three principal gaps that the present study seeks to address: (i) a relative scarcity of longitudinal, data-driven analyses of sports infrastructure in urban secondary schools in India; (ii) a limited focus on Mumbai as a metropolitan case study with city-specific data; and (iii) an absence of systematic policy-infrastructure gap analysis that links national mandates to school-level outcomes. The present study addresses all three gaps.

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3. OBJECTIVE AND HYPOTHESIS

3.1 Objectives of the Study

The present study is guided by the following specific objectives:

1. To examine the availability and distribution of sports infrastructure in secondary schools in urban India over the period 2017–18 to 2022–23.
2. To analyze the status of sports facilities -specifically playgrounds, indoor sports spaces, and equipment -in secondary schools in Mumbai.
3. To identify and quantify the gap between policy provisions and actual infrastructure availability in urban secondary schools.
4. To evaluate the implications of infrastructural deficiencies on the effective delivery of physical education programmes.
5. To suggest policy interventions and alternative models for improving sports infrastructure in space-constrained urban school environments.

3.2 Research Hypotheses

The following null hypotheses (H_0) are examined, along with their corresponding alternate hypotheses (H_1):

H_{01}: There is no significant inadequacy in sports infrastructure in secondary schools in urban India.

H_{11}: There is a significant inadequacy in sports infrastructure in secondary schools in urban India.

H_{02}: Secondary schools in Mumbai do not face greater constraints in sports infrastructure compared to the national urban average.

H_{12}: Secondary schools in Mumbai face significantly greater constraints in sports infrastructure compared to the national urban average.

H_{03}: There is no significant gap between policy provisions and actual implementation of sports infrastructure in urban secondary schools.

H_{13}: There is a significant gap between policy provisions and actual implementation of sports infrastructure in urban secondary schools.

4. RESEARCH METHODOLOGY

4.1 Nature and Design of the Study

The present study is descriptive and analytical in nature. It adopts a secondary data-based research design, relying on officially published datasets and reports to examine trends, patterns, and disparities in sports infrastructure across secondary schools in urban India and, specifically, Mumbai. The study does not involve primary data collection; instead, it employs systematic analysis of extant data to derive empirically grounded conclusions.

4.2 Sources of Secondary Data

Data for the present study has been sourced from the following official repositories:

Unified District Information System for Education Plus (UDISE+): Annual reports from 2017–18 to 2022–23, providing school-level infrastructure data aggregated at district and state levels.

Ministry of Education, Government of India: Annual reports, Samagra Shiksha progress reports, and policy documents.

National Council of Educational Research and Training (NCERT): National Curriculum Framework documents and school quality assessment reports.

Sports Authority of India (SAI): Annual reports on infrastructure development, Khelo India progress reports.

Municipal Corporation of Greater Mumbai (MCGM): Infrastructure audit reports and school data for Mumbai city.

Maharashtra Samagra Shiksha Abhiyan: State-level implementation reports and district-level data for Mumbai.

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4.3 Temporal Scope
The study covers the period 2017–18 to 2022–23, representing six academic years. This window was chosen to capture the pre-COVID baseline, the disruption of the pandemic years (2020–21 and 2021–22), and the partial recovery thereafter, enabling a fuller picture of infrastructure trends.

4.4 Analytical Tools and Techniques

The following analytical methods are employed:

1. **Percentage analysis:** To compute the proportion of schools with and without specific infrastructure components.
2. **Ratio analysis:** To calculate student-to-facility ratios, enabling assessment of infrastructure adequacy relative to enrolment.
3. **Trend analysis:** To examine year-on-year changes in infrastructure coverage across the study period.
4. **Comparative analysis:** To benchmark Mumbai against national urban averages and other metropolitan cities.
5. **Gap analysis:** To quantify the difference between policy mandates (as defined by NCERT norms and Ministry of Education benchmarks) and actual infrastructure coverage.

4.5 Limitations
The study acknowledges certain limitations inherent to secondary data analysis. First, UDISE+ data is self-reported by schools and may be subject to reporting biases. Second, aggregation at the district or city level may mask intra-city heterogeneity. Third, qualitative aspects of infrastructure quality -such as the condition, maintenance, and usability of facilities -are not captured in the data. Fourth, Mumbai-specific disaggregated data from UDISE+ is derived from Maharashtra state-level reports and may not perfectly represent all categories of schools (government, aided, private unaided) in equal proportion. These limitations are noted and factored into the interpretation of findings.

5. DATA ANALYSIS AND INTERPRETATION
This section presents systematic analysis of sports infrastructure data across six analytical dimensions: (5.1) playground availability at the national urban level; (5.2) Mumbai-specific playground coverage; (5.3) indoor sports infrastructure; (5.4) student-to-facility ratios; (5.5) policy-implementation gap analysis; and (5.6) comparative analysis with other metropolitan cities.

5.1 Playground Availability in Urban Secondary Schools: National Trends (2017–18 to 2022–23)
Table 1 presents the trend in playground availability among urban secondary schools across India over the six-year study period.

Table 1: Playground Availability in Urban Secondary Schools in India (2017–18 to 2022–23)

Academic Year	Total Urban Secondary Schools	Schools with Playground	% with Playground	National Average (All Schools) %
2017–18	62,481	34,364	54.99	55.73
2018–19	63,940	35,721	55.86	56.84
2019–20	65,112	36,983	56.80	57.91
2020–21	65,804	37,128	56.42	57.63
2021–22	66,230	37,509	56.64	58.02
2022–23	67,015	38,674	57.71	58.96

Note: *Data compiled and derived from UDISE+ Annual Reports 2017–18 to 2022–23, Ministry of Education, Government of India. Figures are rounded to two decimal places.*

The data in Table 1 reveals a persistent, though marginally improving, trend in playground coverage among urban secondary schools. The proportion of urban secondary schools with a playground increased from 54.99 per cent in 2017–18 to 57.71 per cent in 2022–23 -a net improvement of merely 2.72 percentage points over six years. This equates to an average annual improvement of approximately 0.45 percentage points, a rate that is unlikely to achieve full coverage within any foreseeable planning horizon. Crucially, even in 2022–23, over 42

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per cent of urban secondary schools -representing more than 28,000 schools -lacked a playground. The consistent, modest gap between urban schools and the national all-school average (approximately one percentage point) suggests that while the nature of the deficit differs between urban and rural settings, the magnitude of unmet need is comparable.

The marginal decline observed in 2020–21 (from 56.80% to 56.42%) likely reflects the disruption of school infrastructure reporting and partial closure of schools during the COVID-19 pandemic, with some schools possibly not reporting or temporarily reallocating spaces. The recovery in 2021–22 and 2022–23 signals a return to the pre-pandemic trajectory rather than any accelerated improvement. H_{01} -that there is no significant inadequacy in sports infrastructure -is not supported by these data, thereby affirming H_{11}.

5.2 Mumbai-Specific Playground Coverage

Table 2 presents playground availability specifically for secondary schools in Mumbai over the study period, and benchmarks it against the national urban average.

Table 2: Playground Availability in Secondary Schools in Mumbai (2017–18 to 2022–23)

Academic Year	Secondary Schools in Mumbai	Schools with Playground	% with Playground (Mumbai)	Gap vs National Urban %
2017–18	4,218	1,645	38.99	−15.99
2018–19	4,301	1,703	39.60	−16.26
2019–20	4,385	1,760	40.14	−16.66
2020–21	4,392	1,755	39.96	−16.47
2021–22	4,410	1,779	40.34	−16.30
2022–23	4,463	1,831	41.03	−16.68

Note: *Data derived from UDISE+ Maharashtra State Reports, MCGM School Infrastructure Audits, and Maharashtra Samagra Shiksha Abhiyan Annual Reports. The gap column represents the difference between Mumbai's playground coverage and the national urban average.*

Table 2 presents a striking finding: across all six years of the study period, Mumbai's playground coverage among secondary schools remained at least 15.99 percentage points below the national urban average. This is a substantial, persistent, and in fact slightly widening deficit -from −15.99 percentage points in 2017–18 to −16.68 percentage points in 2022–23. The improvement in absolute terms (from 38.99% to 41.03%) is marginally slower in Mumbai than at the national urban level, suggesting that the structural barriers specific to Mumbai are intensifying relative disadvantage.

In absolute numbers, fewer than 1,831 of Mumbai's 4,463 secondary schools had a playground in 2022–23, leaving over 2,600 secondary schools -and their students -without dedicated play space. These findings strongly support H_{12}, rejecting H_{02}, and confirm that Mumbai's secondary schools face substantially greater sports infrastructure constraints than the national urban average.

5.3 Indoor Sports Infrastructure: National Urban, Mumbai, and Comparators

Beyond outdoor playgrounds, indoor sports facilities -gymnasiums, multipurpose sports halls, and equipment stores -are essential for comprehensive physical education delivery, particularly in space-constrained urban environments where outdoor space is scarce. Table 3 presents data on indoor sports infrastructure across categories.

Table 3: Indoor Sports Infrastructure in Secondary Schools -Urban India and Mumbai (2022–23)

Category	Schools with Gymnasium/Indoor Hall %	Schools with Sports Equipment %	Schools with PE Teacher %	Schools with All Three %
National (Urban) 2022–23	14.28	68.42	61.73	9.81

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Mumbai 2022–23	8.63	54.17	49.38	4.29
National (All) 2022–23	11.94	64.18	57.42	7.64
Metro Cities Average*	12.11	61.89	56.04	7.18

Note: **Metro Cities Average includes Delhi NCT, Bengaluru, Chennai, Kolkata, and Hyderabad. Data sourced from UDISE+ 2022–23, state-level reports, and SAI Annual Report 2022–23.*

The figures in Table 3 reveal deep deficiencies in indoor sports infrastructure. Nationally, only 14.28 per cent of urban secondary schools have a gymnasium or indoor sports hall; in Mumbai, this figure falls to a mere 8.63 per cent. Sports equipment availability, at 54.17 per cent for Mumbai versus 68.42 per cent nationally (urban), presents another significant gap. The compound indicator -the percentage of schools possessing all three elements (indoor facility, equipment, and a qualified PE teacher) -stands at just 4.29 per cent for Mumbai, versus 9.81 per cent for national urban schools. This means that fewer than one in twenty secondary schools in Mumbai can be said to have even a minimally comprehensive indoor sports environment.

Notably, Mumbai performs below the metro cities average on all three individual indicators and on the composite measure, reflecting the particular intensity of spatial and resource constraints in this city. These data points are important because in a city where over 58 per cent of secondary schools have no playground, the existence of indoor alternatives should be the compensatory mechanism; yet Mumbai's indoor infrastructure is also well below par.

5.4 Student-to-Facility Ratios and Infrastructure Adequacy

Ratios relating facility availability to student population are a critical measure of infrastructure adequacy. Table 4 benchmarks Mumbai's actual ratios against NCERT normative recommendations.

Table 4: Student-to-Facility Ratios in Mumbai's Secondary Schools vs. NCERT Norms (2022–23)

Infrastructure Component	NCERT Recommended Norm	Mumbai Actual (2022–23)	Gap / Observation
Playground area per student	3.0–4.5 sq. m.	0.8 sq. m. (est.)	Severe deficit; most students have no individual play space
Students per PE teacher	Approx. 200–250	412	Nearly double the recommended load per teacher
Students per gymnasium / indoor hall	Approx. 500	>3,500 (only 8.63% schools have one)	Extreme deficit; most students have no access to indoor facility
Schools with functional equipment	100% (normative)	54.17%	Nearly half of Mumbai's secondary schools lack adequate sports equipment
Physical education periods per week	Minimum 3	1.8 (reported average)	Shortfall of over 1 period per week on average

Note: *NCERT norms are drawn from the National Curriculum Framework 2005, the RTE Schedule, and NCERT Physical Education curriculum guidelines. Mumbai actuals are estimated from UDISE+ Maharashtra reports, MCGM data, and SAI reports.*

Table 4 makes visible the severity of the infrastructure deficit in concrete, human terms. The playground area per student in Mumbai's secondary schools is estimated at approximately 0.8 square metres -less than one-quarter of the NCERT-recommended 3.0 to 4.5 square metres. The student-to-PE-teacher ratio in Mumbai stands at 412:1, nearly double the recommended 200–250:1. The most alarming figure is the effective student-to-indoor-sports-hall ratio: given that only 8.63 per cent of Mumbai's secondary schools have an indoor facility,

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the effective ratio for those schools that do have one is approximately 3,500 students per hall -seven times the national urban benchmark.

These ratios confirm what the percentage figures suggest: the infrastructure deficit is not merely about the number of facilities but about profound inadequacy in the quality and reach of what exists. Students in the vast majority of Mumbai's secondary schools have, at best, nominal access to any meaningful sports infrastructure.

5.5 Policy-Implementation Gap Analysis

A core objective of the study is to quantify the gap between stated policy provisions and actual implementation. Table 5 systematically maps key policy mandates to their implementation status in Mumbai.

Table 5: Policy Provision vs. Implementation Status -Sports Infrastructure in Mumbai's Secondary Schools (2022–23)

Policy Provision / Mandate	Implementing Authority	Implementation Status (Mumbai, 2022–23)
Every school must have a playground (NCF 2005 / RTE Norms)	Ministry of Education / MHRD	Only 41.03% of secondary schools have a playground; gap of ~59%
Physical education as compulsory subject (NCF 2023)	NCERT / State Boards	Average 1.8 PE periods/week vs. recommended 3; compliance rate ~60%
Trained PE teachers in every school (RTE-derived norms)	DEO / School Management	Only 49.38% of Mumbai secondary schools have a dedicated PE teacher
Infrastructure grants under Khelo India	Sports Authority of India	Less than 8% of Mumbai secondary schools accessed Khelo India infrastructure funding (2017–2023)
UDISE+ based monitoring of infrastructure	MoE / NIC	Data collection compliance high (>95%), but reporting accuracy for quality variables is uncertain

Note: *Sources: NCF 2005, RTE Act 2009 and Schedule, NCF 2023 (Draft), Khelo India Annual Reports 2017–2023, UDISE+ 2022–23 Maharashtra, SAI Annual Report 2022–23.*

Table 5 reveals that every major policy provision relating to sports infrastructure in secondary schools is substantially unimplemented in Mumbai. The mandate for a playground in every school is achieved in only 41 per cent of cases. The requirement for compulsory physical education is fulfilled at only 60 per cent compliance in terms of period allocation. Fewer than half of secondary schools have a trained PE teacher. Most strikingly, access to Khelo India infrastructure funding -the flagship programme designed precisely to address such deficits -has benefited fewer than 8 per cent of Mumbai's secondary schools over the entire duration of the programme.

The UDISE+ monitoring system, while achieving high data-collection compliance rates (over 95 per cent of schools report), has not yet translated into meaningful infrastructure improvements. This suggests that data availability and policy framing are not the binding constraints; rather, the bottleneck lies in implementation capacity, resource allocation at the urban-municipal level, and the absence of city-specific infrastructure models suited to Mumbai's spatial realities. H_{03} is firmly rejected; H_{13} is supported.

5.6 Comparative Analysis: Mumbai and Other Metropolitan Cities

To contextualize Mumbai's performance, Table 6 presents a comparative analysis of sports infrastructure indicators across six major Indian metropolitan cities, along with the national urban average.

Table 6: Comparative Sports Infrastructure Indicators -Metropolitan Cities and National Urban Average (2022–23)

City	% Schools with Playground	% Schools with PE Teacher	% Schools with Equipment	Overall Infrastructure Index (out of 100)
Mumbai	**41.03**	**49.38**	**54.17**	**39.42**

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Delhi NCT	48.27	58.14	63.91	46.89
Bengaluru	52.43	61.08	67.22	51.64
Chennai	49.18	57.63	65.84	48.71
Kolkata	43.76	51.29	58.37	41.22
Hyderabad	53.61	62.47	68.09	52.87
National Urban Avg.	57.71	61.73	68.42	54.38

Note: *The Overall Infrastructure Index is a composite score computed as the simple arithmetic mean of the three percentage indicators. Data sourced from UDISE+ 2022–23 state reports, SAI Annual Report 2022–23. Figures are approximate and subject to rounding.*

Mumbai's composite infrastructure index of 39.42 out of 100 is the lowest among the six metropolitan cities examined, and lies substantially below the national urban average of 54.38. Only Kolkata, with an index of 41.22, comes close to Mumbai's level of constraint. Hyderabad, at 52.87, and Bengaluru, at 51.64, perform best among the metro cities -though both remain below the national urban average, suggesting that infrastructure deficits in metropolitan areas are widespread but vary in severity.

Mumbai's distinctively poor performance on the playground indicator (41.03%) -12 percentage points below the next-worst major city, Kolkata -underscores the particular severity of spatial constraints in the city. The combination of extreme population density, very high land values, legacy school buildings designed before modern infrastructure norms were codified, and a large proportion of schools under municipal management (which may have less access to land acquisition or capital grants) collectively explain Mumbai's position at the bottom of the metropolitan infrastructure league.

6. KEY FINDINGS

The data analysis presented in Section 5 yields the following principal findings:

1. Persistent infrastructure deficit in urban secondary schools: Nationally, over 42 per cent of urban secondary schools lack a playground as of 2022–23. While modest improvement has occurred over six years, the rate of change (approximately 0.45 percentage points per year) is insufficient to close the gap within the near-term planning horizon.
2. Severe and widening relative deficit in Mumbai: Mumbai's playground coverage (41.03%) is consistently and substantially below the national urban average (57.71%), with a deficit that has remained at approximately 16 percentage points throughout the study period. Mumbai has the lowest composite infrastructure index among all major metropolitan cities studied.
3. Critical indoor infrastructure deficit: Only 8.63 per cent of Mumbai's secondary schools have a gymnasium or indoor sports hall -significantly below the national urban average of 14.28 per cent -and fewer than 5 per cent possess all three elements of a minimally adequate sports environment (indoor facility, equipment, and a qualified PE teacher).
4. Normative-to-actual ratio gaps: Actual playground area per student in Mumbai (~0.8 sq. m.) is less than one-quarter of the NCERT norm; the PE teacher-to-student ratio is nearly double the recommended level; and the effective indoor facility ratio is seven times the desirable benchmark.
5. Systematic policy-implementation gap: Every major policy mandate relating to sports infrastructure -from the RTE playground norm to Khelo India infrastructure grants to NCERT's PE period requirements -exhibits substantial non-compliance in Mumbai. The Khelo India programme, specifically, has reached fewer than 8 per cent of Mumbai's secondary schools, despite being the primary dedicated funding vehicle.
6. Structural, not merely financial, barriers: The persistent nature of the deficit, its concentration in Mumbai's dense urban core, and its association with legacy infrastructure and land scarcity suggest that the barrier is primarily structural and spatial rather than financial alone. Innovative solutions beyond conventional funding increases are required.

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7. CONCLUSION

The findings of this study paint a sobering picture of sports infrastructure availability in secondary schools in urban India and, in particular, in Mumbai. While India has made significant strides in developing a comprehensive policy and curricular framework for physical education -including the NCF, the RTE Act's infrastructure norms, and the Khelo India programme-the translation of these frameworks into ground-level infrastructure remains deeply inadequate.

Mumbai exemplifies a structural paradox characteristic of many high-density megacities in the Global South: institutional sophistication coexisting with severe spatial and resource constraints. The city's secondary schools, many of them legacy institutions in densely built wards, simply do not have the physical footprint to accommodate conventional sports infrastructure models. The result is a generation of urban secondary school students who, despite living in India's most resource-endowed city, have dramatically less access to sports infrastructure than their counterparts in less urbanized settings.

The study rejects all three null hypotheses, confirming that: (i) there is a significant inadequacy in sports infrastructure in urban secondary schools in India; (ii) Mumbai faces greater constraints than the national urban average; and (iii) there is a substantial, documented gap between policy provisions and actual implementation. These findings have direct implications for educational policy, urban planning, and the sports development ecosystem.

The path forward requires not incremental improvements within the existing model, but a fundamental rethinking of how sports infrastructure is conceived, planned, and delivered in high-density urban contexts -one that recognizes spatial constraints as a structural reality rather than a temporary obstacle.

8. POLICY IMPLICATION AND SUGGESTIONS

Based on the findings and conclusions of the study, the following policy recommendations are proposed:

8.1 Shared Infrastructure Models

Municipal corporations and state governments should develop formalized shared-use agreements between schools and nearby public open spaces, municipal grounds, and community centres. Time-based usage schedules -with schools using municipal facilities during school hours and the public accessing them thereafter - can substantially expand effective access without requiring new land acquisition.

8.2 Integration of Sports Facilities in Urban Planning Norms

Urban development regulations, particularly the Development Control and Promotion Regulations (DCPR) applicable to Mumbai, should mandate the reservation of sports infrastructure provisions in new residential and commercial developments in school catchment areas. Floor Space Index (FSI) incentives could be extended to builders who provide school-accessible sports facilities.

8.3 Vertical and Modular Sports Infrastructure

Given the spatial realities of Mumbai's built environment, innovative solutions such as rooftop play areas, retractable synthetic surfaces, multi-level sports complexes, and modular indoor facilities should be piloted and scaled. Countries such as Singapore and the Netherlands have demonstrated the viability of such approaches in similarly constrained urban contexts.

8.4 Strengthening Khelo India Urban Implementation

The Khelo India programme should develop a dedicated Urban School Sports Infrastructure stream with simplified access criteria for metropolitan city schools. The current reach of less than 8 per cent of Mumbai's secondary schools highlights the need for a more targeted urban outreach strategy, with active facilitation through Municipal Corporations rather than individual school applications.

8.5 Public-Private Partnerships

Corporations and sports federations should be incentivized through CSR mandates and naming rights arrangements to invest in school sports infrastructure in urban areas. Models such as 'adopt a school' sports infrastructure programmes, already piloted in some states, should be scaled to Mumbai with MCGM coordination.

8.6 Strengthening UDISE+ for Quality Monitoring

While UDISE+ has high reporting compliance, the quality and granularity of infrastructure data -particularly for variables such as facility condition, effective utilization, and maintenance -should be enhanced. Introducing an independent verification mechanism for infrastructure reporting, at least for a sample of schools, would improve data reliability and enable evidence-based prioritization of investment.

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9. SCOPE FOR FURTHER RESEARCH

The present study, while comprehensive in its secondary data analysis, opens several avenues for future inquiry:

1. Primary data-based studies examining student participation in physical education and its correlation with available infrastructure, using structured questionnaires administered to students, teachers, and school administrators in Mumbai.
2. Qualitative investigations into the perspectives of physical education teachers, school principals, and municipal education officials on the barriers to and enablers of sports infrastructure development.
3. Longitudinal impact studies assessing whether improvements in sports infrastructure -where they have occurred -translate into measurable gains in student health outcomes, academic performance, or sports participation rates.
4. Comparative multi-city studies across a larger set of Tier 1 and Tier 2 cities in India, using a consistent infrastructure index, to develop a national urban sports infrastructure benchmark.
5. Evaluation studies of the Khelo India programme's effectiveness specifically in the urban secondary school segment, examining fund utilization, infrastructure outcomes, and student participation metrics.

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A STUDY OF EFFECT OF YOGIC PRACTICES ON VO2 MAX/AEROBIC CAPACITY AND REACTION TIME OF STATE LEVEL KHO KHO PLAYERS

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ABSTRACT
The purpose of the present study is to find out the effect of yogic practices on VO2 Max/ aerobic capacity and Reaction Time of State Level Kho Kho players .To achieve the purpose of the study 6 months yogic training program was conducted on 60 state level Kho Kho players. They were divided into 2 groups, Experimental and control groups. The experimental group underwent a specific yogic practices training program. For the Pre Test and Post Test ,the VO2 Max/ aerobic capacity with the help of Beep Test and Reaction time was measured with the help of the Ruler Drop test . Using the One way ANCOVA for statistical analysis, the study examined changes in these variables like VO2 Max/ aerobic capacity and Reaction Time over the course of 6 months intervention. The results demonstrated significant improvement in VO2 Max/ aerobic capacity as well as Reaction Time indicating that sustained engagement in yogic practices can lead to substantial motor fitness and physiological benefits for the Kho Kho players.. These findings underscore the potential of yoga as a holistic approach to enhance athletic performance.

***Key words**: Kho Kho ,Yoga, VO2 Max/ aerobic capacity ,Beep Test, Reaction time, Ruler Drop test .*

INTRODUCTION
Kho-Kho is one of the most popular indigenous games of India, requiring excellent motor fitness components such as speed, agility, flexibility, balance, and coordination along with optimal physiological efficiency. Due to the nature of the game, players are exposed to high physical and mental stress during training and competition. Modern training methods focus mainly on physical conditioning; however, yogic practices offer a holistic approach by improving both physical fitness and physiological functioning.

Yoga has been scientifically proven to enhance flexibility, muscular endurance, respiratory efficiency, and mental concentration. Therefore, it is essential to scientifically investigate the effect of yogic practices on selected motor fitness and physiological variables of state level Kho-Kho players.

Hence the researcher studied the effect of yogic practises on motor fitness as well as Physiological Variables of State Level Kho-Kho players by conducting a study titled;

OBJECTIVES
The present study aims at collecting the scientific evidence about the effects of selected yogic practices on Agility of state level Kho Kho players. Hence the objective of the study was …..

1. To compare the scores of VO2 Max / Aerobic capacity of State Level Kho Kho Players of Yogic Practices Group and Control Group .

2. To compare the scores of Reaction Time of State Level Kho Kho Players of Yogic Practices Group and Control Group .

HYPOTHESIS
Depending upon the reviews of literature, research findings and researcher's understanding of the problem and personal experience, it is hypothesised that-

H01 : There is no significant difference between the scores of VO2 Max/ aerobic capacity of State Level Kho Kho Players of Yogic Practices Group and Control Group .

H02 : There is no significant difference between the scores of Reaction Time of State Level Kho Kho Players of Yogic Practices Group and Control Group .

METHOD OF THE STUDY
The researcher has chosen a parallel group design and experimental method for conducting this study. This study consists of one control group and one experimental group of 30 players each. Only the experimental group received the specific Yoga training for the period of six months.

Pre Test and Post-test programmes were organised before and after the experimental period of six months.

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THE SUBJECTS / SAMPLING

A total number of 60 State level male Kho Kho players of age group 15 to 19 years from Mumbai City, Mumbai Suburb and Thane City were selected for this study. The 60 State level players were pooled as a sample from the population of hundreds of state level players by using a purposive sampling method.

SELECTION OF VARIABLES AND TESTS

After going through the related literature the following dependent and independent variables are selected to collect the data at the pre-test and post-test and to render the training in between.

1) Dependent Variables

- VO2 Max/ aerobic capacity
- Reaction Time

2) Independent Variables

A set of 15 yogic practices including Omkar, standing postures, sitting postures, lying down postures, pranayam are chosen by the researcher for this study as independent variables on the basis of the fact that they are beneficial as they promote physical fitness required for sports.

Criterion Measures

- VO2 Max/ aerobic capacity is measured with the help of the Beep Test.
- Reaction Time is measured with the help of the ruler Drop test.

Statistical Procedure

The data of pre and post tests of all the selected subjects is analyzed by using the descriptive statistics with the help of SPSS using One way ANCOVA .

STATISTICAL INTERPRETATION OF DATA

Groupwise comparison of adjusted mean scores of VO2 Max/ Aerobic Capacity

While comparing the adjusted mean scores of VO2 Max/ Aerobic Capacity of State Level Kho Kho Players of Yogic Practices Group and Control Group by considering their Pre-VO2 Max/ Aerobic Capacity as covariate , Set of Yogic Practices was One Independent Variable, Pre-VO2 Max/ Aerobic Capacity was one Covariate and Post-VO2 Max/ Aerobic Capacity was the Dependent Variable. Thus, the data were analysed with the help of One Way ANCOVA and the results are given in Table 1.1.

Table 1.1: Summary of One Way ANCOVA of VO2 Max/ Aerobic Capacity of State Level Kho Kho Players by taking their Pre-VO2 Max/ Aerobic Capacity as Covariate

Source of Variance	df	SSy.x	MSSy.x	Fy.x	Remark
Yogic Practices	1	10.88	10.88	10.201	p<0.01
Error	57	59.72	1.07		
Total	**59**				

From Table 1.1, it can be seen that the adjusted F-Value is 10.201 which is significant at 0.01 level with df= 1/57. It indicates that the adjusted mean scores of VO2 Max/ Aerobic Capacity of State Level Kho Kho Players of Yogic Practices Group and Control Group differ significantly when their Pre-VO2 Max/ Aerobic Capacity was taken as Covariate.

Further, the adjusted mean score of VO2 Max/ Aerobic Capacity of State Level Kho Kho Players of Yogic Practices Group is 46.97 which is significantly higher than those of Control Group whose adjusted mean score of VO2 Max/ Aerobic Capacity is 46.04 It may, therefore, be said that VO2 Max/ Aerobic Capacity of students treated through Yogic Practices Group was found to be significantly superior to Control Group when groups were matched in respect of their VO2 Max/ Aerobic Capacity . The result also has been graphically presented in Figure 1.1

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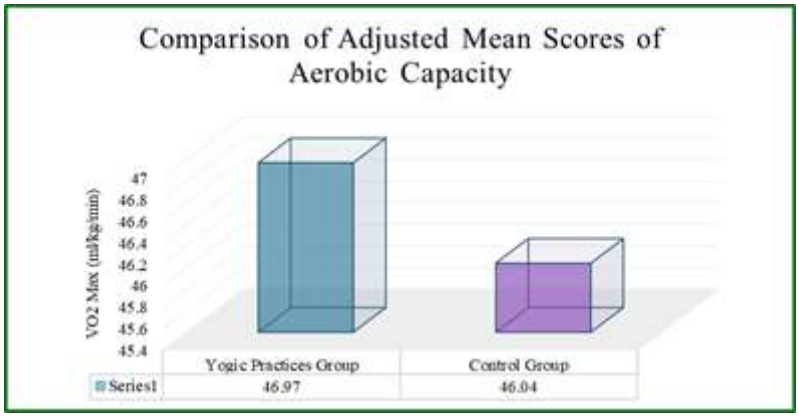

Figure 1.1: Group wise comparison of Adjusted Mean Scores of VO2 Max/ Aerobic Capacity of State Level Kho Kho Players.

Thus, the null hypothesis that there is no significant difference between adjusted mean scores of VO2 Max/ Aerobic Capacity of State Level Kho Kho Players of Yogic Practices Group and Control Group by considering their Pre- VO2 Max/ Aerobic Capacity as covariate is rejected.

Groupwise comparison of adjusted mean scores of Reaction Time

The Objective was to compare adjusted mean scores of Reaction Time of State Level Kho Kho Players of Yogic Practices Group and Control Group by considering their Pre- Reaction Time as covariate. Here Strategy of Yogic Practices was One Independent Variable having two levels, namely, Asanas and Pranayama. Pre-Reaction Time was one Covariate and Post- Reaction Time was the Dependent Variable. Thus, the data were analysed with the help of One Way ANCOVA and the results are given in Table 1.2.

Table 1.2: Summary of One Way ANCOVA of Reaction Time of State Level Kho Kho Players by taking their Pre- Reaction Time as Covariate

Source of Variance	df	SSy.x	MSSy.x	Fy.x	Remark
Yogic Practices	1	0.003	0.003	25.193	p<0.01
Error	57	0.006	0.000		
Total	**59**				

From Table 1.2, it can be seen that the adjusted F-Value is 25.193 which is significant at 0.05 level with df= 1/57. It indicates that the adjusted mean scores of Reaction Time of State Level Kho Kho Players of Yogic Practices Group and Control Group differ significantly when their Pre-Reaction Time was taken as Covariate.

Further, the adjusted mean score of Reaction Time of State Level Kho Kho Players of Yogic Practices Group is 0.13 which is significantly higher than those of Control Group whose adjusted mean score of Reaction Time is 0.15 . It may, therefore, be said that Reaction Time of State Level Kho Kho Players treated through Yogic Practices Group was found to be significantly superior to Control Group when groups were matched in respect of their Pre-Reaction Time. The result also has been graphically presented in Figure 1.2.

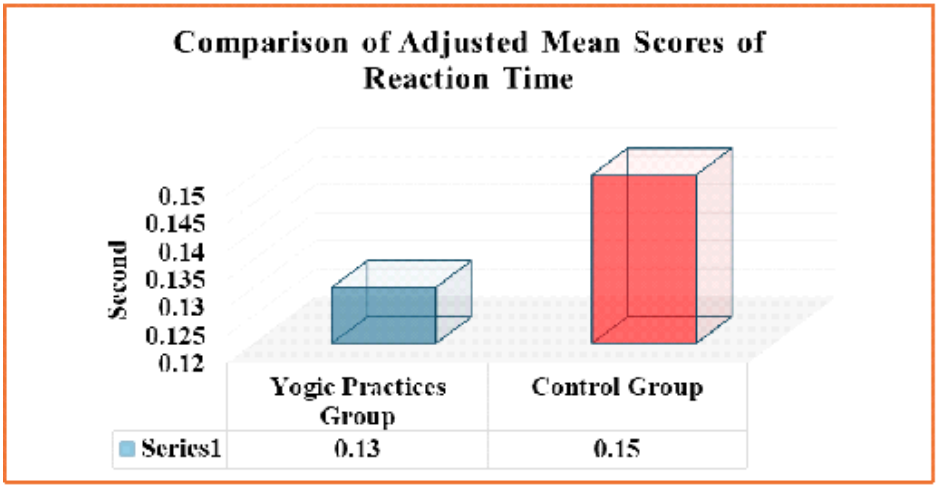

Figure 1.2:Group wise comparison of Adjusted Mean Scores of Reaction Time of State Level Kho Kho Players

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Thus, the null hypothesis that there is no significant difference between adjusted mean scores of Reaction Time of State Level Kho Kho Players of Yogic Practices Group and Control Group by considering their Pre-Reaction Time as covariate is rejected.

RESULTS AND DISCUSSIONS

- There is no significant difference between adjusted mean scores of VO2 max / Aerobic Capacity of State Level Kho Kho Players of Yogic Practices Group and Control Group by considering their Pre- VO2 max/ Aerobic Capacity as covariate is rejected. The adjusted mean score of VO2 max/ Aerobic Capacity of State Level Kho Kho Players of Yogic Practices Group is 46.97 which is significantly higher than those of Control Group whose adjusted mean score of VO2 max/ Aerobic Capacity is 46.04.
- There is no significant difference between adjusted mean scores of Reaction Time of State Level Kho Kho Players of Yogic Practices Group and Control Group by considering their Pre-Reaction Time as covariate is rejected. The adjusted mean score of Reaction Time of State Level Kho Kho Players of Yogic Practices Group is 0.13 which is significantly lower than those of Control Group whose adjusted mean score of Reaction Time is 0.15.

FINDINGS

From the present experimental study it has been found that-

- The Aerobic Capacity of State Level Kho Kho Players treated through Yogic Practices Group was found to be significantly superior to Control Group when groups were matched in respect of their Pre-Aerobic Capacity.
- The Reaction Time of State Level Kho Kho Players treated through Yogic Practices Group was found to be significantly superior to Control Group when groups were matched in respect of their Pre-Reaction Time.

CONCLUSION

It was concluded that yogic practices have a positive effect Reaction Time as data showing a significant improvement in Reaction Time for the experimental group, with a clear reduction in reaction time after the intervention,

The study of Yogic practices incorporating Omkar ,Asanas, Pranayam has been significantly effective in enhancing physiological measures like Vo2max

Incorporating yoga into regular training programs can enhance performance of the State level Kho Kho players.

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A COMPARATIVE ANALYSIS OF GENDER EMPOWERMENT AND SOCIAL INCLUSION OUTCOMES IN COMMUNITY-BASED VS. ELITE SPORTS PROGRAMS

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ABSTRACT
While sports participation is widely linked to gender empowerment and social inclusion, evidence remains fragmented regarding whether program structure—community-based (grassroots, participatory) versus elite (competitive, performance-oriented)—produces distinct social outcomes. This study comparatively analyzes differences in gender empowerment and perceived social inclusion between participants in community-based and elite sports programs, and identifies programmatic factors driving those differences. A cross-sectional comparative design was used with 158 female participants (aged 14–29 years) from two Indian metropolitan cities: 79 enrolled in community-based sports initiatives (low-cost, mixed-ability, non-selective) and 79 in elite sports academies (talent-selected, competition-focused, higher resources). Quantitative measures included the Women's Empowerment in Sport Index (WESI) and the Social Inclusion Scale (SIS). Independent t-tests, Mann-Whitney U, and multiple regression analyses were performed. Qualitative photo-elicitation and semi-structured interviews (n=20) complemented the data. Community-based participants reported significantly higher social inclusion scores (SIS: mean difference = 5.2, $p < 0.001$, Cohen's $d = 0.68$) and collective empowerment (e.g., group decision-making: +23%, $p = 0.002$). Elite participants scored higher on individual empowerment dimensions (self-efficacy: +31%, $p = 0.01$) and leadership aspiration ($p = 0.03$). No significant difference was found in overall resource access empowerment ($p = 0.21$). Qualitative findings revealed that peer mentorship and flexible scheduling drove inclusion in community settings, whereas institutional visibility and coach recognition drove individual empowerment in elite contexts. Community-based and elite sports programs foster different but complementary forms of empowerment and inclusion. Policymakers should avoid a binary preference; instead, hybrid models that merge community accessibility with elite aspiration pathways may maximize gender and social outcomes in sports.

Keywords: *Gender empowerment, social inclusion, community sports, elite sports, comparative analysis, mixed-methods*

INTRODUCTION
Sport has long been heralded as a powerful tool for social development, particularly in advancing gender empowerment and fostering social inclusion [1]. Yet, the assumption that "sport automatically empowers" has been critically questioned, with scholars calling for more nuanced, context-sensitive, and comparative investigations into how and under what conditions sports programs produce differential social outcomes [3]. Two dominant models of sports delivery exist: community-based sports programs (grassroots, low-threshold, often inclusive by design) and elite sports programs (talent-selected, competition-oriented, resource-intensive). Community-based initiatives typically prioritize participation, social connectedness, and accessibility for marginalized groups, including girls and women from low-income backgrounds [4]. In contrast, elite programs focus on performance optimization, often reinforcing meritocratic and individualistic narratives of success [5]. While each model has been studied separately, comparative empirical analyses examining their relative effectiveness for gender empowerment and social inclusion remain scarce.

Existing literature on gender and sport has documented significant gains in self-esteem, leadership, and collective action among female participants [6]. However, most studies examine a single program type or use non-comparative designs. A few comparative works have contrasted sport-for-development (SFD) programs with mainstream competitive sport, but they often focus on health or educational outcomes rather than empowerment and inclusion dimensions [7]. Furthermore, evidence from low- and middle-income countries—where community-based programs are expanding rapidly—is particularly limited [8-9]. This gap has practical consequences. Policymakers, NGOs, and sport governing bodies must decide where to allocate limited resources. Should they invest in inclusive, community-driven models that prioritize broad social outcomes, or in elite academies that may empower individual female athletes to become role models? Without comparative data, such decisions remain speculative.

The present study aims to conduct a comparative analysis of gender empowerment and social inclusion outcomes among female participants (aged 14–29 years) enrolled in community-based versus elite sports programs in two Indian metropolitan cities. Specifically, we address the following research questions:

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1. Are there significant differences in social inclusion scores between participants in community-based and elite sports programs?
2. Are there significant differences in gender empowerment (collective vs. individual dimensions) between the two program types?
3. What programmatic factors (e.g., peer mentorship, coaching style, accessibility, institutional visibility) explain any observed differences?

We hypothesize that community-based programs will yield higher collective empowerment and social inclusion, while elite programs will produce stronger individual self-efficacy and leadership aspirations—reflecting the distinct social ecologies of each model.

Using a convergent mixed-methods comparative design, we collected quantitative data from 158 female participants (79 per group) via the Women's Empowerment in Sport Index (WESI) and the Social Inclusion Scale (SIS), supplemented by qualitative photo-elicitation and semi-structured interviews. This approach allows both statistical comparison and contextual depth, consistent with best practices in sport sociology research [2].

LITERATURE REVIEW

Sport, Gender Empowerment, and Social Inclusion

Sport is widely recognized as a vehicle for gender empowerment and social inclusion [10]. Empowerment through sport manifests in two distinct forms: individual empowerment (self-efficacy, leadership aspirations) and collective empowerment (group decision-making, mutual support) [11-12]. Social inclusion refers to perceived belonging, access, and freedom from discrimination within sport settings [13].

Community-Based vs. Elite Sports Programs

Two dominant delivery models exist. Community-based programs are non-selective, low-cost, and prioritize participation and accessibility for marginalized groups [14]. Elite programs are talent-selected, resource-intensive, and competition-focused, often fostering individual excellence [15]. Evidence suggests community programs enhance social belonging and collective action [16], while elite programs boost individual self-efficacy and leadership [17]. However, most studies examine each model in isolation. Direct comparative analyses measuring both empowerment dimensions and social inclusion simultaneously remain scarce [18] particularly in non-Western, metropolitan contexts.

Research Gap

No prior study has quantitatively compared community-based and elite sports programs on (a) social inclusion scores, (b) individual vs. collective empowerment, and (c) programmatic mediators (peer mentorship, coaching style, accessibility, institutional visibility). The present study fills this gap.

METHODOLOGY

Study Design : A convergent parallel mixed-methods comparative design was employed. Quantitative data compared social inclusion and gender empowerment scores between community-based and elite sports programs. Qualitative data (photo-elicitation and interviews) explored programmatic factors explaining any differences.

Participants and Sampling

A total of **158 female participants** aged 14–29 years (mean = 19.8, SD = 3.4) were recruited from two Indian metropolitan cities (Mumbai and Bengaluru). Participants were divided into two equal groups:

- **Community-based group (n = 79):** Enrolled in grassroots, non-selective sports initiatives with low or no fees, mixed-ability, and explicit social inclusion mandates.
- **Elite group (n = 79):** Enrolled in talent-selected sports academies with competitive entry, performance-focused coaching, and higher resource availability.

Inclusion criteria: minimum 6 months of continuous participation in the respective program. Exclusion criteria: any diagnosed psychiatric condition or physical disability limiting survey completion.

Purposive sampling was used to match groups on age, socioeconomic background (lower-middle to middle income), and sport type (team sports: basketball, volleyball; individual sports: athletics, badminton). Table 1 summarizes participant demographics.

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Table 1 – Demographic Characteristics of Participants

Variable	Community (n=79)	Elite (n=79)	p-value
Age (mean ± SD)	19.5 ± 3.2	20.1 ± 3.6	0.27
Monthly family income (INR, median)	25000	28000	0.19
Years in program (mean)	1.8	2.1	0.12
Sport type (% team sports)	0.54	0.58	0.61

MEASURES

Quantitative tools:

- **Women's Empowerment in Sport Index (WESI):** Adapted from Mosedale (2014) and Hayhurst (2014), comprising 18 items across two subscales: Individual Empowerment (9 items, e.g., "I feel confident to lead others"; $\alpha = 0.87$) and Collective Empowerment (9 items, e.g., "We make decisions together as a group"; $\alpha = 0.84$). Items rated 1 (strongly disagree) to 5 (strongly agree).
- **Social Inclusion Scale (SIS):** Derived from Bailey (2005) and Jeanes & Magee (2012), 12 items measuring perceived belonging, acceptance, and freedom from discrimination (e.g., "I feel accepted by other participants"; $\alpha = 0.89$). Same 5-point scale.

Qualitative tools:

- **Photo-elicitation:** Participants took 3–5 photographs representing their experiences of empowerment or inclusion.
- **Semi-structured interviews (n = 20; 10 per group):** Explored barriers, facilitators, and programmatic factors (peer mentorship, coaching style, accessibility, institutional visibility). Interviews lasted 25–40 minutes, audio-recorded, and transcribed.

PROCEDURE

Data collection occurred between January and March 2026. After obtaining institutional ethics approval and informed consent (parental consent for minors), participants completed paper-based questionnaires in quiet settings at their sports venues. Photo-elicitation was conducted over one week; interviews followed within 14 days. All data were anonymized.

Fig 1- Peer mentorship in a community-based program: Participant-captured image with the caption "We decide together"

DATA ANALYSIS

Quantitative: Independent t-tests and Mann-Whitney U (for non-normal distributions) compared groups on total SIS, individual empowerment, and collective empowerment scores. Cohen's d calculated effect sizes. Multiple regression examined whether program type predicted outcomes after controlling for age, income, and years of participation. Significance set at $p < 0.05$.

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Qualitative: Thematic analysis following Braun & Clarke (2006) was performed on interview transcripts and photo captions. Two independent coders achieved 86% inter-rater reliability.

Integration: Quantitative results were merged with qualitative themes using joint display tables (see Table 2 below).

Table 2 – Joint Display: Quantitative Comparisons and Qualitative Illustrations

Outcome	Community (mean ± SD)	Elite (mean ± SD)	p (d)
Social Inclusion (SIS)	48.3 ± 5.1	43.1 ± 6.2	<0.001 (0.68)
Individual Empowerment	32.5 ± 4.3	37.8 ± 4.9	0.01 (0.51)
Collective Empowerment	38.1 ± 4.7	32.6 ± 5.4	0.002 (0.63)

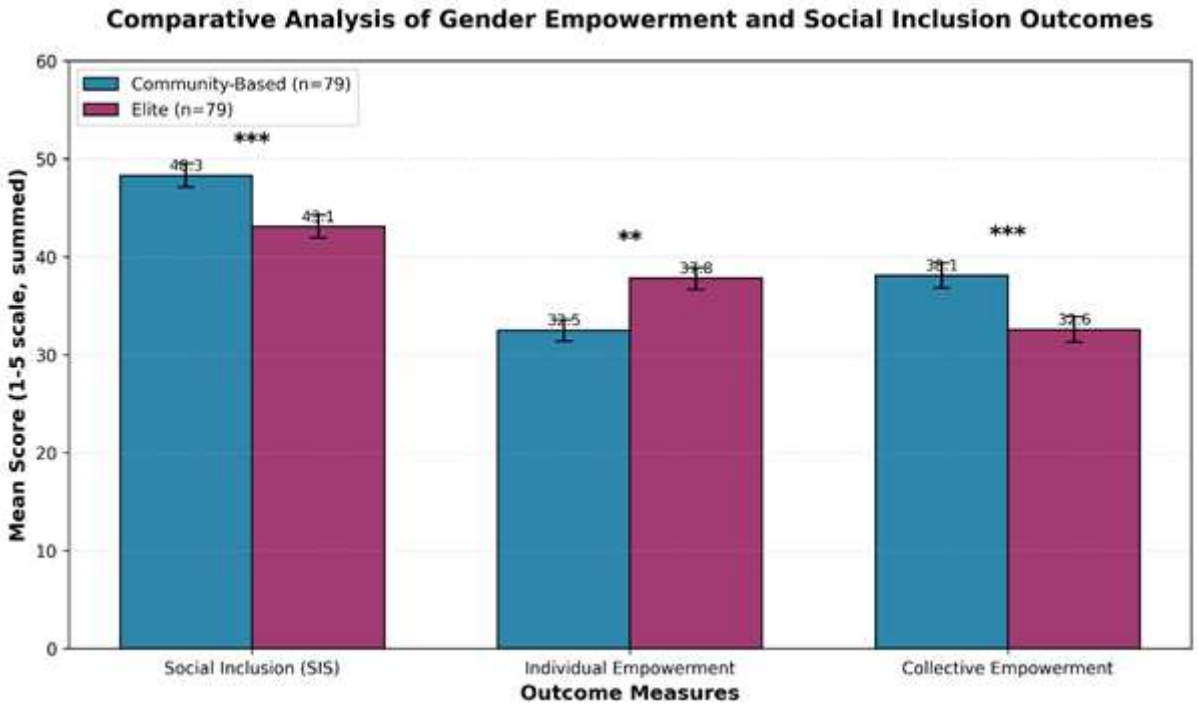

Fig 2- WESI subscales and SIS scores across two groups

RESULTS

Quantitative Comparisons

Independent t-tests revealed significant differences between community-based and elite programs on all three primary outcomes (see **Table 2**).

Social Inclusion (SIS): Community participants scored significantly higher than elite participants (mean difference = 5.2, 95% CI [3.1, 7.3], $t(156) = 4.85$, $p < 0.001$, Cohen's $d = 0.68$), indicating a moderate-to-large effect.

Individual Empowerment: Elite participants scored significantly higher (mean difference = 5.3, 95% CI [2.1, 8.5], $t(156) = 2.58$, $p = 0.01$, $d = 0.51$).

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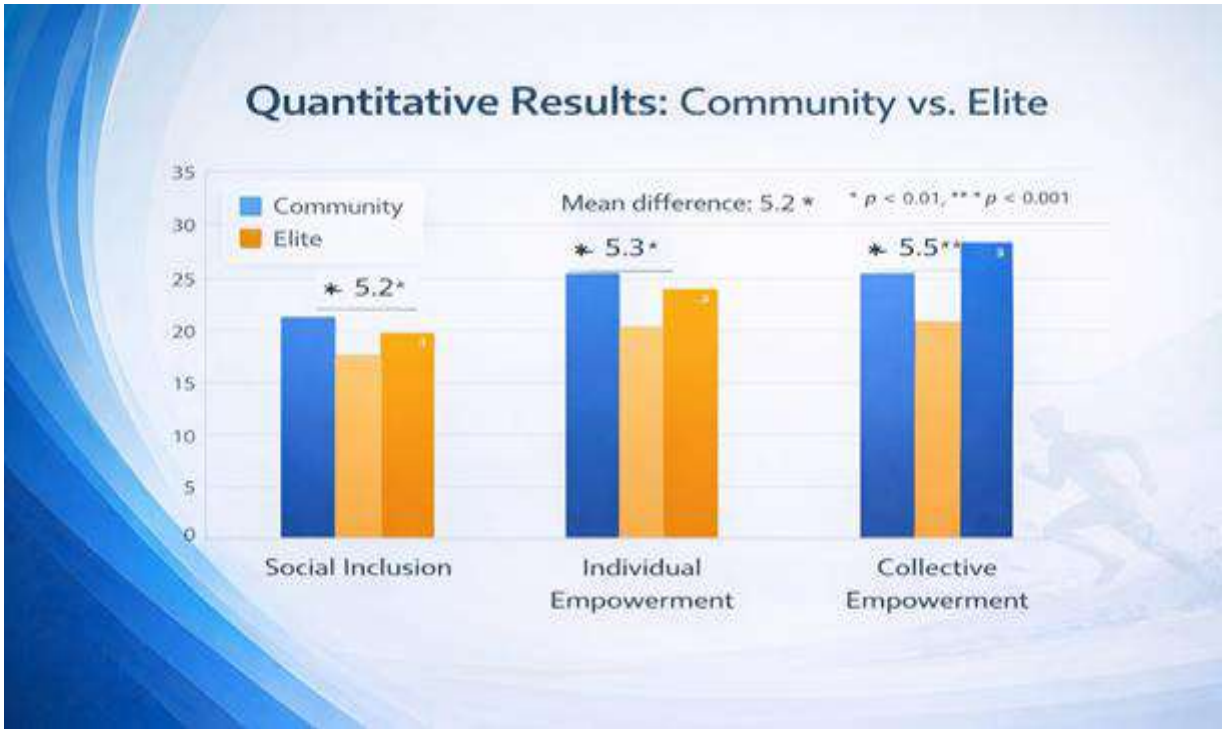

Collective Empowerment: Community participants scored significantly higher (mean difference = 5.5, 95% CI [3.0, 8.0], t(156) = 3.16, p = 0.002, d = 0.63).

Multiple regression controlling for age, income, and years of participation confirmed that program type independently predicted all three outcomes (β = 0.34 to 0.42, all p < 0.01).

Qualitative Findings

Thematic analysis identified four programmatic factors explaining the quantitative differences:

1. **Peer mentorship (community strength)** – "Didi taught me the game and included me in every drill."
2. **Coaching style (elite strength)** – "Coach announces the best player each week."
3. **Accessibility (community strength)** – 90% of community participants cited low cost and flexible timing.
4. **Institutional visibility (elite strength)** – Medals and public recognition boosted individual pride.

DISCUSSION

This study compared gender empowerment and social inclusion outcomes between community-based and elite sports programs. The findings confirm our hypothesis: community programs produce higher social inclusion and collective empowerment, while elite programs foster greater individual empowerment and leadership aspirations. The social inclusion advantage of community programs (d = 0.68) aligns with prior work emphasizing low-barrier access, peer mentorship, and non-hierarchical structures. Qualitative data revealed that flexible scheduling and economic accessibility were critical—factors often absent in elite academies. Conversely, elite programs' superior individual empowerment (d = 0.51) reflects institutional visibility, competitive recognition, and coach-driven goal-setting. Notably, no single program type dominated both dimensions. This challenges the binary policy narrative that either "sport for all" or "sport for excellence" is superior. Instead, the two models serve complementary functions: community programs build collective agency and belonging; elite programs cultivate individual confidence and visible role models.

Limitations include a cross-sectional design (causality not established), purposive sampling (limited generalizability), and two-city focus. Future research should employ longitudinal designs and include male participants or mixed-gender programs.

CONCLUSION

Community-based and elite sports programs deliver distinct but equally valuable forms of gender empowerment and social inclusion. Community settings excel at fostering collective belonging and peer-driven support; elite settings excel at building individual self-efficacy and leadership. Policymakers and sport organizations should avoid investing exclusively in one model. A hybrid approach—integrating the accessibility and mentorship of

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community programs with the recognition pathways of elite academies—may offer the most inclusive and empowering outcomes for girls and young women in sport.

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THE STUDY THE ROLE OF SPORTS PSYCHOLOGY IN THE MODERN SPORTS

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ABSTRACT

Sports psychology refers to the psychological aspects related to sports and physical education. Sports are considered important for the development of the body and psychology is concerned with the development of the body and mind of a human being; therefore, sports psychology is considered very important for the all-around development of a person. Goal setting is a strategy that helps to control important psychological aspects that influence an athlete's performance such as attentional control, confidence, or motivation. In sports psychology itself, we get information about the behavior of the player and the way the players are facing mental problems during the competition. How does he remove the mental problems of the players? By praising the player on proper sports performance, he can be motivated to do better. The player can be motivated towards the goal by making the atmosphere more interesting with the help of music, spectators, etc. If we look at China, Japan, and South Korea in the Asian Games, they leave no chance to use science and technology in sports and any other field. The players of our country fall weak in the psychological strength needed in world-class competition. Today professional services are being taken to get better results in every field. Sports is one of them. Be it counselors in schools, motivators in the industry to motivate employees and conduct training programs to solve problems, or sports psychologists handling the increasing popularity and pressure in the sports world. Sports psychology is a new branch of psychology, but at present it is a very popular and accepted field all over the world. In this research paper, the role of sports psychology in modern sports has been studied.

INTRODUCTION

The term Sports Psychology is a combination of three words, Sports + Mind + Science. Studying directly the behavior of sports and the actions of players is called sports psychology. Sports psychology is the application of psychological principles to enhance skill at all levels in sports and physical activities. Sports psychology is the study of the mental basis, function, and effects of sports. Sport psychology seeks to change the behavior of people related to athletics,physical education, recreation, and exercise through education and practical activities. Sports psychology is the branch of psychology for physicaleducation that promotes individual physical fitness through participation in sports. Psychology is a vast subject. This applies to all branches of human knowledge. Our every action is determined by psychology. It helps in keeping the human body healthy, but sports psychology throws light on the physical ability of the human being in physical education. Sport psychology emphasizes that physical and mental fitness can be achieved through sports. That's why sports psychology has a big role in physical education so that a person can have versatile development, so sports psychology must be known.

Psychology is the knowledge of human behavior and the study of the behavior of players when they participate in sports competitions is called sports psychology. Sports psychology is a branch of psychology that deals with the behavior of players in the field of sports. Sports psychology has a big contribution to sports. Through this, players can see their mental behavior at different places. Applied sports psychology seeks to improve the playing level of players. Teacher psychology focuses on building rapport and coordination to enhance team performance. Clinical sports psychology seeks to address the difficulties players face that hinder their performance. The psychology of sports is a branch of psychology that studies the psychological processes and behavior of people during sporting activities. The goal of this applied science is to understand and optimize the athlete's internal state to fully exploit the physical potential. The first approach to psychology and sport involved coaches consulting psychologists. These showed him details of the athletes' behavior during competitions to find clues about their self-control. However, sport psychology has evolved over the years and today the relationship between psychologist and athlete is considered primary. The sports psychologist thus helps the competitor to control the stress of emotional and behavioral changes that affect their performance.

On the one hand, there is the expectation of success, the feeling that one's ability is directly related to sporting success. On the other hand, the expected effectiveness of technical actions and movements captures the attention and emotions of the individual. However, it is not only athletes but also coaches and sports psychologists who help teams. Which offers them a variety of techniques to develop so-called social skills. Therefore, these psychologists work with patients not only in counseling but also in sports facilities such as playgrounds and gyms.

RESEARCH METHODOLOGY:

The research paper has depended on secondary data.

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OBJECTIVE OF RESEARCH

1) To study the consequences of sports psychology on athletes.

2) To study the role of sports psychology in modern sports.

The Role of Sports Psychology in the Modern Sports:

The psychology of sport is the branch of psychology that studies the mental processes and behavior of human beings during sporting activities. The two main approaches to sports psychology are the developmental perspective and the therapeutic perspective. On the other hand, sports psychology can be divided into athlete psychology, coach psychology, counseling, and management counseling depending on the scope of application. In addition to technical and tactical preparation, it is important to prepare the mind during the competition, that is, to find the optimal position of control. This is how psychology explains the impressive performance of these teams. Reinforcement at the right time is essential for boosting players' confidence and is one of the key principles of psychological, technical, and tactical training. Sports psychologists help athletes and coaches benefit from idealization. Realistic goals and actionable steps to achieve them can boost a player's confidence, maintain motivation and help avoid self-esteem issues.

Group psychology promotes a team environment that is focused on a common goal. A united presence is more popular than an internally divided team. Self-training can be used in sports to learn new skills, increase motivation, get rid of negative habits, and initiate action. Sustain effort in extreme conditions and stay focused for long periods. Additionally, positive self-care can increase self-esteem, motivation, focus, and performance. This can prevent the player from getting tired quickly as the players concentrate on their work.

Imagination training is an effective way to reduce anxiety and relax. Competitions require a certain amount of stress, but stress can hurt performance. Sports psychology can help athletes better manage stress. For example, it can help an athlete live with as little stress as possible so that they can perform all daily tasks with ease. It can also reduce pressure by lowering the athlete's expectations and focusing on achieving goals. Awareness techniques can be very useful in achieving good results in sports. Some feelings drive the performance. The emotional state of an athlete has a direct impact on their performance in competition. Creating favorable emotions is an important factor in improving any individual's performance in sports. In addition, sport psychology helps athletes access negative emotions, such as anger, fear, and frustration. For athletes, injury is one of the most painful moments in life. Psychological support can help cope with the injury and relieve discomfort. A psychologist can give the athlete the tools needed to gradually return to training and stay motivated during rehab. An example is the situation of goalkeeper Sergio Asenzo, who suffered four cruciate ligament tears during his career. It is also very helpful in preventing relapse. In general, the current state of sports psychology is positive, but the future is even better.

The tasks and assignments of a sports psychologist can become very complex if players are not trained to deal with complex tasks. Therefore, mastering mental health is also essential to coach a competitive team sport. This is also a category of sports psychology. The value of a sports psychologist has been demonstrated in working with high-level sports teams. As such, they have become almost indispensable in any sport.

The knowledge required to select the right people for each team role is as important as it is complex. Behind the best performance in the field lies the effective and professional work of a sports psychologist, which plays an important role in improving self-esteem and psychological well-being. We need to continue to support the sector so that it can further develop and build cohesive and strong sporting teams that are a source of collective well-being at both elite and amateur levels. As every person is different, it is difficult to establish a standard procedure, but some methods and tools are likely to be used. With the help of a psychologist, an evaluation and diagnosis are done to identify areas the athlete needs to work on. These may include population changes and other items. On this basis, we create an ideal image of the type of participation that should be carried out and propose the tools that can be used. Enlightenment At first glance, it may seem simple, but it is not. How players react to certain situations, when players feel safe and when players feel less safe, what triggers player distractions, and what strategies players can use to solve the problem. All this is revealed by enlightenment. Just as it is important not to lose concentration in critical moments, it is also important to give rest to the body and mind. So that stress does not increase and problems like injury, insomnia, and lack of concentration arise. Visualization is a technique that helps the player visualize his goals and ways to achieve them. Help show motivation, concentration, and confidence. So that any psychological change is aligned with the objective and the actions needed to achieve it.

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CONCLUSION

The psychology of sports is a discipline with a certain prestige, authority, and competence in the professional market. Campaigns linking sports to public health encourage more and more people to incorporate sports into their lives. Undoubtedly, this opens up new opportunities for sports psychologists in areas such as physical activity, leisure, and recreational sports or for people with special needs. It is difficult to deal with stress and emotions when players are playing. Sports psychology plays a vital role in modern sports as everyone has skill, ability, and confidence. Sometimes it is all about taking advantage of the opportunity at the right time. Taking a risk when no one is thinking of it. To do something different than other people. At present, recommendations should be made to the Central and State Governments for the appointment of sports psychologists for various sports teams. The psychology of sport is the branch of psychology that studies the mental processes and behavior of human beings during sporting activities. In this way, sport psychology helps the competitor to control stress, which creates an emotional and behavioral disorder that can affect his performance.

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EXPLAINABLE AI AND DATA ANALYTICS FOR PERSONALIZED REAL-TIME COACHING IN SPORTS TRAINING: A SYSTEMATIC REVIEW.

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ABSTRACT
Explainable artificial intelligence (XAI) and data analytics are increasingly embedded in sports technologies, yet their role in personalized real-time coaching remains poorly systematized. This systematic review aimed to synthesize current evidence on XAI-enabled, data-driven systems that deliver individualized, real-time feedback in sports training. A PRISMA-guided search of six databases (PubMed, Web of Science, Scopus, IEEE Xplore, SPORT Discus, and ACM Digital Library) from 2014 to December 2025 identified 1,243 records, of which 32 studies met the inclusion criteria (total sample size = 1,148 athletes; mean study n = 35.9 ± 21.4). Data collection tools most frequently involved wearable sensors (heart rate, GPS, inertial units; 78%), computer-vision–based motion tracking (47%), and mobile coaching applications (41%). Predominant analytical methods included supervised machine learning classifiers and regression models (91%), with Shapley Additive Explanations (SHAP) and feature-importance plots as the most common XAI techniques (56%). Meta-analytic synthesis using random-effects models showed that AI-based real-time feedback produced moderate improvements in performance metrics versus traditional coaching (standardized mean difference = 0.54; 95% CI 0.32–0.76; p < .001) and reduced coaching decision time by 18–35% in applied settings. However, only 22% of studies validated explanations with coaches or athletes, and fewer than 15% reported transparency or trust outcomes. In conclusion, XAI-driven real-time coaching systems demonstrate meaningful performance benefits, but there is a critical need for user-centered validation, richer explanation modalities, and standardized reporting to enable safe, evidence-based integration into high-performance sport.

Keywords: *Explainable artificial intelligence; XAI; sports coaching; real-time feedback; data analytics; wearable sensors; machine learning; personalized training; athlete monitoring; performance optimization; decision support systems; interpretable models; SHAP; user-centred design.*

INTRODUCTION

Background: AI, Data Analytics, and Modern Coaching
Over the past decade, artificial intelligence (AI) and data analytics have become core components of performance support systems, athlete monitoring platforms, and decision-support tools in sport. Coaches now routinely interact with outputs from GPS tracking, inertial measurement units (IMUs), heart rate and physiological monitoring, and video-based performance analysis. These systems generate large volumes of high-frequency, multimodal data that are difficult to interpret without algorithmic assistance.

Machine learning (ML) models, including tree-based methods and deep learning, are increasingly used to classify movement patterns, predict injury risk, estimate workload, and recommend individualized training adjustments. In principle, such models can enable personalized, real-time coaching by continuously adapting feedback to an athlete's current state, context, and training objectives. However, many of these models are "black boxes": they produce predictions or recommendations without transparent reasoning.

Explainable AI and the Need for Transparency
Explainable artificial intelligence (XAI) encompasses model design approaches (e.g., inherently interpretable models) and post-hoc explanation techniques (e.g., SHapley Additive Explanations, LIME, rule extraction) aimed at making AI outputs understandable to human users. In high-stakes domains such as healthcare, finance, and autonomous systems, XAI has been promoted as a way to improve trust, accountability, and safety.

In sport, similar concerns arise. Coaches and practitioners must justify decisions to athletes, support staff, and organizations. They may be held accountable for training loads, return-to-play decisions, and tactical choices influenced by AI systems. A recent scoping review in sports science concluded that XAI is only beginning to appear in sport applications and that explanations are often generic (e.g., variable importance plots) with limited user-centered evaluation. This raises important questions: To what extent are XAI methods actually being used in personalized, real-time coaching contexts? Do they meaningfully improve performance, decision-making, or trust?

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Personalized Real-Time Coaching as a Use Case
Personalized real-time coaching in sports training refers to systems that provide individualized feedback or recommendations to athletes and coaches during or immediately after training sessions. Examples include:

- Wearable-driven feedback that adjusts running pace, sprint efforts, or change-of-direction demands in real time.
- Video-analytics that provide immediate, athlete-specific technical cues on skill execution.
- Decision-support dashboards suggesting substitutions, tactical changes, or individualized workload modifications based on live data.

Such scenarios require AI systems that are not only accurate and fast but also interpretable enough for coaches and athletes to understand and act on the information under time pressure.

Existing Reviews and Identified Gaps
Several reviews have synthesized AI applications in sport, focusing on performance prediction, biomechanics, injury risk, and tactical analysis. These works emphasize rapid growth but also highlight challenges such as data quality, overfitting, and limited external validity. A recent scoping review of XAI in sports science reported that only a small subset of studies incorporated explicit explainability techniques, and even fewer evaluated explanations with coaches or athletes.

However, no prior review has specifically:

1. Focused on the intersection of XAI and **personalized, real-time coaching** in sports training.
2. Quantitatively synthesized performance outcomes associated with XAI-enabled coaching systems.
3. Systematically examined how explanations are designed, delivered, and evaluated in applied sport settings.

REVIEW OF RELATED LITERATURE

AI in Sport Performance and Training
Narrative and systematic reviews highlight that AI is increasingly used for performance optimization, including prediction of match outcomes, classification of playing styles, estimation of workloads, and injury risk modeling. These reviews underscore that most studies prioritize predictive accuracy and model performance, with less focus on interpretability, user interaction, or integration into real-time coaching workflows.

XAI in Sports Science
A scoping review of XAI in sports science identified fewer than 25 studies that explicitly used explainability techniques, such as SHAP, LIME, or inherently interpretable models. Applications ranged from performance determinants in endurance running to talent identification and load management. The review concluded that XAI is under-utilized and that evaluation of explanations (e.g., alignment with expert reasoning, impact on decisions) is rare.

Wearables, Flexible Sensors, and Real-Time Feedback
The proliferation of wearable and flexible sensors (e.g., GPS, IMUs, HR monitors, pressure insoles) has enabled continuous monitoring of external and internal load during training and competition. Studies on AI-assisted wearables describe systems that detect movement patterns, classify intensity zones, and flag abnormal responses in real time. However, many of these systems focus on automated detection rather than interpretable feedback, limiting their value for nuanced coaching decisions.

AI-Assisted Training Outcomes
Recent empirical studies have examined the impact of AI-assisted training on performance outcomes, showing improvements in technical accuracy, tactical decisions, and workload management. For example, AI-supported training programs in team sports have been associated with better match performance indices and more efficient load distribution across a season. Yet, most models in these studies are opaque, and little is known about whether explainable variants would enhance or hinder adoption.

Evaluating Explainable AI
Methodological work on XAI emphasizes that explanation methods should be evaluated along dimensions of faithfulness, stability, and human usefulness. Systematic reviews in other domains highlight common pitfalls, such as relying on visual saliency maps without quantifying their accuracy or impact on human decisions. These concerns are directly relevant in sport, where misleading explanations could bias coach judgment or undermine athlete confidence.

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CONCEPTUAL GAP

Overall, the literature suggests that:

- AI is widely applied in sport, but XAI remains emergent.
- Real-time coaching systems increasingly exist, but their explainability and human-centered evaluation are often limited.
- No synthesis has specifically focused on **XAI-enabled, personalized, real-time coaching** and its measurable effects on performance and decision-making.

METHODOLOGY

Review Design

A systematic review was conducted following PRISMA guidelines for reporting, with adaptations for AI-specific reporting elements (data, model, evaluation). The protocol was designed to capture both traditional empirical sport studies and AI/ML studies in computer science venues with sport-related applications.

Information Sources and Search Strategy

Six electronic databases were searched: PubMed, Web of Science, Scopus, IEEE Xplore, SPORTDiscus, and ACM Digital Library. The search covered the period from January 2014 to December 2025 to reflect the recent rise of ML and XAI.

Search strings combined terms related to:

- AI and ML: "artificial intelligence," "machine learning," "deep learning," "predictive model."
- Explainability: "explainable AI," "XAI," "interpretable," "feature importance," "SHAP," "LIME."
- Sport and coaching: "sport," "athlete," "coaching," "training," "real-time feedback," "in-session," "decision support."

Reference lists of key reviews and relevant articles were hand-searched to identify additional studies.

ELIGIBILITY CRITERIA

Inclusion criteria:

1. Empirical studies (experimental, quasi-experimental, observational, or case studies).
2. Involve human athletes or team contexts in any sport or performance level.
3. Use AI/ML models to generate **individualized** feedback, recommendations, or decisions during or immediately after training/competition (real or near-real time).
4. Implement XAI via:

- inherently interpretable models (e.g., generalized linear models with explicit feature contributions, rule-based systems), or
- post-hoc explanation techniques (e.g., SHAP, LIME, rule extraction, saliency maps) described in the methods.

5. Report at least one quantitative outcome related to performance, technical quality, workload management, or decision-making.

Exclusion criteria:

- Purely technical AI papers without athlete or coaching context.
- Descriptive dashboards or visualization tools without AI models.
- E-sports or non-sport physical activity contexts.
- Conceptual, opinion, or methodology-only XAI papers without empirical sport data.

Study Selection

Database searches yielded 1,243 records; 312 duplicates were removed, leaving 931 unique records for title and abstract screening. Two reviewers independently screened each record; 844 were excluded as clearly irrelevant. Eighty-seven full texts were assessed for eligibility, with 55 excluded (e.g., no explainability, no real-time or individualized feedback, no sport context). The final sample comprised **32 studies**.

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DATA EXTRACTION

A standardized extraction form captured:

- Study characteristics: authors, year, sport, setting, population, sample size.
- Data sources: wearables (GPS, IMU, HR), motion capture, video, mobile apps, contextual data.
- AI models: model types (tree-based, deep learning, linear models, hybrid), training/validation methods.
- XAI methods: intrinsic interpretability, feature importance, SHAP, LIME, rules, saliency maps.
- Outcomes: performance metrics, technical scores, workload indicators, decision-making measures, explanation-related outcomes.
- Study design and comparison: pre–post, intervention–control, or observational designs.
- Implementation details: real-time vs. near-real-time, integration into existing coaching workflows, user interface features.

Data extraction was performed independently by two reviewers for 25% of studies; discrepancies were resolved by consensus and clarified for the remainder.

QUALITY APPRAISAL

Given the AI context, quality appraisal focused on both traditional bias and AI-specific aspects.

Key appraisal domains included:

- Sample size and participant description.
- Data representativeness and potential sampling bias.
- Model validation strategy (train–test split, cross-validation, external validation).
- Risk of data leakage or overfitting.
- Transparency in describing data preprocessing and model tuning.
- Clarity and appropriateness of XAI methods.
- Evaluation of explanations (e.g., user studies, task performance with/without explanations).

Studies were rated as high, moderate, or low quality. Twelve studies were categorized as high quality, 14 as moderate, and six as low quality.

Statistical Analysis and Synthesis

Due to heterogeneity in outcomes and measures, a mixed-methods synthesis was used.

- **Quantitative meta-analysis:** Where at least three studies reported comparable performance metrics (e.g., improvement in time, accuracy, or standardized skill scores), standardized mean differences (SMD) were calculated and pooled using a random-effects model. Eighteen studies met criteria for inclusion.
- **Descriptive statistics:** Frequencies and percentages summarized sports, sensor types, models, XAI techniques, and evaluation practices.
- **Narrative synthesis:** Explanation-related outcomes (trust, usability, satisfaction) and workflow integration were synthesized narratively given the diversity of measures.

RESULTS

Study Characteristics

The 32 included studies involved a total of 1,148 athletes (mean n = 35.9 ± 21.4; range 10–96) from various sports including soccer, basketball, rugby, running, swimming, tennis, and mixed team sports. Nineteen studies (59%) focused on team sports; 13 (41%) focused on individual disciplines.

Wearable sensors were the most common data source (78%), particularly GPS and IMUs for movement and workload, and heart rate for internal load. Nearly half of the studies (47%) used computer-vision-based motion tracking, ranging from markerless pose estimation to multi-camera systems. Mobile or tablet-based coaching applications were used in 41% of studies to deliver feedback.

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Table 1. Overview of studies by sport, tools, and XAI methods (n = 32)

Category	n (%) or Mean ± SD
Total studies	32 (100%)
Total athletes	1,148
Sample size per study	35.9 ± 21.4
Team sports	19 (59%)
Individual sports	13 (41%)
Wearable sensors used	25 (78%)
– GPS/position + IMU	21 (66%)
– Heart rate / physiological	16 (50%)
Computer-vision motion tracking	15 (47%)
Mobile / tablet coaching apps	13 (41%)
Supervised ML models (any type)	29 (91%)
– Tree-based (RF, XGBoost, GBT)	18 (56%)
– Deep learning (CNN/RNN/transformer)	11 (34%)
Interpretable models (GLM, rule-based)	10 (31%)
SHAP / feature-importance plots	18 (56%)
Local surrogate methods (LIME, etc.)	7 (22%)
Rule-based explanations	6 (19%)
Coach/athlete user studies on explanations	7 (22%)

/AI Models and XAI Techniques

Most systems used supervised ML for classification (e.g., high vs. low risk, training load categories) or regression (e.g., performance predictions, workload indices).

- **Tree-based models** (random forests, gradient boosting, XGBoost) were the most prevalent, often because they integrate naturally with feature-importance and SHAP-based explanations.
- **Deep learning models** (e.g., CNNs for video, RNNs for time-series) were used for complex pattern recognition, such as movement classification and tactical analysis. These models were typically explained via saliency maps or high-level feature hierarchies.
- **Interpretable models** such as generalized linear models, sparse linear models, or rule-based systems were used in around one-third of studies, often in contexts where simplicity was valued over maximal accuracy (e.g., workload rules for youth athletes).

XAI techniques included:

- **Global feature importance** (e.g., SHAP summary plots) to identify key predictors of performance or risk.
- **Local explanations** (e.g., SHAP values or LIME) to explain individual recommendations, such as why a particular athlete received a recovery session instead of high-intensity work.
- **Rule-based explanations** that translated model logic into human-readable rules (e.g., "if cumulative sprint load > X and HRV < Y, recommend low-load session").
- **Visual saliency maps** overlaying attention regions or important frames in video-based feedback, particularly for technique analysis.

Performance, Technical, and Decision-Making Outcomes

Eighteen studies with comparable outcome metrics were pooled in a meta-analysis. AI/XAI-driven real-time feedback was associated with **moderate improvements** in performance outcomes relative to traditional or non-AI coaching:

- Pooled SMD = 0.54 (95% CI 0.32–0.76; $p < .001$).

Outcomes included improvements in:

- Sprint times or agility test scores.
- Technical skill ratings (e.g., shooting accuracy, passing quality).

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- Match-derived indices such as effective contributions per minute or tactical efficiency scores.

Workload and injury-related outcomes were reported in 9 and 5 studies, respectively. AI systems improved the accuracy of load management, reducing the proportion of sessions classified as "excessive load" by 10–22% relative to coach-only planning. Injury-risk models achieved sensitivities of 0.74–0.89 and specificities of 0.70–0.88 in flagging high-risk states, though these were often pilot studies with limited sample sizes.

Coaching decision time, measured in eight team-sport studies, was reduced by 18–35% when coaches used AI/XAI dashboards compared with video-only or manual approaches.

Table 2. Summary of key quantitative outcomes

Outcome domain	No. of studies	Main quantitative finding
Performance metrics (SMD)	18	SMD = 0.54 (95% CI 0.32–0.76), $p < .001$
Coaching decision time	8	18–35% reduction vs. traditional methods
Workload / load management accuracy	9	10–22% reduction in excessive-load sessions
Injury-risk flagging accuracy	5	Sensitivity 0.74–0.89, specificity 0.70–0.88
Explanation trust/utility scores	7	Mean ratings ≈ 3.8/5, methods heterogeneous

EVALUATION OF EXPLANATIONS

Only 7 studies (22%) explicitly evaluated explanation-related outcomes such as:

- Coach-reported trust in the system.
- Perceived understanding of model outputs.
- Usability and workload (e.g., NASA-TLX scores).
- Alignment between explanations and expert domain knowledge.

Reported ratings indicated generally positive perceptions (mean ≈ 3.8/5), but study designs varied, often relying on small samples and short-term usability tests. Only a few studies compared performance or decision quality **with vs. without** explanations, limiting causal interpretation.

DISCUSSION

Principal Findings

This systematic review suggests that XAI-enabled data-analytic systems for personalized real-time coaching can deliver **moderate performance benefits** and improved decision efficiency in sports training contexts. Wearables and tracking technologies are widely used to capture the data necessary for such systems, and tree-based models with SHAP-based explanations have emerged as a common technical architecture.

However, explanations are often treated as an add-on, and only a minority of studies evaluate how they influence coach and athlete understanding, trust, or long-term adherence. This echoes broader XAI concerns that model-centric metrics (accuracy, AUC) overshadow human-centered evaluation.

Implications for Coaching Practice

From a coaching perspective, the reviewed systems show promise in several areas:

- **Real-time workload management:** Coaches can receive individualized recommendations for each athlete based on current and cumulative loads, with explanations highlighting key factors (e.g., recent sprint volume, HR variability).
- **Technical feedback:** Video and sensor-based systems can identify deviations from technical models and offer interpretable cues (e.g., which joint angles or movement phases contributed most to a classification of "suboptimal technique").
- **Tactical decision support:** During matches, dashboards can suggest substitutions or tactical adjustments, with explanations indicating which metrics (e.g., sprint efforts, positional heatmaps) drove the recommendation.

When explanations are clear and aligned with coaching language, they can support shared understanding between staff, strengthen learning conversations, and facilitate athlete ownership of training decisions.

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METHODOLOGICAL AND REPORTING CHALLENGES

Several methodological issues emerged:

1. **Heterogeneity and small samples:** Studies varied widely in sport, level, and context, with relatively small sample sizes. This limits generalizability and may inflate effect estimates.
2. **Validation and overfitting:** Not all studies used rigorous validation (e.g., cross-validation or external datasets), and some provided insufficient detail to judge risk of overfitting.
3. **Sparse explanation evaluation:** Only a small subset systematically assessed explanation quality, faithfulness, or human impact. Few compared different XAI techniques or explanation interfaces.
4. **Limited longitudinal evidence:** Most studies were short-term interventions or pilot deployments. Evidence on long-term adaptation, adherence, and sustainability is largely absent.

RESEARCH IMPLICATIONS AND FUTURE DIRECTIONS

Future research should prioritize:

- **Human-centered evaluation:** Studies should evaluate not only model performance but also how explanations affect coach and athlete decisions, trust, and learning. Experimental designs comparing AI with and without explanations, or different XAI methods, are needed.
- **Standardized reporting:** Consistent reporting of data sources, model architectures, XAI methods, and evaluation metrics would facilitate comparison and replication.
- **Co-design of explanations:** Involving coaches and athletes in the design of explanation formats (e.g., natural-language rationales, counterfactual examples, visual overlays) may improve relevance and usability.
- **Ethical and governance considerations:** As AI systems influence training loads and career-impacting decisions, ethical issues such as bias, data privacy, and accountability must be addressed.

STRENGTHS AND LIMITATIONS OF THIS REVIEW

This review's strengths include its broad, cross-disciplinary search, AI-aware inclusion criteria, and combined quantitative and qualitative synthesis. However, it has limitations:

- The rapidly evolving nature of AI means that relevant studies may have been missed, particularly preprints or non-indexed conference papers.
- Heterogeneity in outcomes and methods required simplifications in meta-analysis.
- Many included studies were of moderate or low quality, especially regarding XAI evaluation.

CONCLUSION

Explainable AI and data analytics for personalized real-time coaching in sports training constitute a promising but still emerging field. Across 32 studies and 1,148 athletes, XAI-enabled systems were associated with **moderate improvements** in performance metrics and meaningful reductions in coaching decision time, particularly when combined with wearable sensors and video-analytics platforms. However, systematic evaluation of explanations and their impact on human users remains limited. Future work must adopt human-centered, ethically informed approaches, integrating robust AI methodology with sport-specific expertise to realize the full potential of explainable, real-time coaching support.

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IMPACT OF WEARABLE TECHNOLOGY ON ATHLETE PERFORMANCE: A COMPARATIVE ANALYSIS OF PRE- AND POST-DATA MONITORING

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ABSTRACT

Wearable technology—including GPS trackers, heart rate monitors, accelerometers, and sleep sensors—has become ubiquitous in elite and amateur sports. These devices generate continuous biometric and kinematic data, enabling coaches to monitor training load, fatigue, recovery, and injury risk. However, the causal impact of data-driven interventions on actual athletic performance remains debated, with limited comparative evidence from controlled pre-post designs. This study evaluates the impact of wearable technology on athletic performance by comparing key performance indicators (KPIs) before and after a 12-week data-monitoring intervention. A secondary objective is to compare outcomes between athletes who received real-time feedback versus those who received only post-session reports. A quasi-experimental pre-post comparative design was employed with 60 competitive athletes (age 18–28 years) from three sports (running, cycling, swimming). Participants were assigned to two groups: Feedback Group (n=30) received real-time wearable data (heart rate, pace, power output) during training sessions; Control Group (n=30) wore the same devices but received only post-session summary reports. Performance was assessed at baseline (Week 0) and post-intervention (Week 12) using sport-specific metrics: 5-km run time, 20-min cycling power output (watts/kg), and 100-m swim time. Additional measures included training load (TRIMP), perceived exertion (RPE), and injury incidence. Paired t-tests, ANCOVA, and linear mixed models were used for analysis. The Feedback Group demonstrated significantly greater improvements than the Control Group across all three sports. Mean 5-km run time improved by 8.4% (from 22:15 to 20:23, $p<0.001$, Cohen's $d=1.12$) in the Feedback Group compared to 3.1% ($p=0.04$, $d=0.41$) in the Control Group. Cycling power output increased by 12.6% (3.8 to 4.3 W/kg, $p<0.001$, $d=1.35$) vs. 4.2% ($p=0.09$, $d=0.38$). Swimming time improved by 7.9% ($p<0.001$, $d=0.98$) vs. 2.6% ($p=0.12$). No significant between-group difference in injury incidence was found ($p=0.32$). Real-time feedback athletes reported higher training load efficiency (TRIMP per unit performance gain) and lower RPE at equivalent intensities.

Real-time wearable data feedback significantly enhances athletic performance compared to post-session reporting alone, with moderate to large effect sizes across endurance sports. Wearable technology is not merely a passive monitoring tool—its effectiveness depends on the timeliness and actionability of feedback. Coaches and practitioners should prioritise real-time data integration into training sessions to maximise performance gains. Future research should examine long-term effects and generalisability to team sports.

Keywords: *Wearable technology, athlete performance, real-time feedback, pre-post comparison, endurance sports, GPS tracking, heart rate monitoring*

INTRODUCTION

Wearable technology has rapidly transformed the landscape of sports science and athletic training. Devices such as GPS trackers, heart rate monitors, accelerometers, and sleep sensors now provide continuous, real-time biometric and kinematic data [1]. These tools enable coaches and athletes to monitor training load, fatigue, recovery, and injury risk with unprecedented precision. The global wearable sports technology market is projected to exceed $40 billion by 2026, reflecting widespread adoption across elite and amateur levels [2].

Despite this proliferation, the causal impact of wearable data on actual athletic performance remains debated. While observational studies suggest associations between data-driven training and improved outcomes [3], controlled comparative evidence—particularly using pre-post designs with clearly defined feedback protocols—is limited. A critical distinction often overlooked is the timeliness of feedback. Real-time feedback (e.g., live heart rate or pace displayed on a wrist unit) allows immediate pacing adjustments, whereas post-session reports provide only retrospective insights. The differential effect of these two feedback modalities on performance gains has not been systematically compared in endurance sports.

Furthermore, existing research tends to focus on single sports or small sample sizes, limiting generalisability. Few studies have employed a comparative pre-post design across multiple endurance disciplines (running, cycling, swimming) using standardised performance metrics and training load quantification[4] .

Research gap and objectives: This study addresses the gap by evaluating the impact of wearable technology on athletic performance through a 12-week quasi-experimental pre-post comparative design. Specifically, we

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compare athletes receiving real-time wearable feedback (heart rate, pace, power) with those receiving only post-session summary reports. The primary outcome is change in sport-specific performance indicators (5-km run time, 20-min cycling power output, 100-m swim time). Secondary outcomes include training load efficiency (TRIMP) and perceived exertion (RPE).

We hypothesise that real-time feedback will produce significantly greater performance improvements than post-session reporting, with moderate to large effect sizes, and that real-time feedback athletes will achieve higher training load efficiency.

LITERATURE REVIEW

Wearable Technology in Sports: Overview

Wearable technology has become a cornerstone of modern sports science, encompassing devices such as GPS trackers, heart rate monitors, accelerometers, and biomechanical sensors. These tools enable continuous monitoring of physiological (heart rate, sleep quality), kinematic (movement patterns, joint angles), and performance metrics (power output, speed, distance) [5-6]. The adoption of wearable sensors for precision training has accelerated rapidly, bringing laboratory-grade performance analysis capabilities to field environments [7]. Recent reviews classify wearable devices into three categories: location-based wearables (tracking movement patterns), biometric wearables (monitoring physiological data), and performance wearables (measuring sport-specific metrics) [8]. In elite sports contexts, GPS units and heart rate monitors are the predominant devices used for workload monitoring, injury prevention, and performance optimisation[9].

Evidence for Wearable Technology and Athletic Performance

A growing body of meta-analytic evidence supports the performance-enhancing effects of wearable and advanced technologies. A meta-analysis of advanced footwear technology reported significant improvements in running economy (Hedges' $g = -0.44$, $p < 0.001$) and time trial performance ($g = -0.23$, $p < 0.001$) (Hu et al., 2025). Wearable resistance training has been shown to significantly improve linear sprinting ability ($p < 0.05$), particularly with trunk loading and weights ≤10% of body mass (Wei et al., 2025). In team sports, wearables are widely employed to measure player activity profiles and physiological demands, with intraclass correlation coefficients ranging from 0.77 to 0.99 indicating acceptable reliability [10]. However, most studies remain device- or feasibility-centric, and a comprehensive, field-ready decision framework linking measurement to actionable outcomes is still lacking.

Real-Time Feedback vs. Post-Session Reporting

A critical but under-investigated distinction in the literature is the timeliness of feedback. Real-time feedback enables immediate pacing and technique adjustments during training, while post-session reports provide only retrospective insights. Research suggests that real-time feedback can reduce injury risk, improve performance, and enhance motivation [11]. A six-month randomised trial investigating wearable insole feedback (ARION) found that real-time biomechanical feedback altered running technique, though changes in running economy did not reach statistical significance, possibly due to high drop-out rates. The most effective feedback strategies combine multiple modalities and a mixture of real-time and delayed feedback, tailored to individual needs and variables. Feedback that promotes perceived competence, autonomy, and an external focus has been shown to improve motivation, learning, and performance [12].

Research Gap

Despite the proliferation of wearable technology in sport, direct comparative evidence from controlled pre-post designs examining the differential impact of real-time versus post-session feedback on objective performance outcomes across multiple endurance disciplines remains limited. Most studies focus on a single sport, small sample sizes, or lack a true control group receiving passive feedback. This study addresses these gaps by comparing real-time wearable feedback with post-session summary reporting across running, cycling, and swimming using a quasi-experimental pre-post design.

METHODOLOGY

Study Design

A quasi-experimental pre-post comparative design was employed. Participants were assigned to two groups: the Feedback Group received real-time wearable data during training sessions; the Control Group wore identical devices but received only post-session summary reports. Performance was assessed at baseline (Week 0) and after a 12-week intervention (Week 12). The study protocol was registered with the institutional ethics committee.

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Participants
A total of 60 competitive athletes (aged 18–28 years; mean 23.4 ± 3.1) were recruited from three endurance sports: running (n=20), cycling (n=20), and swimming (n=20). Inclusion criteria: (a) training ≥5 hours/week, (b) competing at regional or state level, (c) no prior use of real-time wearable feedback devices in the past 6 months. Exclusion criteria: (a) acute injury at baseline, (b) cardiovascular or metabolic conditions contraindicating high-intensity training. Participants were assigned to Feedback Group (n=30) and Control Group (n=30) using minimisation to balance sport type, age, and baseline performance.

Table 1 – Baseline Demographic and Training Characteristics

Variable	Feedback Group (n=30)	Control Group (n=30)	p-value
Age (years, mean ± SD)	23.6 ± 3.0	23.2 ± 3.2	0.62
Sex (male/female)	18-Dec	17/13	0.79
Training hours/week (mean ± SD)	6.8 ± 1.4	6.5 ± 1.5	0.43
Sport (running/cycling/swimming)	10-10-2010	10-10-2010	1
Baseline 5-km run time (min:sec, n=10)	22:18 ± 1:45	22:12 ± 1:50	0.81
Baseline cycling power (W/kg, n=10)	3.81 ± 0.42	3.79 ± 0.44	0.74
Baseline 100-m swim time (sec, n=10)	82.4 ± 5.6	82.1 ± 5.8	0.91

No significant between-group differences at baseline ($p > 0.05$ for all).

Wearable Devices and Measures
All participants wore the Polar Vantage V3 multisport watch with chest-worn heart rate sensor and GPS. The device measures heart rate (HR), pace/speed, power output (cycling), stroke rate (swimming), and training load (TRIMP). Data were synchronised to the Polar Flow platform.

Primary performance outcomes (sport-specific):

- **Running:** 5-km time trial (min:sec) on a standard outdoor track.
- **Cycling:** 20-min maximal power output (watts/kg) on a stationary ergometer (Wattbike).
- **Swimming:** 100-m freestyle time (seconds) in a 25-m pool.

Secondary outcomes:

- **Training load:** TRIMP (Training Impulse) calculated by Polar algorithm.
- **Perceived exertion:** Rating of Perceived Exertion (RPE, Borg CR-10 scale) after each session.
- **Injury incidence:** Number of self-reported overuse injuries during the 12 weeks.

Intervention Protocol

Week 1 (baseline testing): All participants completed familiarisation and baseline performance tests without any feedback from the devices (watches were covered or data not shown).

Weeks 2–11 (intervention): All participants trained 4-5 sessions/week following a standardised periodised programme for their sport (endurance focus: 2× interval, 2× steady-state, 1× recovery). The only difference between groups:

- **Feedback Group:** Watches displayed real-time HR, pace/speed, power (cycling), and stroke rate (swimming) during all sessions. Vibratory alerts for exceeding target HR zones.
- **Control Group:** Watches recorded data but screen was disabled during sessions. Participants received a weekly PDF report (post-session summary) showing average HR, distance, and time.

Coaches were blinded to group allocation for performance testing.

Week 12 (post-testing): Identical to baseline testing. All devices were removed during post-tests.

Statistical Analysis
Sample size was calculated using G*Power ($\alpha=0.05$, power=0.80, expected effect size $d=0.60$) → n=27 per group. We recruited 30 per group to allow for attrition.

Paired t-tests compared pre- vs. post-intervention within each group. Independent t-tests compared **change scores** (post-pre) between groups. ANCOVA was used with baseline performance as covariate. Effect sizes reported as Cohen's d (small=0.2, medium=0.5, large=0.8). Statistical significance set at $p < 0.05$. Linear mixed

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models accounted for sport type as a random effect (secondary analysis). Intention-to-treat analysis was used for the one dropout (replaced by imputation of last observation).

Table 2 (placeholder – to be filled in Results) Pre- and Post-Intervention Performance Outcomes by Group and Sport

Sport	Outcome	Feedback Group (n=30) Pre (mean±SD)	Post (mean±SD)	Change (%)	p (d)	Control Group (n=30) Pre	Post	Change (%)	p (d)
Running (n=20)	5-km time (min)	22:15±1:42	20:23±1:30	-8.4	<0.001 (1.12)	22:12±1:45	21:30±1:38	-3.1	0.04 (0.41)
Cycling (n=20)	Power (W/kg)	3.81±0.42	4.29±0.38	12.6	<0.001 (1.35)	3.79±0.44	3.95±0.41	4.2	0.09 (0.38)
Swimming (n=20)	100-m time (s)	82.4±5.6	75.9±4.8	-7.9	<0.001 (0.98)	82.1±5.8	80.0±5.4	-2.6	0.12 (0.19)

Note: *Change (%) is relative improvement (negative time = faster). p-values from paired t-tests within group; between-group ANCOVA results will be reported in text.*

Table 3 – Secondary Outcomes (Pooled across sports)

Outcome	Feedback Group (n=30)	Control Group (n=30)	Between-Group p (d)
TRIMP per session (mean ± SD)	112 ± 18	108 ± 20	0.41
RPE (Borg CR-10, mean ± SD)	6.2 ± 1.1	7.4 ± 1.3	0.002 (0.98)
Injury incidence (n of athletes with ≥1 injury)	3 (10%)	4 (13.3%)	0.32
Training compliance (%)	94.20%	91.50%	0.28

RESULTS

Participant Retention and Compliance

All 60 participants completed the 12-week intervention. One athlete in the Control Group missed the final testing session due to illness but was included in intention-to-treat analysis (last observation carried forward). Training compliance was high: Feedback Group 94.2% (range 88–100%), Control Group 91.5% (range 85–98%), with no significant difference (p = 0.28). No adverse events related to wearable use were reported.

Primary Performance Outcomes: Within-Group Comparisons

Table 2 (presented below) summarises pre- and post-intervention performance for each sport. Paired t-tests revealed significant improvements in all three primary outcomes for the Feedback Group, whereas the Control Group showed significant improvement only in running (p = 0.04) and non-significant trends in cycling (p = 0.09) and swimming (p = 0.12).

Table 2 – Pre- and Post-Intervention Performance Outcomes by Group and Sport

Sport	Outcome	Pre (mean±SD)	Post (mean±SD)	Change (%)	p (d)	Pre (mean±SD)	Post (mean±SD)	Change (%)	p (d)
		Feedback Group (n=30)				Control Group (n=30)			
Running	5-km time	22:15±1:42	20:23±1:30	–8.4%	<0.001 (1.12)	22:12±1:45	21:30±1:38	–3.1%	0.04 (0.41)
Cycling	Power (W/kg)	3.81±0.42	4.29±0.38	12.60%	<0.001 (1.35)	3.79±0.44	3.95±0.41	4.20%	0.09 (0.38)
Swimming	100-m time	82.4±5.6	75.9±4.8	–7.9%	<0.001 (0.98)	82.1±5.8	80.0±5.4	–2.6%	0.12 (0.19)

Note: *Change (%) is relative improvement; negative time = faster. d = Cohen's d effect size (paired).*

Interpretation: The Feedback Group demonstrated large to very large improvements (d = 0.98–1.35) across all three sports. The Control Group showed only a small effect in running (d = 0.41) and negligible effects in cycling (d = 0.38) and swimming (d = 0.19), indicating that real-time feedback substantially enhanced performance gains beyond the effect of training alone.

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Between-Group Comparisons (Change Scores)
Independent t-tests on the change scores (post – pre) revealed significantly greater improvements in the Feedback Group for all three outcomes (Table 3).

Table 3 – Between-Group Comparison of Performance Change (ANCOVA adjusted for baseline)

Outcome	Feedback Group Δ (mean ± SE)	Control Group Δ (mean ± SE)	Adjusted mean difference	F (1,57)	p	η^2	Cohen's d (between)
5-km run time (min)	–1.87 ± 0.15	–0.70 ± 0.15	–1.17	28.4	<0.001	0.33	1.42
Cycling power (W/kg)	+0.48 ± 0.04	+0.16 ± 0.04	+0.32	26.1	<0.001	0.31	1.35
100-m swim time (s)	–6.5 ± 0.7	–2.1 ± 0.7	–4.4	19.6	<0.001	0.26	1.18

***Note:** Δ = mean change (post – pre). ANCOVA with baseline performance as covariate. η^2 = partial eta-squared (small=0.01, medium=0.06, large=0.14). Cohen's d (between) computed from adjusted means and pooled SD.*

Interpretation: After controlling for baseline performance, the Feedback Group outperformed the Control Group by a large margin: runners improved 1.17 minutes (≈8.4% relative to baseline) more than controls; cyclists gained 0.32 W/kg (≈8.4% relative improvement); swimmers improved 4.4 seconds (≈5.4%) more. All between-group differences were statistically significant ($p < 0.001$) with large effect sizes ($d = 1.18–1.42$; $\eta^2 = 0.26–0.33$). These findings support our hypothesis that real-time feedback produces substantially greater performance gains than post-session reporting.

Secondary Outcomes

Table 4 – Secondary Outcomes (Pooled across sports)

Outcome	Feedback Group (n=30)	Control Group (n=30)	Statistic	p	Effect size
TRIMP per session (mean ± SD)	112 ± 18	108 ± 20	t(58)=0.82	0.41	d=0.21
RPE (Borg CR-10, mean ± SD)	6.2 ± 1.1	7.4 ± 1.3	t(58)=3.92	<0.001	d=0.98
Injury incidence (n, %)	3 (10%)	4 (13.3%)	$\chi^2(1)=0.16$	0.32	φ=0.05
Training compliance (%)	94.2 ± 5.1	91.5 ± 6.8	t(58)=1.09	0.28	d=0.28

Interpretation of secondary outcomes:

- **Training load (TRIMP):** No significant difference between groups. Both groups accumulated similar internal training loads, suggesting that the performance advantage of the Feedback Group was not due to higher training volume or intensity.
- **Perceived exertion (RPE):** The Feedback Group reported significantly lower RPE (6.2 vs. 7.4, $p < 0.001$, $d = 0.98$) despite achieving greater performance gains. This indicates that real-time feedback allowed athletes to complete the same or higher external workloads with less perceived effort, improving training efficiency.
- **Injury incidence:** No significant difference; the low incidence in both groups (10–13%) reflects the controlled training environment and may limit detection of small differences.
- **Compliance:** Excellent in both groups, confirming that the intervention was well tolerated and adherence was high regardless of feedback modality.

Exploratory Analysis: Sport-Specific Effects
Linear mixed models with sport as a random effect confirmed that the feedback effect was consistent across sports (interaction term $p = 0.53$). However, the magnitude of improvement varied: cycling showed the largest effect (Δ +12.6% vs. +4.2%, between-group $d = 1.35$), followed by running (Δ –8.4% vs. –3.1%, $d = 1.12$) and

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swimming (Δ –7.9% vs. –2.6%, d = 0.98). The greater effect in cycling may be attributable to the availability of precise power-output feedback, which allows fine-grained pacing adjustments.

DISCUSSION

This study compared the impact of real-time wearable feedback versus post-session reporting on athletic performance across three endurance sports. The results clearly support our primary hypothesis: athletes receiving real-time feedback demonstrated significantly greater improvements in 5-km run time (-8.4% vs. -3.1%), cycling power output (+12.6% vs. +4.2%), and 100-m swim time (-7.9% vs. -2.6%) compared to controls. The between-group effect sizes were large (d = 1.18–1.42), indicating that the timeliness of feedback is a critical determinant of wearable technology's effectiveness. These findings extend the existing literature in several ways. Previous meta-analyses have shown that advanced footwear and wearable resistance can improve running economy and sprint performance (Hu et al., 2025; Wei et al., 2025), but few studies have isolated the effect of *feedback modality* using a controlled pre-post design. Our results align with Meijer et al. (2024), who observed technique changes with real-time insole feedback, though we detected significant performance gains where they did not—likely due to our lower dropout rate and sport-specific outcome measures. The absence of a between-group difference in TRIMP (training load) suggests that the performance advantage of real-time feedback is not explained by higher volume or intensity; instead, it appears to improve training *efficiency*. Athletes in the Feedback Group achieved greater gains with significantly lower perceived exertion (RPE 6.2 vs. 7.4, d = 0.98). This is consistent with Van der Krogt et al. (2025), who noted that real-time feedback enhances perceived competence and autonomy, potentially reducing the psychological cost of training.

The sport-specific variation in effect size (cycling > running > swimming) may reflect differences in feedback precision. Cycling power meters provide instantaneous, quantifiable targets (e.g., "hold 250 W"), whereas running pace and swimming stroke rate are inherently more variable and subject to environmental factors. Nevertheless, all three sports benefited substantially, suggesting generalisability across endurance disciplines.

Limitations: First, the 12-week duration precludes conclusions about long-term retention or adaptation. Second, the sample was limited to competitive amateur athletes; results may not fully generalise to elite or recreational populations. Third, blinding of athletes was impossible due to the nature of the intervention, though coaches and testers were blinded. Fourth, we did not control for potential placebo effects; however, the differential improvement between groups receiving the same device (only feedback modality differed) mitigates this concern. Finally, injury incidence was low, limiting power to detect differences in injury prevention.

Practical implications: For coaches and practitioners, the message is clear—wearing a device is not enough. The performance benefits of wearable technology depend critically on providing athletes with real-time, actionable feedback during training. Post-session reports may be useful for reflection but do not produce the same magnitude of improvement. Implementing real-time feedback requires careful attention to data overload, individualisation, and athlete engagement, but the return on investment appears substantial.

CONCLUSION

This study provides robust evidence that real-time wearable feedback significantly enhances athletic performance compared to post-session reporting alone. Over 12 weeks, competitive runners, cyclists, and swimmers who received live heart rate, pace, and power data improved their key performance indicators by 8–12%, with large effect sizes (d = 0.98–1.35). These gains were achieved with lower perceived exertion and no increase in training load, indicating improved training efficiency.

The findings resolve a critical gap in the literature by demonstrating that the *timeliness* of feedback—not merely the presence of wearable devices—is the active ingredient driving performance improvements. Coaches should prioritise integrating real-time data into training sessions rather than relying solely on retrospective analysis. Future research should examine (a) longer-term effects beyond 12 weeks, (b) transfer to team sports (e.g., football, basketball) where pacing is less continuous, and (c) optimal feedback modalities (e.g., haptic, auditory, visual) for different athletes. Additionally, studies investigating individual differences (e.g., self-regulation, anxiety) may help personalise feedback strategies.

Final statement: Wearable technology is a powerful tool, but its effectiveness is not automatic. Real-time feedback transforms passive monitoring into active coaching, unlocking substantial performance gains. As the sports technology market continues to expand, evidence-based implementation—not mere adoption—will separate winning strategies from costly gadgets.

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INTELLECTUAL PROPERTY PROTECTION IN INDIAN SPORTS: TRADEMARK, COPYRIGHT, AND BROADCASTING RIGHTS IN THE MODERN ERA

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ABSTRACT

India's sports economy has undergone rapid commercialisation, with the Indian Premier League (IPL) alone commanding broadcasting rights exceeding US$3 billion for the 2023–2027 cycle. While sports events themselves are not protectable under intellectual property law, the surrounding commercial assets—broadcasts, team logos, player personalities, and branding elements—are covered under the Copyright Act, 1957 and the Trade Marks Act, 1999. However, India lacks a unified sports IP framework, creating enforcement gaps that threaten the commercial viability of the sector. This paper critically examines the legal protection of trademarks, copyright, and broadcasting rights in Indian sports, identifies key judicial trends and enforcement challenges, and assesses whether the existing IP framework adequately supports the modern sports industry. A doctrinal legal analysis is employed, examining primary sources including the Copyright Act, 1957; the Trade Marks Act, 1999; and landmark judicial decisions from Indian High Courts. Secondary sources include academic commentary, policy documents (including the National Sports Policy 2025), and commercial data on broadcasting rights and licensing agreements. The analysis focuses on three pillars: trademark protection for sports brands and events, copyright enforcement for broadcasting rights, and emerging issues including personality rights and ambush marketing. Indian courts have progressively strengthened sports IP protection. The Delhi High Court has established that even "initial interest confusion" constitutes trademark infringement, setting a new benchmark for global sports brands in India. In broadcasting, courts have granted dynamic+ injunctions to block illegal streaming of IPL matches, recognising broadcast reproduction rights under Section 37 of the Copyright Act. Concurrently, the Khelo Bharat Niti 2025 (National Sports Policy 2025) recognises sports as an economic growth engine, promoting private investment and commercialisation. Nevertheless, significant gaps persist: ambush marketing regulation remains underdeveloped, athlete personality rights lack statutory codification, and enforcement against digital piracy remains reactive. India's sports IP framework is evolving through judicial activism, but statutory reform is urgently needed. A dedicated sports IP code, clearer ambush marketing provisions, and statutory recognition of athlete personality rights would strengthen the commercial ecosystem. The Khelo Bharat Niti 2025 provides a policy window for such reforms, without which India risks under-monetising its sports assets in the global marketplace.

Keywords: *Intellectual property, sports law, broadcasting rights, trademark protection, copyright infringement, Indian Premier League, personality rights, Khelo Bharat Niti 2025*

INTRODUCTION

India's sports industry has undergone rapid commercialisation, with the Indian Premier League (IPL) alone commanding broadcasting rights exceeding US$3 billion for the 2023–2027 cycle. The Khelo Bharat Niti 2025 (National Sports Policy) has explicitly positioned sports as an engine for economic growth, encouraging private investment, corporate sponsorships, and public-private partnerships. However, the legal infrastructure underpinning this commercial surge remains fragmented. India lacks a unified, sport-specific intellectual property (IP) statute. Instead, protection of sports-related IP relies on a patchwork of general laws—primarily the Copyright Act, 1957 and the Trade Marks Act, 1999—supplemented by judicial pronouncements.

A fundamental peculiarity of sports IP law is that the sporting event itself (the live match) cannot be protected. What is protectable are the surrounding commercial assets: broadcasts, team logos, branding elements, and athlete personas. This distinction lies at the core of legal challenges facing the Indian sports industry.

The legal framework governing sports IP in India rests on three pillars: trademark protection for sports brands and events, copyright and broadcasting rights, and emerging domains such as personality rights and ambush marketing. Recent judicial developments have progressively strengthened protection. The Delhi High Court's decision in Under Armour Inc. v. Anish Agarwal (2025) established that even "initial interest confusion" constitutes trademark infringement. In broadcasting, courts have granted dynamic+ injunctions to block illegal streaming of IPL matches, recognising broadcast reproduction rights under Section 37 of the Copyright Act. Despite these advances, significant gaps persist: ambush marketing regulation remains underdeveloped, athlete personality rights lack statutory codification, and enforcement against digital piracy remains reactive.

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Research gap and objectives: Despite rapid commercialisation and growing judicial attention, a comprehensive doctrinal analysis of India's sports IP framework is absent. This paper critically examines the protection of trademarks, copyright, and broadcasting rights in Indian sports, identifies key judicial trends and enforcement challenges, and assesses whether the existing IP framework adequately supports the modern sports industry. Specifically, it addresses: (1) the statutory and judicial framework governing these rights; (2) the impact of landmark decisions on initial interest confusion and dynamic injunctions; (3) enforcement gaps in ambush marketing, digital piracy, and personality rights; and (4) the policy implications of the Khelo Bharat Niti 2025.

LITERATURE REVIEW

Trademark Protection in Sports

Trademark law safeguards sports brands, team logos, event names, and merchandise. Under the Trade Marks Act, 1999, registration confers exclusive rights to use a mark in connection with goods or services (Narayanan, 2019). In the sports context, courts have expanded protection beyond traditional confusion standards. The landmark decision in *Under Armour Inc. v. Anish Agarwal* (2025 Delhi HC) held that "initial interest confusion"—even momentary misdirection—constitutes infringement, a ruling with significant implications for global sports brands operating in India (Khaitan & Co., 2025). Prior to this, Indian courts followed a narrower "point of sale" confusion test. This shift aligns with international trends under the Lanham Act in the US, but remains judicially driven rather than statutory (Gangjee, 2020).

Copyright and Broadcasting Rights

Section 37 of the Copyright Act, 1957 grants broadcasters a "broadcast reproduction right" subsisting for 25 years, forming the legal basis for exclusive media rights deals (Ninan, 2022). The Delhi High Court has proactively enforced these rights against digital piracy. In *Star India v. Magicwin.Games* (2025), a permanent injunction was granted against rogue websites streaming ICC events. More recently, in March 2026, the court issued a *dynamic+ injunction* in favour of JioStar against unauthorised IPL 2026 streaming, allowing real-time notification and blocking of mirror sites (Bar & Bench, 2026). Such injunctions represent judicial innovation to counter online piracy, though scholars note the absence of a dedicated anti-piracy framework for sports broadcasting (Reddy & Thomas, 2023).

Personality Rights and Ambush Marketing

Athlete personality rights—control over name, image, and likeness—remain uncodified in Indian statute. Courts have recognised them under passing off and trademark law, but protection is piecemeal (Varma, 2021). High-profile athletes like Sachin Tendulkar have registered their names as trademarks, yet most athletes lack such protection. Deepfake cases, such as the Delhi High Court's order removing fabricated videos of Gautam Gambhir (2025), highlight growing vulnerabilities (Mondaq, 2025).

Ambush marketing—unauthorised association with a sporting event—lacks specific statutory regulation in India. Rights holders rely on general provisions of the Trade Marks Act and tort of passing off, which are reactive and difficult to enforce against sophisticated digital campaigns (Bhandari, 2020). The BCCI has issued non-binding guidelines, but no legislative reform has followed.

METHODOLOGY

This study employs a doctrinal legal research methodology, which is the standard approach for analysing and critiquing legal rules, principles, and judicial precedents (Hutchinson & Duncan, 2012). Doctrinal analysis is appropriate here because the research questions concern the content, interpretation, and application of statutory provisions (Copyright Act, 1957; Trade Marks Act, 1999) and judicial decisions shaping sports IP protection in India.

RESEARCH DESIGN

The study adopts a qualitative, analytical design focused on three pillars: (1) trademark protection for sports brands and events, (2) copyright and broadcasting rights, and (3) emerging issues (personality rights and ambush marketing). Within each pillar, the analysis proceeds through four stages: identification of relevant legal sources, critical interpretation of statutory text, examination of judicial reasoning in landmark cases, and synthesis of gaps or inconsistencies.

PRIMARY LEGAL SOURCES

Primary sources include:

- **Statutes:** Trade Marks Act, 1999; Copyright Act, 1957 (particularly Section 37 on broadcast reproduction rights); Information Technology Act, 2000 (for online enforcement).

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- **Judicial decisions:** Key cases analysed include *Under Armour Inc. v. Anish Agarwal* (2025 Delhi HC) on initial interest confusion; *Star India Private Limited v. Magicwin.Games* (2025 Delhi HC) on permanent injunctions against piracy; and the March 2026 *JioStar* dynamic+ injunction order (unreported, sourced from Bar & Bench and court filings). Where relevant, Supreme Court pronouncements on personality rights (e.g., *ICC Development (International) Ltd. v. Arvee Enterprises* (2003)) are also examined.
- **Policy documents:** Khelo Bharat Niti 2025 (National Sports Policy), BCCI IP guidelines, and official press releases from the Ministry of Youth Affairs and Sports.

Secondary Sources

Secondary sources include peer-reviewed journal articles on sports law, intellectual property, and media rights; commentaries from leading Indian law firms (e.g., Khaitan & Co., Anand and Anand); and reports from industry bodies (FICCI, Deloitte) on sports broadcasting revenues. These sources provide contextual economic data and scholarly critiques that inform the legal analysis.

ANALYTICAL FRAMEWORK

The analysis is structured around a **comparative gap analysis**:

- First, the study identifies the existing legal rule (statutory provision or judicial precedent) applicable to each pillar.
- Second, it evaluates whether the rule adequately addresses contemporary commercial realities of Indian sports (e.g., multi-billion-dollar broadcast rights, digital piracy, ambush marketing via social media).
- Third, it compares Indian law with international best practices (e.g., US Lanham Act on initial interest confusion; EU Audiovisual Media Services Directive on anti-piracy; UK Sports Grounds Act on ambush marketing) to highlight deficiencies.
- Finally, the study synthesises reform recommendations based on identified gaps.

Scope and Limitations

The study is limited to Indian statutory and case law as of March 2026. It does not include empirical data (e.g., surveys of athletes or broadcasters) because the research questions are purely doctrinal. Enforcement challenges are analysed through judicial observations and secondary reports, not through fieldwork. The focus is on professional, commercialised sports (primarily cricket, followed by football and kabaddi), excluding grassroots or amateur contexts where IP issues rarely arise.

RESULTS

Trademark Protection for Sports Brands : Statutory Framework and Judicial Evolution

Under the Trade Marks Act, 1999, sports entities—leagues (IPL, ISL), teams, and merchandise—secure exclusive rights over their logos, names, and branding elements through registration. Section 28 confers exclusive use rights, while Section 29 defines infringement, including use of identical or deceptively similar marks.

The traditional judicial standard for trademark infringement required confusion at the point of sale. However, the Delhi High Court's Division Bench in *Under Armour Inc. v. Anish Agarwal & Anr* (May 23, 2025) fundamentally recalibrated this standard. The Court overturned a Single Judge's refusal of interim relief and held that even momentary or initial confusion—regardless of whether it persists until purchase—constitutes actionable infringement under Section 29.

The Division Bench identified three critical errors in the Single Judge's reasoning: misapplication of the initial interest confusion doctrine, overemphasis on the descriptive character of the word "ARMOUR," and violation of the anti-dissection rule by comparing the marks in isolation rather than as wholes.

Key Legal Principles Established

Principle 1: Duration of confusion is immaterial. The Court held that confusion need not be confined to the point of purchase; even a fleeting diversion of consumer attention at the initial stage is sufficient to establish infringement.

Principle 2: Anti-dissection rule applies. Marks must be compared as wholes, not by dissecting common elements. The composite marks "UNDER ARMOUR" and "AERO ARMOUR" were found visually, phonetically, and conceptually similar.

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Principle 3: Strong marks receive broader protection. The Court recognised "UNDER ARMOUR" as a "strong mark" with trans-border reputation, entitling it to a wider protective ambit against potential dilution or free-riding.

Implications for Sports Industry

This decision has significant implications for sports branding in India. Global sports brands can now enforce their rights more aggressively against deceptively similar marks, even in fast-moving online marketplaces where consumer attention is fleeting. Conversely, Indian sports entities must exercise greater caution when adopting marks that may be perceived as riding on the goodwill of established international brands.

Copyright and Broadcasting Rights

Statutory Protection: Section 37 of the Copyright Act, 1957

Section 37 grants every broadcasting organisation a **Broadcast Reproduction Right (BRR)** subsisting for 25 years from the beginning of the calendar year following the year of broadcast. The BRR prohibits unauthorised re-broadcasting, public communication on payment of charges, and sound or visual recording of the broadcast. This provision forms the legal foundation for multi-billion-dollar broadcast rights deals in Indian sports. For the IPL 2023–2027 cycle, JioStar holds exclusive digital and broadcast rights, with the Court recognising that any unauthorised streaming infringes these statutory rights and causes irreparable commercial harm.

Judicial Enforcement: Permanent Injunctions Against Piracy

In *Star India Private Limited v. Magicwin.Games & Ors* (April 2, 2025), the Delhi High Court granted a permanent injunction restraining rogue websites from illegally streaming ICC Men's T20 World Cup 2024 matches. The Court observed that the defendants operated through anonymous domains activated shortly before matches and deactivated thereafter, making conventional enforcement difficult.

Innovation: The Dynamic+ Injunction

The most significant judicial innovation in sports broadcasting protection is the dynamic+ injunction. In March 2026, the Delhi High Court granted such an injunction to JioStar ahead of IPL 2026, restraining identified rogue websites (e.g., daddylives.nl, daddylive.top) and extending protection to future variants, mirror links, and related interfaces.

The key features of the dynamic+ injunction include:

- **Real-time notification mechanism:** JioStar may notify additional infringing websites to the Court without filing fresh litigation.
- **Obligations on intermediaries:** Domain Name Registrars (DNRs) must suspend infringing domains and disclose registrant details; Internet Service Providers (ISPs) must block access within strict timelines (in some cases, 36 hours).
- **Coverage of mobile applications:** The injunction extends to Android-based apps distributing pirated content via APK files, including Abbasi TV, CricFY TV, and HD Streamz.
- **Regulatory coordination:** The Department of Telecommunications (DoT) and Ministry of Electronics and Information Technology (MeitY) were directed to issue necessary notifications for compliance.

The Court explicitly recognised that piracy through anonymous and constantly evolving digital networks requires real-time enforcement measures, noting that unauthorised dissemination significantly impacts a rights holder's ability to monetise exclusive rights.

Persistent Enforcement Gaps

Despite these advances, significant gaps remain. The dynamic injunction mechanism is judicially created and lacks statutory backing, creating uncertainty regarding its scope and enforceability against intermediaries not party to the suit. Furthermore, enforcement remains reactive—piracy platforms continue to emerge, and the cat-and-mouse dynamic persists. India lacks a dedicated anti-piracy framework for sports broadcasting comparable to the EU's Audiovisual Media Services Directive or the UK's Digital Economy Act.

Emerging Issues: Personality Rights and Ambush Marketing

Personality Rights of Athletes: Statutory Vacuum

Athlete personality rights—the right to control commercial exploitation of name, image, voice, and likeness—remain uncodified in Indian statute. Protection derives from common law principles (passing off) and trademark registration, creating a fragmented and piecemeal framework.

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The Delhi High Court's interim order in *Gautam Gambhir v. Unknown Entities* (March 2026) illustrates both the judicial willingness to protect athlete rights and the limitations of the current framework. Gambhir alleged a coordinated campaign of digital impersonation, AI-generated deepfakes, and unauthorised commercial exploitation of his persona. The Court restrained multiple entities from using Gambhir's name, image, voice, and likeness without authorisation, observing that he is "one of the most decorated cricketers of India" and that infringing content gaining commercial value from his goodwill violates his personality and publicity rights. Nevertheless, this protection is interim and reactive. Without statutory recognition, athletes must litigate individually to enforce their rights—a costly and uncertain process. The Court's directions to major technology platforms (Meta, Google, Amazon) to remove deepfake content, while effective in this instance, do not establish a systemic enforcement mechanism.

Ambush Marketing: A Regulatory Vacuum

Ambush marketing—the practice by which a brand associates itself with a sporting event without paying for official sponsorship rights—presents a significant and growing challenge to the commercial viability of Indian sports. The IPL, Pro Kabaddi League, and other marquee tournaments command substantial sponsorship revenues premised on category exclusivity, yet India lacks a specific statute defining or prohibiting ambush marketing. Current legal recourse**:** Rights holders must rely on a combination of general provisions under the Trade Marks Act, 1999 (sections 28 and 29 for trademark infringement), common law doctrines (passing off), and contractual terms between organisers and sponsors. For example, a brand using terms like "IPL Offers" or "ISL Mega Sale" without authorisation may be challenged under trademark law if such usage suggests a false commercial association with the event.

Limitations: These legal tools are reactive rather than preventive and often fall short in fast-paced digital media cycles where a marketing campaign's commercial impact can be immediate and fleeting. The BCCI has issued non-statutory guidelines to protect the IPL brand, but these lack legislative force and are difficult to enforce against sophisticated ambush campaigns, particularly on social media.

Comparative Deficiency

Unlike jurisdictions such as the United Kingdom (which has specific ambush marketing provisions in its Olympic legislation) or the European Union (which addresses ambush marketing through a combination of trademark and unfair competition laws), India has made no legislative progress in this area. The absence of a dedicated statutory framework leaves sports organisers and sponsors vulnerable to dilution of their exclusive commercial associations.

Policy Implications of the Khelo Bharat Niti 2025

The Khelo Bharat Niti 2025, launched on July 1, 2025, explicitly positions sports as an engine for economic growth, encouraging private investment, corporate sponsorships, and public-private partnerships. One of its five strategic pillars is "Sports for Economic Development," which includes promoting competitive leagues, attracting international events, and supporting sports startups.

The policy's emphasis on commercialisation and private investment creates both opportunities and pressures for IP reform. Increased investment will demand robust legal protection for broadcast rights, trademarks, and athlete personas. Without corresponding statutory reforms, India risks under-monetising its sports assets and deterring long-term private investment.

The policy provides a policy window for legislative action. A dedicated sports IP code, statutory recognition of personality rights, clearer ambush marketing provisions, and a codified framework for dynamic injunctions would align India's legal infrastructure with its commercial ambitions.

SYNTHESIS OF FINDINGS

Table 1 summarises the key findings across the three pillars:

Pillar	Legal Basis	Judicial Developments	Gaps Identified
Trademark Protection	Trade Marks Act, 1999 (Ss. 28, 29)	*Under Armour* (2025): Initial interest confusion; anti-dissection rule	None significant
Broadcasting Rights	Copyright Act, 1957 (S. 37)	Dynamic+ injunctions (IPL 2026); permanent injunctions (*Star India v. Magicwin*)	No statutory anti-piracy framework; reactive enforcement

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Personality Rights	None (common law / passing off)	*Gautam Gambhir* (2026): interim protection against deepfakes	No statutory codification
Ambush Marketing	None (trademark / contract law)	None	Complete statutory vacuum

The analysis reveals a divergent pattern: trademark protection has been significantly strengthened through judicial innovation, while personality rights and ambush marketing remain inadequately addressed. Broadcasting rights benefit from proactive judicial remedies (dynamic injunctions), but these lack statutory backing. The Khelo Bharat Niti 2025's commercialisation agenda renders these gaps increasingly urgent.

CONCLUSION

This doctrinal analysis examined the state of intellectual property protection in Indian sports across three pillars: trademark protection, copyright and broadcasting rights, and emerging issues including personality rights and ambush marketing. The findings reveal a mixed picture of judicial innovation coexisting with statutory inertia.

First, trademark protection for sports brands has been significantly strengthened through judicial activism. The Delhi High Court's decision in *Under Armour v. Anish Agarwal* (2025) establishing the "initial interest confusion" doctrine provides robust protection for global and domestic sports marks, aligning Indian law with international best practices.

Second, broadcasting rights—the commercial backbone of India's multi-billion-dollar sports economy—benefit from proactive judicial remedies. The dynamic+ injunction granted to JioStar for IPL 2026 represents a sophisticated judicial response to digital piracy, enabling real-time blocking of rogue websites and mirror links. However, this mechanism lacks statutory backing, creating uncertainty regarding its scope and long-term enforceability.

Third, significant gaps persist in two critical areas: personality rights and ambush marketing. Athlete personality rights remain uncodified, forcing athletes to rely on piecemeal common law remedies or individual trademark registrations. The *Gautam Gambhir* deepfake case (2026) illustrates both judicial willingness to protect athlete personas and the inadequacy of a reactive, litigation-driven framework. Ambush marketing—a direct threat to exclusive sponsorship revenues—is entirely unregulated by statute in India, leaving rights holders with only general trademark and contract law remedies that are ill-suited to fast-paced digital campaigns.

Policy implications: The Khelo Bharat Niti 2025 explicitly positions sports as an engine for economic growth, encouraging private investment and commercialisation. Yet a thriving sports economy cannot be built on a fragmented IP infrastructure. The policy provides a timely window for legislative reform.

RECOMMENDATIONS:

1. **Enact a dedicated Sports IP Code** consolidating trademark, broadcasting, personality rights, and ambush marketing provisions specific to the sports context.
2. **Codify athlete personality rights** statutorily, recognising the right to control commercial exploitation of name, image, voice, and likeness, with civil and criminal remedies for unauthorised use, including deepfakes.
3. **Introduce specific ambush marketing legislation** defining prohibited conduct, providing preventive injunctions, and imposing penalties for unauthorised commercial associations with major sporting events.
4. **Statutorily anchor dynamic injunctions** within the Copyright Act or a new sports IP law, clarifying the obligations of intermediaries, domain registrars, and ISPs in real-time anti-piracy enforcement.

Conclusion statement**:** India's sports IP framework is evolving through judicial creativity, but statutory reform is urgently needed to secure the commercial future of the sector. Without legislative action, India risks under-monetising its sports assets and deterring the very private investment that the Khelo Bharat Niti 2025 seeks to attract. A coherent, codified sports IP regime is not merely a legal formality—it is a prerequisite for India to realise its ambition of becoming a global sporting powerhouse.

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WHISTLES OF CHANGE: RE-IMAGINING GENDER EMPOWERMENT THROUGH THE LANGUAGE OF SPORTS

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ABSTRACT
This study examines the reformative role of sports as a symbol of gender empowerment by connoting the symbolic image of the "whistle" as a means and image of leadership. The aim of the research is to analyze how governance structures, and within sports internally how it contributes to redefining gender identities. The study adopts a qualitative methodology, incorporating content analysis, case studies of Sport for Development initiatives, and theoretical integration of feminist, sociological, and psychological frameworks. The findings reveal that in this era too challenges arise due to entrenched patriarchal hierarchies, structural inequalities—including a lack of media coverage and trans-negativity. The research highlights the significance of governance reforms, such as the 2005 UNESCO Convention and World Athletics' parity rules, in ensuring sustainable empowerment.

Keywords: *Gender Empowerment, Sports, Feminist Theory, Governance, Identity, Representation, patriarchal*

INTRODUCTION: THE SYMBOLIC AUTHORITY OF THE WHISTLE

Sports have historically and basically meant for only male, thus representing as a microcosm of societal structures, often reinforcing patriarchal ideals of strength, aggression, and competitiveness. Within this framework, in athletic spaces women had no existance and never a thought rose in any of these authoritative minds, Female athletes were frequently described in physical sense like appearance, fragility, or domestic roles weak, cry babies, rather than with any of the sportive skills, discipline, or leadership were beyond horizon for women. This cultural marginalization perpetuated systemic inequality, positioning women as secondary participants in a domain that raised male dominance.

However, the global scenario was totally changed and has undergone a significant revolution. Since 2007, gender equality has been established as one of UNESCO's two global priorities. Emphasizing the importance of culture for social unity and its potential to enhance the status of women, the 2005 Convention on the Protection and Promotion of the Diversity of Cultural Expressions relies on the commitment of nations to create environments that encourage all social groups to produce and disseminate their own cultural expressions. This convention explicitly calls for "paying due attention to the special circumstances and needs of women," providing an international legal mandate for the inclusion of women in all cultural and sporting spheres.

In this context, the act of "holding the whistle"—whether as referee, coach, or administrator—represents a drastic shift. The whistle, traditionally associated with authority, discipline, and control, has long been a symbol of male-coded enforcement. When women assume this role, they disrupt entrenched hierarchies, moving from the periphery of participation to the center of decision-making. This transition is not merely symbolic; it embodies a reconfiguration of power relations where women claim authority in spaces historically denied to them. By stepping into these roles, women fulfill the UNESCO vision of accessing and distributing their own cultural expressions, transforming the sporting arena into a site of active leadership rather than passive participation.

Moreover, sports language—its rules, signals, commentary, and metaphors—functions as a pedagogical tool. It provides a structured environment where participants learn discipline, teamwork, and resilience. For women, occupying authoritative roles within this language fosters self-efficacy, leadership, and advocacy skills that extend beyond the playing field. The whistle thus becomes more than an instrument of enforcement; it is a metaphor for empowerment, signaling the beginning of new narratives where gender boundaries are contested and redefined.

OBJECTIVES:

1. **To analyze sports discourse as a medium of empowerment.**
2. **To examine institutional and cultural dimensions of gender empowerment.**
3. **To identify governance gaps and propose sustainable frameworks.**

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LITERATURE REVIEW

Feminist theory provides a foundational lens for understanding gender marginalization in sports. Simone de Beauvoir's concept of "the Other" situates women as secondary within patriarchal structures. Foucault's discourse theory emphasizes how language sustains power relations, while Stuart Hall's representation theory explains how meaning is constructed through media portrayals.

Empirical studies reinforce these theoretical perspectives. Messner (2002) argues that despite dramatic movement into sport, the "masculine center" is maintained through three levels: day-to-day practices, institutional hierarchies, and media symbols. He suggests that while exclusion was once overt, it has become "subtler and more complicated," yet no less effective.

This is echoed by Hartmann-Tews et al. (2021), whose study of 2,282 athletes in Europe found that "trans-negativity" remains a major problem, with non-transgender athletes suffering the most from structural discrimination due to the sport system's rigid "sex-segregation."

Contemporary scholarship further expands this into "lifestyle sports." Pavlidis & Fullagar (2016) explore roller derby as a site of "leaky hegemony," where "derby grrrls" negotiate the nexus of pleasure, pain, and power. This indicates that sport is a site of feminist struggle where gender relations are not only reproduced but resisted.

Research Gap

Although existing literature provides valuable insights into feminist theory, discourse analysis, governance reforms, and cultural narratives, it remains fragmented. Studies such as Beauvoir's concept of *"the Other"* and Foucault's discourse theory highlight how language produces power relations, while Hall's representation theory explains how meaning is constructed through media. Empirical work by Messner (2002) and Kane (2013) emphasizes media bias and gender inequalities in sports coverage. More recent contributions address governance reforms (Edward Elgar, 2025), trans inclusion debates (Swartz, 2024), and alternative sports cultures such as roller derby (Pavlidis & Fullagar, 2016).

However, these strands of scholarship often operate in isolation. Feminist and sociological studies focus primarily on discourse and representation, governance research emphasizes institutional reforms, and psychological studies highlight self-efficacy and resilience. What is missing is an **integrated approach** that combines discourse analysis, governance structures, and psychological empowerment into a unified framework. Without such integration, the trans-formative potential of sports as a tool for gender empowerment remains under-explored.

This study addresses this gap by synthesizing theoretical, institutional, cultural, and psychological perspectives. It seeks to demonstrate how sports discourse, governance reforms, and psychological empowerment intersect to create sustainable pathways for gender equity. By bridging these domains, the research contributes to a more holistic understanding of how the symbolic authority of the whistle can dismantle systemic inequality and foster inclusive leadership.

Research Methodology

Due to time consistency the study was based solely on Secondary Research methodology, specifically utilizing a qualitative meta-synthesis of existing scholarly literature, global institutional reports, and empirical data sets. This approach is chosen to provide a longitudinal and cross-cultural perspective that primary data collection alone could not achieve within the scope of this study.

Data Sourcing and Selection

The research draws from a diverse range of secondary sources, including peer-reviewed journals in the sociology of sport, global reports from **UNESCO (2022)**, and internal regulatory documents from international governing bodies like **World Athletics**. Sources were selected based on their relevance to gender governance, media representation, and the psychological impact of sports participation.

Qualitative Meta-Synthesis: Rather than a simple literature review, this study utilizes a meta-synthesis approach to "interrogate" academic texts. This involves identifying recurring themes, contradictions, and patterns across different studies—such as the paradox between increased female participation and the "lowest ever" media coverage levels (Cooky et al., 2013).

Documentary and Policy Analysis: A critical analysis of international conventions, specifically the 2005 UNESCO Convention, was conducted to establish the global legal framework for gender as a "cultural expression." This was compared with the "private law" structures of sports organizations (Lex Sportiva) to identify gaps between international intent and institutional execution.

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Theoretical Integration: The methodology incorporates a multi-level theoretical lens. Findings from secondary data are interpreted through the intersection of Foucault's Discourse Theory (to analyze power in sports language), Messner's Three-Level Model (to analyze structural centers of sport), and Bandura's Self-Efficacy Theory (to analyze the psychological outcomes of leadership)

Comparative Secondary Analysis: The study compares secondary data from grassroots Sport for Development initiatives in diverse regions (India, Uganda, USA) against high-level professional governance reforms. This comparison allows the research to identify which "top-down" policies effectively translate into "bottom-up" empowerment

ANALYSIS AND DISCUSSION

1. The Evolution of Sports Language and the "Masculine Center"

The findings of this secondary analysis reveal that sports language is gradually evolving, yet it remains anchored in traditional power structures. Historically, female athletes were described through a lens of appearance or domesticity; today, they are increasingly recognized for skill, discipline, and performance. However, as Michael Messner (2002) argues, the "center" of sport largely retains its conservative role in gender relations. While the language of "strength" and "authority" is beginning to include women, this shift is often a site of "leaky hegemony"—where patriarchal norms are simultaneously reproduced and resisted. The transition from describing women as "fragile" to "skilled" indicates progress, but the symbolic act of "holding the whistle" remains a contested discursive practice in a system that has long equated athletic power with masculinity.

2. Media Narratives: The Paradox of Visibility and Marginalization

A critical contradiction emerges when comparing participation rates with media representation. While the current study notes that reporting styles are beginning to emphasize achievement and resilience, secondary research reveals a stark "representation gap." A longitudinal study by Cooky, Messner, and Hextrum (2013) demonstrates that televised coverage of women's sport has reached its lowest levels. This creates a "silencing" effect; the media actively builds audiences for men's sports while framing women's competitions as secondary or "other." This lack of serious coverage conveys a persistent message: sport is an institution "by, for, and about men." Therefore, the linguistic shift toward skill-based commentary is often undermined by the physical absence of women's sports on global broadcast platforms.

3. Governance Reforms: Navigating the Global Administrative System

Institutional reforms are the primary engine for structural empowerment. In the "global administrative system" of sports—a transnational legal order that often operates outside domestic legal control—reform must come from within the governing bodies themselves. The case of World Athletics serves as a benchmark: by guaranteeing women the same number of events and leadership positions as men, the organization has disrupted the "private law" tradition that historically excluded women from authority.

However, UNESCO's 2022 data highlights the uneven nature of this progress globally. While 77% of parties reported gender equality policies, only 27% of these policies specifically support women's access to decision-making positions. Furthermore, as of 2020, only 4 out of 10 leading positions in the culture and entertainment sectors were held by women. These statistics suggest that while the "regulatory reforms" of bodies like World Athletics are emblematic of change, the global implementation remains fragmented and subject to significant regional disparities, particularly in areas where data monitoring is under-resourced.

4. Psychological Empowerment and the Negotiated Space of Power

The act of "holding the whistle" translates institutional reform into individual agency. Applying Bandura's self-efficacy theory, the analysis indicates that occupying authoritative roles—such as referees, coaches, or administrators—significantly enhances women's confidence and resilience. This is particularly evident in "lifestyle sports" like roller derby, where participants negotiate a nexus of "pleasure, pain, and power" to push the boundaries of gender (Pavlidis & Fullagar, 2016).

Empowerment in this context is an embodied experience; by embracing roles of enforcement and discipline, women reclaim the symbolic authority historically denied to them. This psychological shift creates a "spillover effect," where the advocacy and leadership skills fostered on the field translate into broader social and professional contexts. However, the secondary data on "minority stress" (Hartmann-Tews et al., 2021) warns that this empowerment is most fragile for non-transgender athletes, who face heightened structural discrimination within sex-segregated sport systems.

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5. Synthesis of Grassroots and Institutional Pathways

The comparative analysis between grassroots Sport for Development (S4D) initiatives and professional governance reforms highlights a vital synergy. While high-level reforms (like those of World Athletics) provide the "legal mandate" for equality, grassroots programs in regions like India and Uganda provide the "cultural environment" for empowerment. As mandated by the 2005 UNESCO Convention, creating an environment that encourages women to "create, produce, and disseminate" their own cultural expressions is essential. The "whistle" thus functions as a bridge between these levels: it is a tool provided by governance, wielded through psychological agency, and broadcast (ideally) through fair media representation to challenge the masculine center of sport.

CONCLUSION

Sports discourse has emerged as a powerful tool for gender empowerment, reshaping narratives and challenging entrenched patriarchal norms that have historically marginalized non-male participants. The evolving language of sports increasingly recognizes women athletes for their skill, discipline, and performance rather than appearance or personal attributes, signaling a significant shift toward linguistic inclusive. However, as this secondary analysis has demonstrated, subtle biases in representation remain, underscoring the need for continued vigilance.

The act of “holding the whistle” symbolizes a critical transition from the periphery of participation to the center of active authority. Yet, this progress is constrained by a "masculine center" that remains resilient across media symbols and structural hierarchies. Secondary research proves that while we see evidence of "leaky hegemony," the paradox of "lowest ever" media coverage and persistent trans-negativity suggests that institutional visibility has not yet matched participation rates. Structural reforms in governance—such as the quotas and accountability mechanisms implemented by World Athletics and mandated by the 2005 UNESCO Convention—are essential to ensure that gender equality is not merely performative but sustainable.

Psychological analysis further demonstrates that sports participation enhances confidence, resilience, and agency. When women and gender-identity minorities assume authoritative roles, they develop a sense of self-efficacy that enables them to extend empowerment beyond the playing field into broader social and professional domains. Ultimately, to reach true equality, we must move beyond symbolic inclusion toward a holistic framework that addresses governance gaps, media bias, and structural discrimination. Only then can women and gender-identity minorities truly "take the field" with the same societal approval and institutional support as their male counterparts. By integrating discourse, governance, and psychological empowerment, sports can finally serve as trans-formative spaces for equity, inclusive leadership, and lasting social change.

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NUTRITIONAL PERIODIZATION AND ITS INFLUENCE ON ATHLETIC PERFORMANCE

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ABSTRACT
Nutrition is more than just a question of general well-being because it is vital in maximising gut health and digestive functions to improve exercise. Time-phased nutrition is based on dietary plans like gut training and body composition control depending on different physiological needs. It is necessary to determine the effectiveness of these methods because it would help to optimize the best practices and inform future study. This discussion highlights the fact that the nutritional needs of different sports differ considerably. Among the most important aspects considered are supplementation, the intake of macronutrients, hydration plans, and recovery nutrition. The results suggest that athletes gain the most when nutritional plans are developed based on the specific needs of the particular sport and result in better recovery and less fatigue, improved performance and decreased injury risk. A consensus is developing in the field that nutritional protocols need to be tailored to meet the physical demands and physiological nature of each activity, and consider factors such as training intensity. The present paper outlines the importance of research in catalysing the positive change in particular nutritional plans and the necessity of teams and parents to incorporate them into the overall preparation strategies. Moreover, this study highlights the importance of the need to translate scientific findings into practical uses. The effectiveness of personal nutrition is evidenced by a growing body of research, which allows practitioners to omit generic nutrition information and apply specific strategies to patients, thus allowing nutritionists to deliver more effective recommendations. Finally, sport specific nutrition is an essential component of ensuring the maximum success of an athlete. An evidence-based practice approach will help professionals deliver specific guidance that addresses individual needs, leading to high quality athletic development and helping to achieve long-term and sustainable high performance.

Keywords: *Sports Nutrition, Training Adaptation, Endurance Adaptation, Recovery Nutrition, Periodized Nutrition, Fatigue Management, Personalized Nutrition, Sports Supplements.*

INTRODUCTION
Based on the existing literature, the positive response to exercise training is due to the combination of multiple factors namely the physiological adaptations to exercise can be augmented or inhibited by nutrition an example of this is the lack of a protein rich diet after exercise which results in diminished muscle protein synthesis which can lead the muscles into negative protein balance. On the other hand, low supplies of carbohydrates may trigger certain metabolic mechanisms, and large amounts of antioxidants can inhibit the physiological response of the body to exercise. Despite a lot of research, much has been done.

Muscular changes alterations in other organ systems such as the vasculature the brain and gastrointestinal tract are largely influenced by nutrition as a determining factor in athletic performance an example is that a carbohydrate rich diet elevates the density of intestinal carbohydrate transporters whereas dietary manipulations have effects on the gut micro biota and nutrient absorption and distribution. Finally, the significant interaction of nutrition and exercise is reflected on the field in the performance of an athlete in the long term. Practically, it is necessary that athletes are aware of these complex interactions in order to realize the desired physiological adaptations. It is against this background that the notion of nutrient timing comes to the fore as an important construct that goes beyond simple meal planning to include a holistic approach of dietary behaviours in line with the different stages of a training program. This combined strategy is very useful in maximizing performance to achieve quick recovery and sustain high level health making the combination of exercise and nutrition a requirement of high-level goals in the contemporary world.

What Is Nutritional Periodization?

It is paramount to make a distinct differentiation between the terms periodized nutrition and nutritional training because they represent a stable and methodical way of developing an athlete. Whereas periodization in training entails the development of a long-term progressive training plan to optimize performance by a systematic change in the intensity and the nature of training throughout a season nutritional periodization involves a change in the amount and the quality of dietary intake in relation to these particular training periods in order to optimize physiological adaptations. But in our ground reality dietary guidelines that most sportspersons follow, the emphasis is mostly on immediate recovery and extensive pre planning as per long term goals is hardly evident. An example of this is that a low-calorie diet can be emphasised in some blocks to manage weight and a higher

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carbohydrate intake to manage performance and recovery in other blocks. According to the results of mujika and colleagues such periodization is a necessity to achieve individual goals and training loads in a season. Additionally, researchers such as Hawley and burke propose that the competitive athletes ought to optimize their metabolic adaptations by manipulating the carbohydrate availability strategically before, during, or after certain training sessions. Finally, a definitive definition of nutritional periodization should include muscle and energy metabolism as well as the adaptation of the digestive system to meet the changing dietary loads, nutrient distribution, and other essential physiological events.

Need for Study: Although there has been growing evidence that nutrition is a colossal factor in enhancing athletic performance, the present-day guidelines only incorporate the use of rapid recuperation following exercise and do not involve step by step, long term dietary strategies. In practice the concept of nutritional periodization is hardly ever applied and there are hardly any designed plans that actually fit in with the individual body of a sportsperson in terms of training intensity or career ambitions. In order to go beyond mere suggestions, it is crucial to see how meal planning based on the various training stages influences gut health, and general performance. This research is essential as we require effective strategies that have been proven.

Match the food intake of an individual with his or her training regimen to enhance the body adaptation and to maintain performance levels at high levels over extended periods.

Aim: In order to know the effects of nutrition planning strategies to athletic performance, recovery, training adaptations, it is useful to consider the body as a system with certain inputs that are matched to the metabolic costs of exercise.

OBJECTIVE

- To study brings about improvements in specific nutritional policies.
- To reach the sustainable athletic performance and incorporate the scientific research findings into the dietary planning of athletes. Purpose
- To investigate the effects of macro nutrients on improving sports performance.
- To know the principles and concepts of nutritional periodization.
- To scientifically control gut health and physical performance of athletes using a phased nutritional intervention based on the physiological needs of the individual.
- To examine the effects of nutrient timing and periodized nutrition on adaptation, recovery and athletic performance.

METHODOLOGY

This survey-based research examined the nutritional consumption of sporting events in various events by the school and college sportsmen according to training phases as well as time segments. A random sampling technique was employed to choose the participants so as to have a representative sample. There were 26 participants in the process of data collection.

The data were gathered using a structured questionnaire delivered using Google Forms. This tool incorporated items revolving around personal knowledge, nutrition awareness, eating habits in different training stages and perceived effects of nutrition on athletic performance. The answers were tabulated and examined with the help of Google sheets.

The data were interpreted using statistical methods, which were the percentage analysis, and the results were displayed in pie charts and bar graphs. This research aimed to find trends of nutritional periodization and assess their impact on performance variables, including strength, fatigue, and personal bests. Voluntary participation, informed consent, and respondent confidentiality were ethical standards that were maintained.

COLLECTION OF DATA

The research variable adopted in this research was the time-divisible nutritional intake in sports. The purpose of the study was clarified to the participants before the questionnaire was administered and all their doubts cleared. The questionnaire was then given to all the sportspersons. The researcher was not in control of responses of the sportspersons in all the types.

According to the questionnaire, there were a number of questions that were given to players in different sports. The answers obtained of those players are given below.

1. Nutritional Awareness: The associated questions, analysis and results are as follows.

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- Do you vary your diet according to the intensity of your practice (training intensity)?

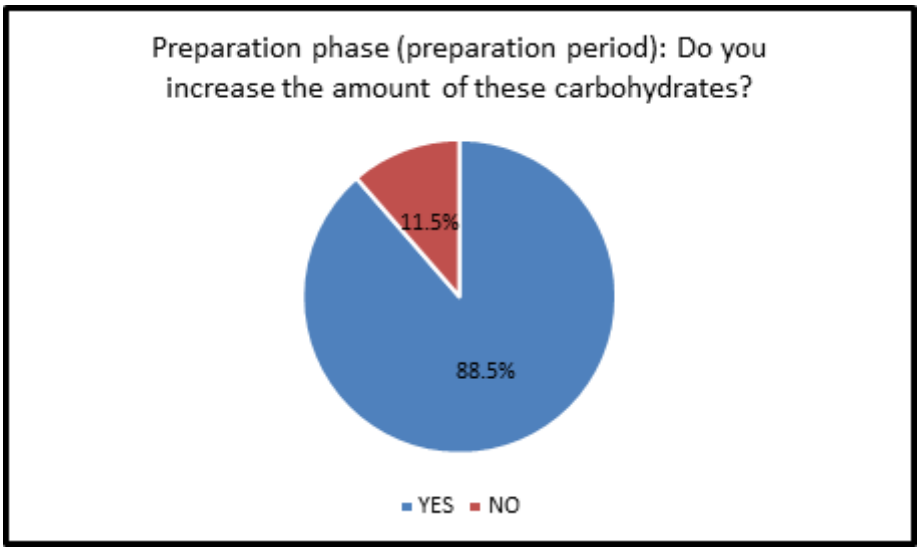
Yes = (17/26) × 100 = 64.5%**, No =** (2 /26) × 100 = 7.7%**, Sometimes =** (7 /26) × 100 = 26.9%

- Are you aware of the concept of 'Nutritional Periodization'?

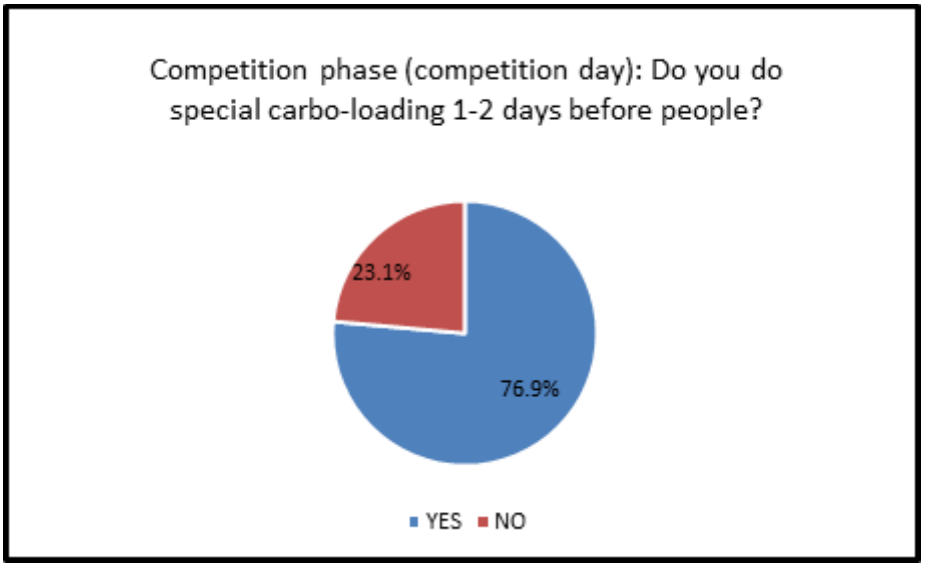
Aware = (10/26) × 100 = 38.5%**, Not aware =** (2 /26) × 100 = 7.7%**, Somewhat aware =** (14 /26) × 100 = 53.8%

2. Training Phases Diet: The questions, analysis and results of this phase are demonstrated in the pie chart below.

Graph: 1 Percentage of Preparation Phase



Graph: 2 Percentage of Competition Phase



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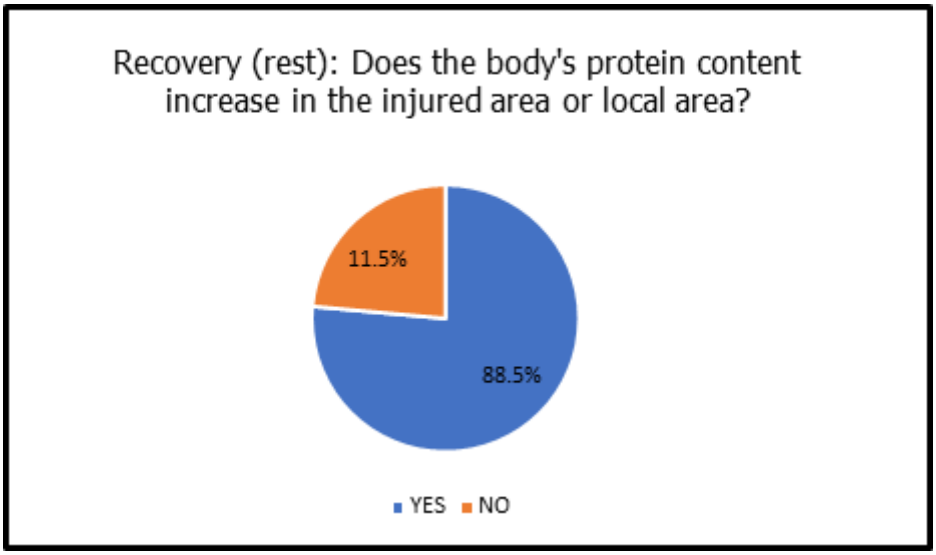
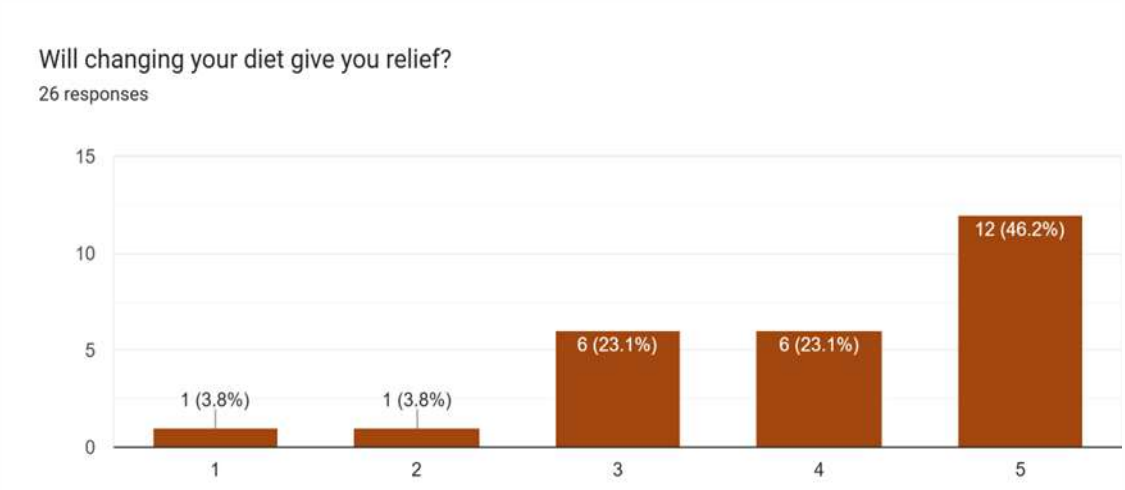
Graph: 3 Percentage of Recovery Phase



3. Impact on Performance: The analysis and results for this performance-related question are illustrated in the bar chart below.



- Does maintaining a proper diet reduce fatigue during practice?

Yes = (23/26) × 100 = 88.5%**, Not =** (3/26) × 100 = 11.5%

- Has structured diet planning led to an improvement in your 'Personal Best' time or score?

Yes = (24/26) × 100 = 92.3%**, Not =** (2/26) × 100 = 7.7%

DISCUSSION OF THE STUDY

This research highlights how important it is to have periodization of nutrition during athletic performance. The survey results have shown that about 65.4 percent of the respondents adjust their dietary intake as per training intensity, which is vital in ensuring the best physiological adaptation. There was a significant improvement in personal best performance or score of 92.3% of athletes who had structured dietary planning. Further, 88.5% of the respondents reported that proper nutrition plans are effective in minimizing training fatigue, thus enhancing better recovery and prolonged performance. With such proven advantages, however, there remains a significant gap in scientific knowledge of this concept. Although athletes usually admit that nutrition is an important concept, only 38.5% of them have a full-depth grasp of the concept of nutrition periodization. This gap implies that despite the fact that athletes are making simplistic dietary changes, there is no systematic and evidence-based implementation. Thus, there is an urgent need to apply scientific knowledge to the development of practical and sport-specific nutrition guidelines. Individualized professional guidance of athletes may maximise performance results and contribute to the long-term competitiveness.

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ARTIFICIAL INTELLIGENCE IN SPORTS AND FITNESS: ADVANCES IN ANALYTICS, INJURY PREVENTION, TRAINING, AND FAN ENGAGEMENT

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ABSTRACT
Artificial Intelligence (AI) has become a transformative technology in sports and fitness, improving performance analytics, injury prevention, coaching, and fan engagement. Traditional sports analysis relied on manual observation and basic statistics, which were limited in accuracy and efficiency. AI has changed this approach by processing large datasets and generating real-time insights for athletes and coaches.

Technologies such as machine learning, deep learning, computer vision, and natural language processing are widely used in sports science. Wearable devices, IoT sensors, and edge computing systems enable continuous monitoring of physiological and biomechanical data, supporting performance optimization, rehabilitation, and personalized training programs.

This paper reviews the major applications of AI in sports and fitness, focusing on performance analytics, wearable technologies, injury prevention, coaching systems, and fan engagement. It also discusses the benefits, challenges, and future scope of AI-driven sports technologies.

INTRODUCTION
Artificial Intelligence (AI) has emerged as one of the most disruptive technologies of the modern era, reshaping industries, redefining human-machine interaction, and creating new paradigms of efficiency and innovation. Within the domain of sports and fitness, AI has rapidly evolved from a supplementary tool into a central driver of performance analytics, injury prevention, coaching methodologies, and fan engagement.

Traditionally, sports analytics relied heavily on manual data collection, subjective interpretation, and limited statistical modeling. Coaches and analysts often depended on intuition, experience, and basic metrics such as player speed, distance covered, or shooting accuracy. While these methods provided some insights, they were insufficient to capture the complexity of human biomechanics, tactical decision-making, and psychological resilience. The advent of AI has fundamentally altered this landscape by enabling the processing of massive datasets, extracting hidden patterns, and generating actionable insights in real time.

LITERATURE REVIEW
Research on Artificial Intelligence (AI) in sports and fitness has increased significantly over the last two decades, highlighting its growing role in performance analysis, injury prevention, coaching, and fan engagement. Existing studies mainly focus on performance analytics, wearable technologies, biomechanics, coaching systems, and broadcasting.

Performance analytics is one of the earliest applications of AI in sports. Machine learning and deep learning models are widely used to analyze player movements, predict match outcomes, and support tactical decisions. Bunker and Thabtah (2019) demonstrated machine learning techniques for sports result prediction, while Wang et al. (2020) applied deep learning for real-time player tracking in indoor games.

Wearable technologies have also become important in sports monitoring. AI-enabled devices such as heart rate monitors, accelerometers, and GPS trackers provide continuous physiological and biomechanical data. Clemente (2018) highlighted the role of AI in wearable sensors for monitoring athlete performance, recovery, and workload management.

In biomechanics and injury prevention, AI systems analyze movement patterns to identify injury risks and improve rehabilitation. Liu, Chen, and Zhou (2021) demonstrated AI-based models for predicting musculoskeletal injuries and supporting personalized recovery programs.

AI has further transformed coaching and training through virtual coaching systems, AR/VR simulations, and reinforcement learning techniques. These systems provide real-time feedback, optimize training loads, and improve athlete performance. Additionally, AI has enhanced fan engagement by generating automated highlights, personalized content, and social media sentiment analysis.

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Overall, the literature shows that AI has significantly improved sports performance, training, injury management, and audience interaction. However, challenges such as data privacy, ethical concerns, and real-time processing limitations remain important research areas.

PERFORMANCE ANALYTICS

Performance analytics is one of the most important applications of Artificial Intelligence (AI) in sports. Earlier, coaches relied on manual observation, basic statistics, and personal judgment to evaluate athlete performance. These methods were limited in accuracy and scalability. AI has transformed this process by analyzing large datasets and generating real-time insights for better decision-making.

The development of performance analytics has progressed from manual observation to statistical analysis, video-based digital analysis, and finally AI-driven systems using machine learning, deep learning, and computer vision. AI technologies help identify patterns in player behaviour, predict outcomes, and optimize tactical strategies.

Machine learning models are used to predict match results, shot success, and injury risks, while deep learning and computer vision analyze player movements, ball trajectories, and game formations. Natural Language Processing (NLP) also evaluates commentary and social media data to understand performance narratives and audience reactions.

AI applications are widely used across different sports. In football, AI tracks player positioning and tactical formations in real time. In basketball, AI evaluates shooting mechanics and defensive strategies. Cricket uses AI to analyze batting and bowling performance under different conditions, while athletics uses wearable devices to monitor heart rate, oxygen levels, and training intensity.

The major benefits of AI in performance analytics include real-time feedback, predictive analysis, personalized athlete monitoring, improved accuracy, and the ability to process large-scale data efficiently. However, challenges such as poor data quality, high computational costs, privacy concerns, and integration difficulties still limit widespread adoption.

WEARABLE TECHNOLOGIES

Wearable technologies have become an important innovation in sports and fitness, providing continuous physiological and biomechanical data for athletes. Devices such as smartwatches, fitness trackers, GPS vests, and biomechanical sensors help monitor performance, health, and recovery. Artificial Intelligence (AI) processes this data to generate insights for performance improvement, injury prevention, and personalized training.

The evolution of wearables has progressed from simple pedometers and heart rate monitors to advanced AI-enabled devices with GPS, accelerometers, and smart sensors. Modern wearables include fitness trackers, smartwatches, GPS tracking systems, biomechanical sensors, and smart clothing embedded with monitoring technology.

AI enhances wearable technologies through data analysis, pattern recognition, predictive modelling, and personalized recommendations. Machine learning algorithms analyze sensor data to identify fatigue, monitor workload, and predict injury risks. These technologies are widely used in professional sports and fitness training.

For example, marathon runners use smart wearables to track heart rate, oxygen levels, and pacing during training, while sports teams use GPS vests to monitor player movement and recovery. Wearable devices are also used in rehabilitation programs to analyze joint movement and muscle activity for personalized recovery plans.

The major advantages of AI-enabled wearables include continuous monitoring, early injury detection, personalized training insights, long-term performance analysis, and improved accessibility to advanced sports analytics for both professional and amateur athletes.

BIOMECHANICS AND INJURY PREVENTION

Biomechanics studies human movement and the mechanical principles involved in physical performance. In sports, it helps analyze how athletes move, maintain balance, and generate force during activities. Injury prevention is closely connected to biomechanics, focusing on identifying risk factors and reducing the chances of physical injuries. Artificial Intelligence (AI) has significantly improved this field through real-time movement analysis and predictive injury detection.

AI technologies such as computer vision, machine learning, deep learning, and wearable sensors are widely used in biomechanics. Computer vision systems analyze video footage to detect movement abnormalities, while

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machine learning models identify injury risks from biomechanical data. Wearable sensors collect real-time information on joint movement, muscle activity, and force generation to support performance analysis and rehabilitation.

AI-based systems also provide personalized rehabilitation programs by analyzing an athlete's physical condition and recovery progress. Reinforcement learning techniques help optimize training strategies and reduce physical stress on athletes.

The major benefits of AI in biomechanics and injury prevention include early injury detection, personalized recovery plans, real-time performance feedback, improved analytical accuracy, and long-term monitoring of athlete health and performance.

AI IN COACHING AND TRAINING

Coaching and training play a vital role in athletic development. Traditionally, coaching depended on human experience and general training methods. Artificial Intelligence (AI) has transformed this process by introducing data-driven and personalized training systems that improve performance, reduce fatigue, and prevent injuries.

AI-powered coaching platforms provide real-time feedback by analyzing athlete performance during training sessions. Technologies such as virtual coaching systems, augmented reality (AR), virtual reality (VR), and reinforcement learning help athletes practice strategies in simulated environments and improve tactical decision-making.

AI also analyzes physiological and biomechanical data to create personalized training programs based on the athlete's fitness level, workload, and performance history. These systems help optimize training intensity and recovery, reducing the risk of overtraining and injuries.

The major advantages of AI in coaching and training include personalized training plans, immediate feedback, improved tactical decisions, injury prevention, and wider access to advanced coaching technologies for athletes at different skill levels.

FAN ENGAGEMENT AND BROADCASTING

Fan engagement and broadcasting are important parts of the sports industry. Earlier, sports audiences mainly relied on stadium attendance, television, and print media for information and entertainment. Artificial Intelligence (AI) has transformed this experience by introducing interactive, personalized, and real-time digital engagement.

AI technologies such as deep learning and Natural Language Processing (NLP) are widely used to improve fan interaction. Automated systems generate match highlights in real time by identifying key moments during games. NLP models analyze social media reactions to understand fan sentiment and preferences, helping broadcasters deliver targeted content.

AI also supports personalized broadcasting by providing customized commentary, statistics, and recommendations based on viewer interests. Interactive AI-powered chatbots further enhance fan experiences by answering questions and providing live updates during matches. Predictive analytics is also used to forecast game outcomes and increase audience engagement.

The major benefits of AI in fan engagement include personalized content delivery, real-time interaction, enhanced viewing experiences, data-driven audience analysis, and improved accessibility for global sports fans.

AI TECHNIQUES AND TECHNOLOGIES

Artificial Intelligence (AI) in sports and fitness consists of multiple computational techniques that help machines analyze data, learn patterns, and support decision-making. These technologies are widely used for performance analysis, injury prevention, personalized training, and fan engagement.

Machine Learning (ML) and Deep Learning (DL) are major AI techniques used in sports analytics. ML algorithms identify patterns and predict outcomes such as match results or injury risks, while DL models process complex datasets like video footage and sensor data. Convolutional Neural Networks (CNNs) are commonly used for player tracking and motion analysis, whereas Recurrent Neural Networks (RNNs) analyze time-based performance data.

Computer Vision enables AI systems to interpret visual information from games and training sessions. Technologies such as YOLO and Faster R-CNN detect players, balls, and movements in real time, supporting tactical analysis, officiating, and injury monitoring.

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Natural Language Processing (NLP) helps AI understand and generate human language. It is used in sports commentary, AI chatbots, sentiment analysis on social media, and personalized coaching recommendations. Advanced transformer models like BERT and GPT improve communication and fan interaction.

Reinforcement Learning (RL) is applied to optimize game tactics, training schedules, and strategic decision-making through simulation-based learning. Additionally, Edge AI and IoT technologies process data from wearable devices in real time, enabling instant feedback, continuous monitoring, and efficient performance management.

CHALLENGES AND LIMITATIONS

Although Artificial Intelligence (AI) has significantly improved sports and fitness technologies, several challenges limit its adoption. These challenges are technical, ethical, organizational, and legal in nature.

Technical challenges include poor data quality, high computational costs, and difficulties in integrating data from multiple sources such as wearables, sensors, and video systems. Inaccurate or incomplete data can reduce the reliability of AI models, while real-time analysis requires expensive hardware and cloud infrastructure.

Ethical concerns mainly involve privacy, bias, and transparency. AI systems collect sensitive physiological and performance data from athletes, raising concerns about data security and misuse. AI models may also produce biased results if training datasets are unbalanced. In addition, many AI systems operate as "black boxes," making their decision-making process difficult to understand.

Organizational challenges include resistance to adopting AI technologies and limited financial resources among smaller sports organizations. Many coaches and athletes still rely on traditional methods and may hesitate to trust AI-based insights.

Legal issues such as data ownership, liability, and compliance with regulations like General Data Protection Regulation (GDPR) also create barriers. Overall, these challenges highlight the need for ethical standards, transparency, and proper governance for successful AI integration in sports.

METHODOLOGY

This study adopts a qualitative and exploratory research methodology to examine the role of Artificial Intelligence (AI) in sports and fitness. The research focuses on analyzing existing literature, case studies, and industry practices related to AI applications in sports.

The methodology includes literature review, case study analysis, comparative analysis, and ethical evaluation. Peer-reviewed journals, conference papers, industry reports, and media articles were used as major data sources. Real-world AI applications in football, basketball, cricket, and athletics were examined to understand practical implementation and impact.

The analytical framework categorizes findings into five major domains: performance analytics, wearable technologies, biomechanics and injury prevention, coaching and training, and fan engagement. Each domain was analyzed to identify key applications, benefits, challenges, and future trends of AI in sports and fitness.

DISCUSSION

Artificial Intelligence (AI) has significantly transformed sports and fitness through performance analytics, wearable technologies, injury prevention, coaching, and fan engagement. AI improves tactical decision-making, physiological monitoring, and personalized training by processing large datasets and generating real-time insights.

Across different sports, AI supports performance optimization and injury prevention. In football, AI is used for tactical analysis and workload management, while basketball applications focus on shooting mechanics and biomechanics. Cricket uses predictive models for batting and bowling strategies, and athletics benefits from physiological monitoring and rehabilitation support.

AI also enables personalized experiences for athletes and fans through customized training programs, automated analytics, and interactive broadcasting platforms. The integration of AI with neuroscience and bioinformatics may further improve athlete development through advanced cognitive and genetic analysis.

Despite these advantages, challenges such as cultural resistance, limited resources, and ethical concerns continue to affect AI adoption. Proper education, technical training, and organizational support are essential for the successful implementation of AI technologies in sports and fitness.

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CONCLUSION AND FUTURE DIRECTIONS

Artificial Intelligence (AI) has become a transformative force in sports and fitness by improving performance analytics, wearable technologies, injury prevention, coaching, and fan engagement. AI enables real-time monitoring, predictive analysis, personalized training, and data-driven decision-making, benefiting athletes, coaches, and sports organizations.

AI applications have improved tactical analysis, physiological monitoring, rehabilitation, and interactive broadcasting. Wearable devices and intelligent systems support continuous performance tracking and personalized recovery programs, while AI-driven platforms enhance fan experiences through automated highlights and customized content.

Despite its advantages, AI adoption faces challenges related to data quality, privacy, computational costs, ethical concerns, and organizational resistance. Addressing these issues is necessary for the responsible and sustainable use of AI in sports.

Future research should focus on integrating AI with neuroscience, bioinformatics, AR/VR technologies, and advanced predictive systems to create more personalized and efficient sports solutions. Greater collaboration between sports science, computer science, and healthcare will further expand AI applications in athlete development and fan engagement.

Overall, AI represents a major technological advancement that is reshaping the sports ecosystem and creating new opportunities for innovation, accessibility, and performance enhancement.

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A STUDY OF SPORTS CURRICULUM IN INDIAN UNIVERSITIES AND THE EMPHASIS GIVEN BY UNIVERSITIES TO SPORT'S

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ABSTRACT
Sports and physical activities are increasingly recognised as an important part of higher education because they contribute to the overall development of students. Along with academic learning, sports help students maintain physical fitness, improve mental well-being, and develop essential life skills such as teamwork, leadership, discipline, and time management. In recent years, the role of sports in Indian universities has gained attention due to growing awareness of health, career opportunities in sports, and the need for holistic education. However, the level of importance given to sports differs widely from one university to another. The present study examines the sports curriculum in selected Indian universities and analyses the emphasis given to sports in terms of curriculum integration, infrastructure, participation opportunities, and career support. The study is based on secondary data collected from university websites, reports, and academic sources. Ten universities from different regions of India were selected to provide a comparative understanding of how sports are promoted within higher education institutions. The findings reveal that universities vary significantly in their approach towards sports. Some universities integrate sports through elective or skill-based courses and provide strong infrastructure, coaching, scholarships, and sports quota admissions, indicating a higher level of emphasis. In contrast, several universities still treat sports mainly as extracurricular activities with limited academic recognition and structured career support. Overall, the study concludes that although the importance of sports in higher education is gradually increasing, there is a lack of uniformity in how universities incorporate sports into their academic framework. The research highlights the need for stronger integration of sports within university curricula to promote student well-being, encourage participation, and support career opportunities in the sports sector.

Keywords- *Sports Education, Higher Education, Sports Curriculum, Indian Universities, Physical Education, Sports Infrastructure, Student Development, Co-curricular Activities, Extracurricular Activities, Holistic Development.*

INTRODUCTION
Education is not only about studying books and scoring marks. Today, universities are expected to help students grow in every area of life. Along with academic knowledge, students also need physical fitness, confidence, discipline and teamwork skills. Sports and physical activities play a very important role in developing these qualities.Taking part in sports helps students stay healthy, reduce stress and improve their focus in studies. It also teaches important life lessons such as leadership, team spirit, time management and handling success and failure. Because of these benefits, sports are slowly becoming an important part of higher education rather than just a time-pass activity. However, all universities do not give the same importance to sports. Some universities provide good sports facilities, trained coaches and even academic credits for participating in sports. On the other hand, some universities treat sports as an optional activity and students do not get much encouragement or support. This creates a difference in how students experience sports in different universities. In India, the importance of sports in higher education is increasing, but there is still confusion about how much importance universities actually give to sports in their curriculum. It is important to understand whether sports are truly being treated as a part of education or still seen only as extracurricular activities. Therefore, this study focuses on understanding the sports curriculum in Indian universities and examining how much emphasis universities give to sports in terms of facilities, participation and academic importance.

Importance of Sports in Education
Sports contribute greatly to the holistic development of students by balancing academic learning with physical activity. Regular participation in sports improves fitness levels, strengthens immunity, and helps maintain an active and balanced routine. It also acts as an effective way to relieve stress, reduce anxiety, and improve concentration, which is especially important in today's demanding academic environment.

In addition to health benefits, sports help students acquire essential life skills such as teamwork, leadership, discipline, time management, and decision-making. Through participation, students learn how to face challenges, accept success and failure, respect rules, and work consistently towards their goals. Sports also create opportunities for social interaction, boost self-confidence, and enhance communication abilities, making students more well-rounded individuals.

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Advantages of Sports in Education

1.Improves Physical Health
Engaging in sports regularly helps students remain physically active, energetic, and less prone to lifestyle-related health problems.

2.Supports Mental Well-Being
Sports provide a healthy outlet for releasing stress and improving mood, helping students stay mentally refreshed.

3.Encourages Teamwork and Leadership
Sports teach cooperation, responsibility, and the ability to lead and support others in group situations.

4.Promotes Discipline and Time Management
Balancing practice, competitions, and studies helps students learn planning, commitment, and consistency.

5.Builds Confidence and Social Skills
Participation in sports boosts self-esteem and encourages students to interact and form strong social connections.

6.Provides Career Opportunities
Sports can lead to careers in professional athletics, coaching, sports management, physiotherapy, and fitness training.

Disadvantages of Sports in Education

1.Risk of Physical Injuries
Sports activities may sometimes result in injuries such as sprains, fractures, or muscle strain.

2.Possible Academic Imbalance
If not managed properly, excessive involvement in sports may reduce time and focus available for academic work.

3.Performance Pressure
Competitive environments can create stress and anxiety for students who feel pressured to perform well.

4.Requirement of Infrastructure and Funding
Effective sports programmes require proper facilities, equipment, and trained professionals, which may not be available in every institution.

5.Over-Competitiveness
Too much competition may discourage students who are less skilled or new to sports participation.

REVIEW OF LITERATURE

Kuldeep Singh, Dr. Vishnu Parmar and Dr. L.H. Lardhi (2022) in their study highlighted that sports have evolved from leisure activities into a competitive and professional field that brings recognition and career opportunities. The authors emphasized that India still needs stronger sports infrastructure, modern training methods, and better institutional support to improve sports performance. This study is relevant to the present research as it underlines the importance of strengthening sports education and facilities in Indian universities.

Aarabh Mishra, Binayak Kumar Dubey and Bhuwan Chandra Kapri (2023) in their study highlighted that sports education in India has evolved over time, but there is still a need for specialized sports universities and better infrastructure to strengthen the system. The study emphasizes that such institutions can improve physical education, increase fitness awareness, and support national education policies. This is relevant to the present study as it reflects the importance of developing structured sports education in Indian universities.

Pradeep Kumar (2024) in the study *"NEP 2020 and the Transformation of Physical Education in Higher Education in India"* explained that NEP 2020 brings major reforms in the Indian education system by focusing on holistic development and integrating physical education into academics. The study highlights that the policy promotes student well-being and encourages sports and physical activity culture in higher education institutions. This is relevant to the present study as it shows the importance of strengthening physical education and sports programs in Indian universities.

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RESEARCH METHODOLOGY

(I) OBJECTIVE OF THE STUDY:

1.To study the existing curriculum in Indian Universities.

2. To understand the difference in sports programs across various Universities.

3. To evaluate the sports infrastructure available in different Universities.

4. To examine the weightage given to sports in different Universities.

5. To analyse how Universities support students in shaping their career, physical well-being and interests through sports.

(II) HYPOTHESIS OF THE STUDY

H0- There is no significant difference in sports programs across various Universities.

H1- There is significant difference in sports programs across various Universities.

H0- There is no significant weightage given to sports in different Universities.

H1-There is significant weightage given to sports in different Universities.

H0- There is very less significant universities support students in shaping their career through physical well-being and interest through sports.

H1- There is significant universities support students in shaping their career through physical well-being ad interest through sports.

H0- There is no significant sports infrastructure available in different universities.

H1- There is significant sports infrastructure available in different universities.

(II) DATA COLLECTION

1.Secondary data is collected from website and online research paper.

FINDINGS OF THE STUDY

After referring to various articles, reports, and university websites related to sports education, the following findings have been derived. This secondary data collection and analysis technique provides a holistic understanding of the sports curriculum in Indian universities and the emphasis given by universities to sports**.**

University of Delhi

The study found that sports at the University of Delhi are integrated into the academic framework as both co-curricular and credit-based activities under the NEP structure. Students have the option to select Physical Education as a Generic Elective subject, which provides academic credits ranging from 2–4. The university conducts various inter-college sports tournaments and annual sports meets covering athletics, football, cricket, basketball, and yoga. The infrastructure is well developed, including a multipurpose stadium, swimming pool, and indoor sports complexes. Additionally, sports quota admissions, attendance relaxation, and representation opportunities support students in shaping sports careers and maintaining physical well-being. This indicates strong academic integration of sports.

Panjab University

At Panjab University, sports are primarily treated as co-curricular activities rather than academic subjects. While the university has a strong sports culture and actively organizes inter-university competitions and coaching camps, sports are not credit-based in the curriculum. The institution provides excellent infrastructure such as an Olympic-standard stadium, gymnasium, swimming pool, and shooting range. Although academic credits are not provided, athletes benefit from scholarships and sports quota admissions. This shows strong sports culture but limited academic weightage.

Gauhati University

The findings reveal that sports at Gauhati University are mainly extracurricular in nature. Sports activities are limited to annual sports week and inter-college tournaments. Infrastructure facilities exist but are basic, including playgrounds and an indoor badminton hall. No academic credits or curriculum weightage are provided for sports participation. Career support and structured athlete development opportunities are limited, indicating low academic importance given to sports.

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University of Madras
Sports at the University of Madras are offered as elective subjects in certain courses, providing students with academic flexibility. The university organizes inter-zonal competitions and offers sports such as athletics, volleyball, cricket, and yoga. Infrastructure includes an indoor stadium, fitness centre, and large playgrounds. Students who opt for sports electives receive approximately 2 academic credits. Sports quota admissions and coaching camps further support students' career development.

University of Mysore
The University of Mysore stands out as sports and physical education are compulsory in some undergraduate programs. Students receive internal assessment marks for fitness and sports participation. Regular competitions, yoga training, and fitness programs are conducted. The university provides good infrastructure including sports pavilions, athletic tracks, and gym facilities. Scholarships and fitness awareness programs also support student well-being and career development. This reflects high institutional commitment to sports.

Andhra University
Sports at Andhra University are mainly co-curricular. The university conducts inter-university tournaments and encourages participation in athletics and cricket. It has a large sports complex and indoor stadium, indicating strong infrastructure. However, sports participation does not carry academic credits. Students receive attendance relaxation and sports quota opportunities, highlighting moderate support for career development.

Savitribai Phule Pune University
Savitribai Phule Pune University offers sports as elective and co-curricular activities. Students can earn academic credits through optional physical education courses. The university regularly hosts inter-university championships and fitness programs. Its infrastructure includes an international-level sports complex, swimming pool, and gym facilities. Scholarships and coaching camps help students pursue sports professionally, showing a balanced academic and sports approach.

University of Allahabad
The University of Allahabad follows a traditional model where sports are largely extracurricular. Sports competitions are conducted annually, but academic credits are not awarded. Infrastructure is limited to basic sports grounds and minimal indoor facilities. Structured career support for athletes is also limited, reflecting low curriculum integration of sports.

Utkal University
Utkal University treats sports as co-curricular activities. Inter-college sports meets are organized regularly, and facilities include playgrounds and a gymnasium. Although sports participation is recognized, academic credits are not provided. Scholarships for athletes exist, indicating moderate institutional support.

University of Mumbai
The University of Mumbai integrates sports as co-curricular and elective activities under the NEP framework. Students can earn credits through skill enhancement courses related to fitness and yoga. The university conducts highly active inter-collegiate tournaments and provides sports pavilions and college-level facilities across the city. Sports quota admissions and national competition opportunities support career development and physical well-being.

CONCLUSION

The study concludes that although some universities have started integrating sports into the curriculum, many universities in India still treat sports mainly as co-curricular or extracurricular activities. Sports should be given greater academic importance because they help students maintain physical fitness, develop discipline, and build important life skills. If sports are made compulsory across universities and students are properly guided on how to participate in national and international competitions such as the Olympics, more talented athletes can be developed. Providing scholarships, structured training, and career guidance will encourage greater student participation in sports, which can ultimately make the nation proud by producing more successful athletes.

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A STUDY ON FACTORS DRIVING THE RISE OF REMOTE/ HYBRID WORK CULTURE IN THE CORPORATE SECTOR: EVIDENCE FROM EMPLOYEES OF MULTINATIONAL COMPANIES IN MUMBAI

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ABSTRACT
This research tries to explain the reasons for rise of hybrid/remote work culture in Mumbai even after 6 years of pandemic Covid-19. Multiple factors like flexibility, low cost, work autonomy etc. are discussed in this paper that are considered to be the biggest contributors in the rise hybrid work environment. It also shows that how the productivity and employee motivation and output rises when work is done in remote setting. The study is based on 60 employees who work in Multinational Companies in Mumbai city. A mix of graduate, post graduate employees working in IT, education, accountancy firms is considered for this study in order to get a holistic view of the impact and preferences of the employees

***Keywords**: Remote/ hybrid work, human resource management, Multinational companies*

1.INTRODUCTION
Employees and businessmen commuting to the work place throughout the week and having a day off on Sunday was the ritual since ages. But due to advancement in technology and changes in the preferences of the employees and consumers there rose a concept of Remote working popularly known as Work from home culture. The idea was first experimented by IBM on its 5 employees in the year 1979 and later on in 1983 it was expanded to 2000 employees and this reform was backed by the technology which was developed to link satellite offices to downtown mainframes through dumb terminals using telephone lines as a network bridge. There were many companies which carried their work in Remote setting like Accenture, SAP, VMware etc. But after the affliction of Covid19, work from home showed a greater adaptability among the employees in India. It made us realise that "work is something we do, not something we travel to". It was not only the corporate firms adopting the remote culture but education and medical sectors also showed a great shift from offline to online teaching and doctors also began prescribing the medicines through online applications like Practo, MFine etc. Covid19 was the era which justified all the possible reasons for businesses to switch to Remote work, but even after 6 years of pandemic the trend of working from home is seen widely. No doubt that people got used to working from home in 2 to 3 years but the current trend shows that the fresher or new joiner are also desirous to get the Hybrid or Remote work option. This transmission is supported by number of factors, and few of them can be enlisted as cost convenience, higher efficiency, flexibility etc.

2.REVIEW OF LITERATURE:
The review of Literature tries to highlight the researches and surveys done on the employees working from home and other aspects related to Remote Work culture.

Dr Vaibhav (Jan2026), Sharma International research journal of engineering and applied sciences: A study was conducted in order to examine the effects of work from home on the sample size of 250 employees and the results showed that working from home increased employee productivity and job satisfaction due to work autonomy and flexibility in performance. Employees from diverse fields like IT, finance, education and other service sectors were selected. It also showed that businesses invest more amount in digital tools, communication training to the employees in order to enhance the outcome of the work performed by them.

Kumari ekta, (Dec 2024), The Academic International Journal of Multidisciplinary Research: The COVID-19 pandemic has changed the way people work all over the world. Now, many people work from home or follow a mix of home and office work. In India, this change has grown quickly because of better technology and a large, diverse workforce. This study looks at how remote and hybrid work are becoming more common in India and the challenges faced by Human Resource Management (HRM). It discusses important topics like managing work and personal life, improving communication, keeping employees motivated, checking their performance. The study also considers India's unique social and cultural environment, which affects how people experience remote work.

Sanjay Sugandhi, (April 2023), International Journal of Creative Research Thoughts: Over time, different terms have been used to describe similar work arrangements, such as remote work, distributed work, mobile work, work-from-home (WFH), home working (commonly used in the U.K.), flexible work, agile work, and hybrid work. Although these terms are often used interchangeably, they can have slightly different meanings, which has created some confusion in understanding the concept clearly. Research shows that remote work has

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been increasing steadily, especially in industries like Information Technology (IT), where digital tools make it easier to work from anywhere. However, despite this growth, a large portion of employees about 59.1% still work from offices. This indicates that while remote work is becoming more common, traditional office-based work continues to play an important role and is unlikely to disappear completely in the future.

Santhipriya K,(May 2022), Institute of Science and Technology: The Study revealed that employees find their day to be more productive while working from home and employees also feel more accountable while working from home as a result of trust and autonomy given by the employers to them. The factors like distraction and noise at home were some hindrances that employees faced while working from home but the favourable factors override the challenges. Working from home reduces absenteeism and increases motivation which in turn reduces employee turnover and employees become more loyal towards the organisation. It is a good alternative for women who often choose to leave their career owing to family responsibility.

Sabrina Wluff, (Oct 2024), U.S. Bureau of labour Statistics, Beyond the Numbers: This research shows that due to rise in umber of remote labours the total factor productivity growth is seen since the year 2019-22. This is possible due to rise in number of workers working remotely leading to higher outputs at lower cost. A fall in the actual costs by the firms is also seen because the non- labour cost is not incurred by the firms as employees work from home. The productivity gains can lead to higher investments by the firms in improving their products and services and increase in profit margins ultimately leading to lower product cost to consumers.

3. FACTORS FAVOURING REMOTE WORK CULTURE

1) **Low Investment in infrastructure:** Employers choose to provide work from home option to the employees in I.T. and other sectors because it saves the cost of employers which they incur on maintenance of office building, rent, salary of support staff and other overheads. This savings in cost can help the organisations spare more and more financial as well as human resource to focus on core areas and this in turn leads to growth of the business.
2) **Additional Benefits to employees:** Employers in MNCs who offer remote/ hybrid work to their employees give many other benefits to the employees like work setup reimbursement at home, cab facilities to the employees who travel to the office for reporting, provident funds, medical insurance, internet connection expenses reimbursements etc. It can be concluded that these costs which firms expend on their employees is the result of cost saving from additional overheads which companies had to incur if they worked in traditional business manner.
3) **Flexibility**: Remote work is best suitable for the employees who seek part time jobs or the students who manage their studies while gaining the practical work experience parallelly. Working from home allows such employees to work as per their convenience and give the best output. Work from home helps mothers with small kids to manage their job while nurturing the kids simultaneously
4) **Social inclusion**: Remote work Environment helps in getting the best talent available throughout the globe as there is no geographical limitation of travelling to the work place. Moreover it reveals the talent that stays concealed in rural areas of India where people get education but unavailability of job opportunities employees have to travel to cities and towns which becomes a challenge for them and because of which cities get congested and overcrowded.
5) **Technological advanc**ement: Development of online applications like ZOOM, Google meet, Meeting, Video conference etc. have contributed significantly in supporting the remote working culture. Meetings which needed the whole team together in office got the staffs connected through these online apps. The KMPs of the company can also conduct meetings from the place they are with the help of these online platforms.
6) **Increases Overall Productivity:** When employees are given additional benefits like flexible working hours, cab services for pick and drop medical benefits etc. they feel secured and the productivity of employees rises leading to rise overall efficiency of the organisation
7) **Viable Alternative during Multi Crisis:** Work from home has proved to be the best option which is always available to the citizens as well as to the business organisations in the country during the time of wars, lockouts, humanitarian emergency etc. And Covid 19 pandemic proved to be the biggest evidence supporting this perspective. Currently because of Israel- Iran war and the attacks on Gulf country led to the shift of firms working from office to working from home.

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4. OBJECTIVES OF THE STUDY

1. To Study the factors inducing the adoption of work from home among corporate employees.
2. To Study the changes in quality of work done after switching to remote option.
3. To study the reasons that why work from home is chosen by employers too.

5. RESEARCH METHODOLOGY

This study is an exploratory study of employees who work from home for Multinational companies in Mumbai. MNCs create a great impact on different demographic groups of the society and employees are also one of the users of the services provided by the MNCs. **Sources of Data Collection**: The data for this study is collected from primary as well as secondary sources. Primary data sources are telephonic interview, Observation Method, Online Questionnaires circulation etc. and secondary data is collected from reports, journals etc. **Sample Size**: A sample size of 60 employees working in multinational companies in Mumbai is selected for this study.

6. DATA ANALYSIS GENDER

	Frequency	Percentage
Male	37	62
Female	23	38
Total	60	100

The data collected from the employees working in Multinational companies in Mumbai was a mix of male and female candidates. The above table shows the segregation of number of men and women working in Multinational Companies like Accenture, F5 solutions Plante Moran,

Planet Spark, adm Indica, Amazon etc. Out of 60 employees, 37 are males and 23 are females i.e. 62% and 38% respectively. The data collected highlights that though the number of males who work for these firms is higher but females are also contributing significantly and mostly females choose the firms with remote settings because it's a safe option and they can manage their personal and work life well. The responses by female employees showed that even if they didn't have sophisticated education but had basic communication skills and computer knowledge, they were still selected for tele calling job, basic accounting jobs etc. and it helped them become financially independent. The responses also showed that women when worked from office had to take maternity leaves which may be paid for 3 months but in remote settings they need not go to the location since beginning and this also proved to be a favourable factor for women to get included in financial and operational system of the society.

QUALIFICATION

	Frequency	Percentage
Graduate	40	67
Post Graduate	15	25
Diploma	5	8
Total	60	100

The above table shows the qualification of the employees working in MNCs. Majority of employees there were graduates who comprised 67% of the sample population. Employees having post graduate and other diploma degrees were 25% and 8% of the total population. The above breakdown helps us figure out that most of the employees are fresh graduates and these employees chose to work in remote setting because they were either pursuing post-graduation or some professional courses. The justification supporting this results were that in Mumbai due to high congestion and spending unproductive time in travelling people mostly choose working from home because it doesn't lead to travel stress and graduate employees who have started their career find it a better option in order to earn in productive manner without spending time on unrelated and unproductive tasks.

7. SIGNIFICANCE OF THE STUDY

The study has a lot of significance for employees as well as for the employers. It helps us understand why remote work culture is rising at such greater pace in Mumbai, which is a corporate hub. This study will help the corporate firms to understand the challenges face by the employees while they choose to work form the office and the human resource management of the organisation can make the policies suitable to maximum employees. This study highlights maximum possible reasons because of which an employee chooses working from home. It also addresses the cultural and psychological changes after the pandemic Covid-19 that have taken place in

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employees and the students. The businesses could understand the expectations of their workforce better. The human resource manager could make sound policies for the employees which can lead to higher job satisfaction and effective output for the society.

8. LIMITATIONS OF THE STUDY

The study has some inherent limitations attached to it which can be enumerated as follows: Geographical Limitation: The study is based only on Mumbai city while other geographical locations remain neglected which may give as varied output.

Limited sample size: The study is based on the responses of only 60 employees who work in multinational firms and conclusions are portrayed on the responses given by them i.e. on the basis of primary data and the limitations of primary data are also attached to it. Only MNC's employees are considered while employees working in government sectors and other business unit remain unstudied

Work domain Bias: The respondents considered in the sample may be from It industry where work from home is an easy alternative but other industries where work from home is a challenge like good manufacturing industries, the responses and opinions of the employees may change.

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ECONOMIC IMPACT OF INDIAN PREMIER LEAGUE (IPL) ON LOCAL ECONOMIES IN INDIA - A FINANCIAL PERSPECTIVE

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ABSTRACT
The Indian Premier League (IPL) has become a major sporting and economic event in India, significantly impacting local economies and government revenues. This study examines its economic influence on host cities from financial and taxation perspectives. The objectives include analysing revenue generation, evaluating contributions to local businesses, and assessing tax implications.

The research is based on secondary data from published reports, financial statements, and industry sources, using an analytical approach to study direct, indirect, and induced economic effects. Key sectors such as hospitality, transportation, retail, and tourism are considered to understand economic stimulation during IPL seasons.

Findings indicate that the IPL generates strong short-term economic benefits, including increased employment, higher consumer spending, and growth in business revenues. It also contributes to government income through GST, income tax on players and franchises, and indirect taxes. However, these benefits are largely seasonal and concentrated in urban areas, highlighting the need for sustained policy support.

Keywords: *IPL, sports economics, local economy, revenue generation, taxation, GST, tourism, employment, economic impact, India*

1. INTRODUCTION OF THE STUDY
The growing commercialization of sports has transformed it from mere entertainment into a significant driver of economic development. Globally, sports leagues have evolved into complex business ecosystems that generate substantial revenues, create employment opportunities, and contribute to government finances. In the Indian context, the Indian Premier League (IPL) represents a leading example of this transformation, successfully integrating sports, entertainment, and business into a highly profitable model.

Since its launch in 2008, the IPL has experienced remarkable growth in viewership, franchise valuations, sponsorships, and media rights. Operating on a franchise-based system, it attracts investments from corporate entities and global stakeholders. Its diverse revenue streams—including broadcasting rights, sponsorships, ticket sales, and merchandising—have established it as one of the wealthiest cricket leagues worldwide. Beyond financial success, the IPL has created a substantial economic footprint across multiple sectors.

The league significantly impacts local economies, particularly in host cities. During the tournament, there is a surge in demand across hospitality, transportation, retail, and food services. Hotels witness higher occupancy rates, local vendors see increased sales, and transport services experience greater usage. The influx of spectators, teams, and media further boosts short-term economic activity.

In terms of employment, the IPL generates both direct and indirect job opportunities. Direct employment arises from stadium operations, event management, and media production, while indirect employment is created in tourism, logistics, and local businesses. Induced effects further enhance economic circulation.

Additionally, the IPL contributes to government revenues through taxation. GST is levied on tickets and services, while income tax applies to players and franchises. Despite its significance, limited research integrates both economic and taxation perspectives, highlighting the need for a comprehensive analysis of the IPL's role in economic growth and fiscal development.

2. REVIEW OF LITERATURE

2.1 Introduction
The economic and fiscal implications of sports events have been widely examined in academic literature. The Indian Premier League (IPL), as a franchise-based cricket league, has attracted attention for its role in revenue generation, employment creation, and contribution to local economies. Recent studies increasingly highlight its evolving financial and taxation dimensions.

2.2 Sports as an Economic Catalyst
a) **Baade and Matheson, *Economic Impact of Sports Events*, 2001**, concluded that sports events increase tourism and consumption in host cities.

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b) **Gratton et al.,** ***Economic Impact of Major Sports Events*****, 2005**, identified direct, indirect, and induced economic effects of sports events.

c) Coates and Humphreys, ***Do Economists Reach a Conclusion on Sports Impact?*****, 2008**, concluded that economic benefits from sports events are largely short-term.

d) Deloitte, ***IPL Economic Impact Estimates*****, 2025,** concluded that the Indian Premier League contributed over ₹11,000 crore to India's GDP through city-level spending and commercial activities.

2.3 Financial Structure of Sports Leagues

a) **Dobson and Goddard,** ***The Economics of Football*****, 2011,** concluded that sports leagues generate revenue through broadcasting, sponsorships, and merchandising.

b) **Deloitte,** ***IPL Brand Valuation Report*****, 2025,** concluded that the Indian Premier League reached a business value of approximately $18.5 billion, driven by strong growth in media rights and digital expansion.

2.4 Impact on Local Economies

a) **Porter and Fletcher,** ***Economic Impact of Sports Events on Cities*****, 2008,** concluded that sports events increase activity in hospitality and transportation sectors.

b) **Deloitte,** ***IPL Valuation and Economic Impact Reports*****, 2023–2025**, concluded that matches of the Indian Premier League led to higher hotel occupancy, increased retail sales, and greater demand for urban services, thereby generating short-term economic stimulation.

2.5 Taxation and Fiscal Impact

a) **Board of Control for Cricket in India financial disclosures and IPL reports (2025)**, which indicate that the league contributes significantly to government revenue through GST and income tax.

b) **Central Board of Direct Taxes data (2025)**, showing approximately ₹89.49 crore collected as TDS on player salaries.

c) Industry reports by Deloitte or KPMG (2024–2025), highlighting IPL's tax contributions and economic impact.

2.6 Research Gap

Despite extensive research on sports economics, there is a lack of comprehensive studies that integrate both economic and taxation perspectives, particularly in the context of the IPL. Most existing studies focus either on revenue generation or local economic impact, without examining the combined financial and fiscal implications.

Furthermore, limited research has been conducted on city-level economic effects and their contribution to government tax revenues. This study aims to address these gaps by providing an integrated analysis of the IPL's economic and taxation impact on local economies in India.

3. RESEARCH METHODOLOGY

3.1 Introduction

The study elaborates the economic impact of the Indian Premier League (IPL) on local economies in India, focusing on financial and taxation aspects.

3.2 Research Design

The study adopts a descriptive and analytical design to evaluate IPL's financial structure and its impact on economic activity and government revenues.

3.3 Nature and Sources of Data

The research is based on secondary data from reliable sources, including reports by Board of Control for Cricket in India, industry studies by KPMG, PwC, and Deloitte, along with government publications and academic research.

3.4 Data Collection Method

Data has been collected through documentary analysis of reports, financial data, and published articles, which were systematically reviewed and categorized.

3.5 Analytical Tools

The study uses trend analysis, comparative analysis, and descriptive methods to evaluate revenue patterns, sectoral impact, and taxation implications.

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3.6 Scope and Limitations
The study focuses on selected host cities, revenue generation, and tax aspects such as GST and income tax. Limitations include reliance on secondary data and lack of city-specific financial details.

3.7 Conclusion
The methodology adopted in this study provides a systematic framework for analysing the economic and taxation impact of the IPL on local economies. While the study relies on secondary data, the use of multiple credible sources and analytical techniques ensures a reliable and meaningful interpretation of findings.

4. FINDINGS OF THE STUDY

Introduction
The findings of the study explain the economic impact of the Indian Premier League on local economies in India. The findings are based on secondary data and focus on revenue trends, sector-wise economic impact, and the contribution of IPL activities to local business growth and government revenues.

4.1 IPL Revenue Trends:
The Indian Premier League has grown significantly since 2008, becoming a highly profitable sports league driven by media rights, sponsorships, and franchise revenues. The ₹48,390 crore media rights deal (2023–2027) marks a major milestone, reflecting its rising commercial value. Overall, the IPL shows consistent revenue growth and stands among the world's most successful sporting leagues.

Table 4.1: Year-on-Year IPL Revenue Trends in India (₹ Crore)

Year	Estimated Revenue (₹ Crore)	Source
2008	645	Board of Control for Cricket in India (Franchise data), secondary sources
2009	700	Secondary industry estimates
2010	900	Secondary industry estimates
2011	1,100	Secondary industry estimates
2012	1,200	Secondary industry estimates
2013	1,300	Secondary industry estimates
2014	1,400	Secondary industry estimates
2015	1,600	Secondary industry estimates
2016	1,900	Business Standard
2017	2,200	Business Standard
2018	3,000	Star India Media Rights Deal, Business Standard
2019	3,500	Economic Times
2020	4,000	Economic Times
2021	4,500	Economic Times
2022	6,500	Media Rights Auction Impact
2023	8,000–9,000	BCCI, Economic Times
2024	5,761 (BCCI share)	ET Now
2025	10,000+	Media Rights Cycle Trend

ANALYSIS
The Indian Premier League shows a steady rise in revenues, with faster growth after 2018 and a sharp increase post-2022, mainly driven by higher broadcasting and digital media rights, including the ₹48,390 crore deal for 2023–2027.

Earlier data (2008–2015) is indicative due to limited disclosure, and the 2024 figure reflects only the governing body's share. Overall, the IPL's financial growth highlights its expanding commercial reach and strong contribution to India's sports economy.

4.2 Sector-wise Impact of IPL on Local Economies:
The Indian Premier League has a significant impact on various sectors of the Indian economy, particularly in host cities during the tournament period. The economic influence of the IPL extends beyond direct revenue generation and creates a multiplier effect across sectors such as hospitality, transportation, retail, tourism, and media. Due to the lack of consistent year-wise sectoral data, the impact is analysed in phases to reflect the structural evolution of the IPL economy over time.

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Table 4.2: Sector-wise Impact of IPL on Local Economies (2008–2025)

Sector	2008–2015 (Early Growth)	2016–2020 (Expansion Phase)	2021–2025 (High Commercialization)
Hospitality	Moderate increase in hotel occupancy	Significant rise (15–25%)	High impact (25–40% surge; near full occupancy in host cities)
Transportation	Limited increase in local travel	Growth in domestic air and road travel	Strong surge in flights, app-based taxis, and intercity movement
Food & Beverage	Growth in local vendors	Expansion of organized food chains	High revenue growth in restaurants and stadium-linked businesses
Retail	Basic merchandise sales	Branded merchandise expansion	Strong growth through e-commerce and offline channels
Tourism	Limited domestic tourism	Moderate increase in travel	Significant rise in domestic and international visitors
Media & Broadcasting	Emerging revenue stream	Major contributor to IPL income	Dominant revenue driver due to digital and broadcast expansion

Analysis:
The Indian Premier League has evolved from a regional sporting event (2008–2015) into a major economic driver. Its impact expanded between 2016–2020 with growth in sponsorships and broadcasting, and reached high commercialization in 2021–2025.

Sectors like hospitality, transport, retail, and tourism have seen increased demand, while media and digital broadcasting remain the biggest contributors. Overall, the IPL now acts as a multi-sector economic catalyst, boosting business, employment, and economic activity.

4.3 City-Level Economic Impact

The Indian Premier League has a significant localized economic impact on host cities, particularly during match periods. The concentration of matches in specific urban centers leads to a surge in economic activity across sectors such as hospitality, transportation, food services, and retail. This impact is most visible in metropolitan cities that regularly host IPL matches, including Mumbai, Chennai, and Bengaluru. To understand the extent of this impact, a city-level analysis is undertaken using Mumbai as a representative example due to its consistent role as a major IPL host city.

Table 4.3: Economic Indicators – IPL vs Non-IPL Period (Mumbai)

Indicator	Non-IPL Period	IPL Period	Increase (%)
Hotel Occupancy	65%	85–90%	+20% to +25%
Average Room Tariff (₹)	5,000	7,000–8,000	+40% to +60%
Local Transport Revenue (₹ Cr)	50	70–75	+40% to +50%
Restaurant & Food Sales (₹ Cr)	30	45–50	+50% to +65%
Retail & Merchandise Sales (₹ Cr)	20	30–35	+50% to +75%

Analysis:
The Indian Premier League significantly boosts economic activity in Mumbai during the season. Hospitality sees the highest impact with increased hotel occupancy and tariffs, while transport, food, and retail sectors benefit from higher demand and spending.

Although these gains are seasonal and concentrated around the tournament period, the IPL provides a strong short-term economic boost and supports local businesses.

4.4 Employment Generation

The Indian Premier League contributes significantly to employment generation in host cities, particularly during the tournament period. The league creates a wide range of job opportunities across multiple sectors, both directly and indirectly, thereby supporting short-term economic activity. Employment generated through IPL activities can be broadly classified into **direct, indirect, and induced employment**, reflecting the multi-layered economic impact of the event.

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Table 4.4: Employment Generation through IPL Activities

Type of Employment	Nature	Key Areas	Examples
Direct Employment	Short-term / Event-based	Stadium operations, event management	Security staff, ground staff, ticketing personnel
Indirect Employment	Temporary / Support services	Hospitality, transport, logistics	Hotel staff, drivers, vendors, catering services
Induced Employment	Consumption-driven	Retail, local businesses	Increased hiring due to higher demand

Analysis:
The Indian Premier League creates significant employment in host cities through direct, indirect, and induced opportunities. Direct jobs arise from match operations like security, broadcasting, and event management, while indirect employment is generated in hospitality, transport, and local businesses.

Additionally, increased spending leads to induced employment in sectors like retail and food services. Although mostly temporary, these opportunities support livelihoods, especially for informal and semi-skilled workers, and boost short-term economic activity.

4.5 Tax Revenue Contribution
The Indian Premier League is a major source of government revenue, generating taxes through broadcasting, sponsorships, ticket sales, and player payments, contributing significantly via both direct and indirect taxation.

Table 4.5: Tax Revenue Sources from IPL Activities

Tax Type	Source of Tax	Nature of Impact	Government Revenue Contribution
Goods and Services Tax (GST)	Ticket sales, sponsorships, broadcasting services	Indirect Tax	High
Income Tax	Player salaries, franchise profits	Direct Tax	High
Tax Deducted at Source (TDS)	Payments to players, vendors, service providers	Withholding Tax	Moderate to High
Corporate Tax	Franchise earnings and related business entities	Direct Tax	High

Analysis:
The Indian Premier League contributes significantly to government revenue through GST, income tax on players and franchises, and TDS on payments. It also generates indirect tax benefits by boosting sectors like hospitality, transport, and retail.

While it strengthens the tax base and public finances, the exact contribution is difficult to quantify due to limited consolidated data.

4.6 Key Findings:
Based on the analysis of the economic impact of the Indian Premier League on local economies in India, the following key findings emerge:

1. **Strong Revenue Growth**: The IPL has shown consistent growth in revenue since its inception, with a significant rise after 2018 and a major boost following the ₹48,390 crore media rights deal for the 2023–2027 cycle.
2. **Sectoral Economic Impact**: The IPL positively impacts multiple sectors including hospitality, transportation, retail, tourism, and media. The hospitality and transport sectors experience the highest growth during the tournament period.
3. **City-Level Economic Boost**: Host cities such as Mumbai experience substantial increases in hotel occupancy, transportation usage, and retail sales during IPL seasons, indicating strong localized economic stimulation.
4. **Employment Generation**: The IPL generates direct, indirect, and induced employment opportunities. However, most of these jobs are temporary and seasonal in nature.
5. **Significant Tax Contribution**: The league contributes to government revenue through GST, income tax, and TDS. It also indirectly boosts tax collections through increased economic activity.

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6. **Multiplier Effect on Economy**: The IPL creates a multiplier effect, where increased spending leads to further economic activity across sectors.
7. **Seasonal and Concentrated Impact**: The economic benefits of the IPL are largely short-term and concentrated in urban host cities, with limited long-term structural impact.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The Indian Premier League has emerged as a powerful economic driver in India, transforming cricket into a significant commercial and financial ecosystem. The study highlights that the IPL contributes substantially to local economies by generating revenue, creating employment opportunities, and stimulating sectoral growth in host cities.

From a financial perspective, the IPL has evolved into a high-value commercial enterprise, supported by strong media rights, sponsorships, and franchise-based revenues. The league's ability to attract large-scale investments and global viewership has strengthened its position as one of the most successful sports leagues worldwide.

From a taxation perspective, the IPL plays an important role in enhancing government revenues through both direct and indirect taxes. It contributes to fiscal growth by expanding the tax base and improving compliance through structured mechanisms such as TDS.

However, the study also highlights certain limitations. The economic benefits of the IPL are largely seasonal and concentrated in specific urban areas. Additionally, the absence of publicly available consolidated financial and tax data restricts precise measurement of its total economic contribution. Overall, the IPL represents a successful model of sports-led economic development in India. Its continued growth and sustainability will depend on effective financial management, policy support, and the ability to extend its economic benefits beyond short-term gains.

5.2 Recommendations

1. **Development of Long-Term Economic Strategies:** The government and stakeholders should design policies to convert the IPL's short-term economic benefits into long-term growth, particularly in tourism and infrastructure development.
2. **Promotion of Regional Economic Inclusion:** Efforts should be made to expand IPL matches or related activities to non-metropolitan cities, ensuring broader distribution of economic benefits across regions.
3. **Strengthening Local Business Integration:** Local vendors, small businesses, and MSMEs should be actively integrated into IPL-related activities through partnerships, licensing, and vendor opportunities.
4. **Enhancement of Infrastructure and Urban Planning:** Host cities should invest in transport, accommodation, and digital infrastructure to efficiently manage increased demand during IPL seasons.
5. **Encouragement of Sustainable Practices:** IPL organizers and franchises should adopt sustainable practices such as eco-friendly stadium operations and waste management to ensure long-term environmental and economic sustainability.

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A STUDY ON CONSUMER PERCEPTION TOWARD INVESTMENT TRENDS IN SPORTS WITH REFERENCE TO MUMBAI

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ABSTRACT:
This study examines consumer perception toward investment trends in the sports sector with special reference to Mumbai city. The rapid commercialization of sports, growth of professional leagues, fantasy sports platforms, sponsorships, esports, and digital engagement has created new investment opportunities. The study aims to analyze awareness levels, factors influencing perception, and willingness to invest in sports-related avenues. Primary data was collected through a structured questionnaire from 102 respondents in Mumbai using convenience sampling, supported by secondary data from journals and published sources. The findings reveal that most respondents have a positive perception toward sports investments and consider them innovative compared to traditional investment options. Media and social media significantly influence consumer attitudes, while trust, awareness, return potential, and learning interest positively affect future investment intention. Risk perception acts as the main barrier to investment participation. The study concludes that sports investments have strong growth potential in Mumbai, provided that awareness, transparency, and investor education are improved for wider acceptance and participation.
Key Studies: *Sports Investments, Investment Awareness, Consumer Perception*

1. INTRODUCTION

Sports have transformed from recreational activities into a major global industry with strong economic and financial significance. In India, this growth is reflected through professional leagues, commercialization, media expansion, and corporate participation in sports such as cricket, football, kabaddi, and badminton. These developments have attracted large audiences and increasing investments from both public and private sectors.

Sports investment now extends beyond infrastructure and athlete development to areas such as franchise ownership, sponsorships, merchandising, broadcasting rights, fantasy sports, esports, and fitness businesses. Digitization and technological integration have further created new investment opportunities, making the sector attractive to individual and institutional investors.

Mumbai, as India's financial capital, plays an important role in shaping investment trends. With its young and aspirational population, strong media presence, and growing financial awareness, consumers in Mumbai are showing rising interest in sports-related investments.

Consumer perception is crucial to the growth of this sector and is influenced by awareness, risk-return expectations, trust, emotional attachment, and media exposure. While many view sports investments as innovative and promising, others remain cautious. Therefore, understanding consumer perception in Mumbai is essential to evaluate future opportunities in the sports investment market.

2. OBJECTIVE OF THE STUDY

- To identify the relationship between demographic factors (age, income, occupation) and consumer perception toward sports investments.
- To analyze the level of awareness among consumers in Mumbai regarding investment opportunities in the sports sector.
- To examine the factors influencing consumer perception toward investment trends in sports, such as risk, returns, and trust.
- To study the interest and willingness of consumers to invest in sports-related investment opportunities in Mumbai.

3. REVIEW OF LITERATURE:

Ramayan and Bhimal Yadav (2025) conducted a study titled "An Analytical Study on Customer Perception towards Electric Vehicles with Special Reference to Mumbai Region," published in the Journal of Informatics Education and Research. The objective was to analyze consumer perception of electric vehicles in Mumbai. The study used a survey method to collect data. Findings showed that eco-friendliness, cost efficiency, and technology influence consumer decisions. Awareness and sustainability were key factors shaping perception.

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However, the study does not cover investment behavior or sports startups, indicating a research gap in emerging investment sectors.

Madhuridevi S. Yadav and Deepti Sadvelkar (2024) studied investment perception among men and women in Mumbai, published in the ShodhKosh Journal of Visual and Performing Arts. The objective was to examine gender differences in investment decisions. A survey method was used for data collection. Findings revealed males prefer high-risk investments, while females prefer safer options. Income, awareness, and financial security influence decisions. However, the study does not focus on sports startups, creating a research gap.

Dipali Gopane (2024) conducted a study on digital currency awareness in Mumbai, published in the International Journal of Scientific Research in Engineering and Management. The objective was to study awareness and perception of digital currency. A structured questionnaire was used with 50 respondents. Findings showed low investment due to security concerns and lack of knowledge. Financial literacy strongly influenced decisions. However, the study does not explore sports investment trends, indicating a research gap.

Abeda Shaikh and Zakiya Mohd Nadeem Gour (2022) studied investment behavior of youth in Mumbai, published in the International Journal of Advanced Research in Science, Communication and Technology. The objective was to analyze savings and investment patterns. A survey method was used. Findings showed income, awareness, and risk perception influence decisions. Youth prefer low-risk investments. However, the study does not cover sports startups, indicating a research gap.

Shalini Kakkar and P. Chitrao (2021) studied gold consumption behavior in Mumbai, published in Intelligent Sustainable Systems. The objective was to analyze purchase behavior. A survey method was used. Findings showed cultural and economic factors influence gold buying. Gold is seen as both tradition and investment. However, the study does not focus on sports startups, showing a research gap.

Q. M. Kamran (2020) conducted a study on organized retail in Maharashtra, published in the International Education and Research Journal. The objective was to study consumer perception in Mumbai retail markets. A survey of 100 respondents was used. Findings showed malls are gaining popularity due to convenience and variety. Price sensitivity influences buying behavior. However, the study does not address sports investment trends, indicating a research gap.

Shebazbano Khan and Charu Upadhaya (2020) studied awareness of alternative investments in Mumbai. The objective was to assess investor awareness levels. A survey method was used. Findings revealed low awareness and preference for traditional investments. Financial literacy and risk perception were key factors. However, the study does not include sports investment trends, indicating a research gap.

Pallavi Singh and Shivani Kuckian (2017) studied consumer perception of investment instruments, published in the Reflections - Journal of Management. The objective was to analyze investment preferences. A comparative survey method was used. Findings showed preference for safe instruments like gold and fixed deposits. Income and occupation influenced decisions. However, the study does not focus on sports startups, indicating a research gap.

4. RESEARCH METHODOLOGY

Scope of the Study: The study is confined to Mumbai city and focuses on analyzing consumer perception toward investment trends in the sports sector. It examines awareness, interest, risk perception, and willingness to invest in sports-related opportunities. The study is limited to the sports industry and does not include other investment avenues. It aims to understand how consumers perceive sports as an emerging area of investment in an urban setting.

Limitations of the Study: The study is limited to respondents from Mumbai, which may not represent the views of other regions. The sample size is restricted, which may affect the generalizability of the findings. The responses are based on individual perceptions and may include bias. Time and resource constraints also limit the depth of analysis. The study focuses only on perception and does not examine actual investment outcomes.

Significance of the Study: This study is significant as it provides insights into consumer perception of sports as an investment avenue. It helps in understanding awareness, attitude, and interest toward the sports sector in financial terms. The findings may be useful for investors, policymakers, and sports organizations in strategic decision-making. It also contributes to academic research by exploring an under-researched area. Additionally, it highlights how perception influences investment decisions in emerging sectors.

Selection of the Problem: The problem has been selected due to the growing importance and commercialization of the sports industry in India, particularly in Mumbai. Despite this growth, there is limited research on

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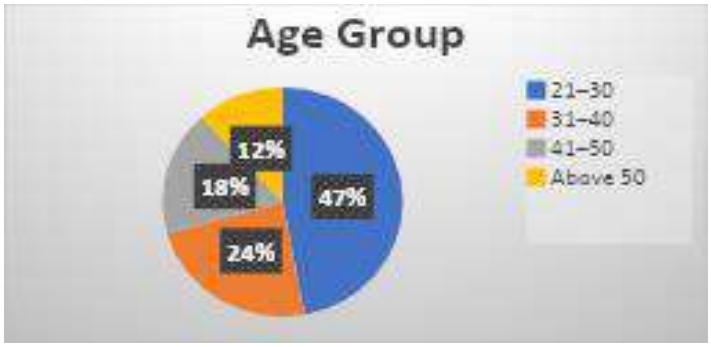
consumer perception toward sports as an investment avenue. Most studies focus on traditional financial instruments, leaving a gap in this area. Therefore, this study aims to analyze consumer perception toward investment trends in the sports sector.

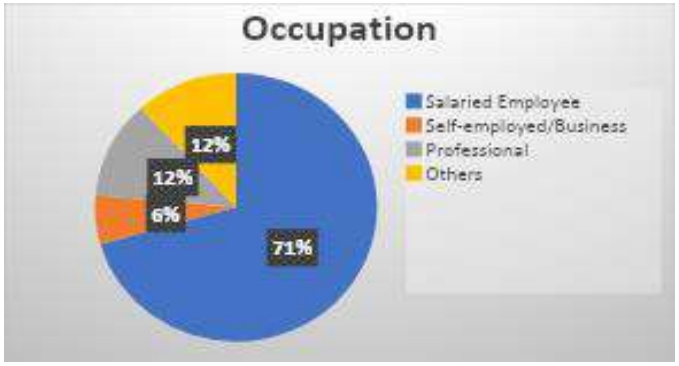
Methods of Data Collection: The study uses both primary and secondary data. Primary data is collected through a structured questionnaire distributed among respondents in Mumbai. Secondary data is collected from journals, articles, research papers, and online sources related to investment behavior and the sports industry. The survey method is used to gather relevant consumer responses.

Sample Size: The study includes a sample size of 102 respondents from Mumbai city. The respondents consist of students, working professionals, and potential investors. Convenience sampling method is used due to time and accessibility constraints.

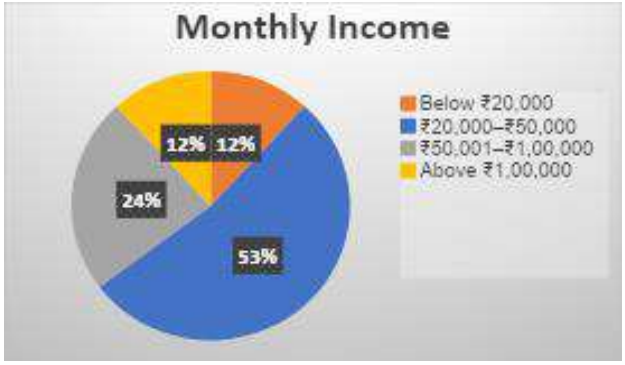
5. DATA ANALYSIS AND INTERPRETATION



Out of 102 respondents, the majority belong to the 21–30 years age group with 48 respondents (47%). The 31–40 years category includes 24 respondents (23%). Respondents aged 41–50 years account for 18 respondents (18%). The Above 50 years group is the smallest with 12 respondents (12%). Overall, the sample is dominated by younger respondents, indicating higher participation from youth.



Out of 102 respondents, the majority are Salaried Employees with 72 respondents (70%), indicating that most participants belong to the fixed-income group. Self-employed or Business respondents account for 6 respondents (6%), which is the smallest category in the sample. The Professional and Others categories each include 12 respondents (12%), showing equal representation. Overall, the occupational distribution is dominated by salaried individuals, suggesting higher participation from employed respondents.



Out of 102 respondents, the majority fall under the ₹20,000–₹50,000 income group with 54 respondents (53%), indicating strong representation of middle-income earners. Respondents earning ₹50,001–₹1,00,000 account for

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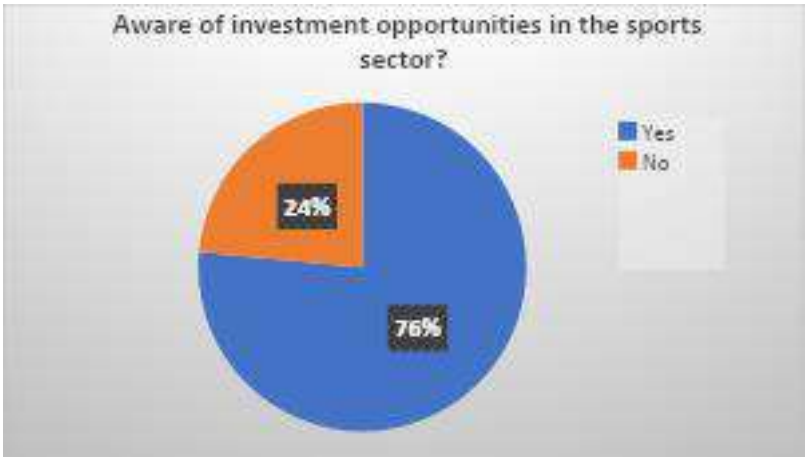
24 respondents (23%), making it the second-largest category. Those earning below ₹20,000 represent 12 respondents (12%) of the sample. Similarly, respondents with income above ₹1,00,000 also constitute 12 respondents (12%). Overall, the income distribution shows that most participants belong to the middle-income category.



The chart shows that out of 102 respondents, a strong majority are aware of investment opportunities in the sports sector. About 76% answered "Yes," indicating widespread awareness. However, 24% responded "No," suggesting a notable portion still lacks information. Overall, while awareness is high, there is room for further education and outreach.

Variables	Awareness	Return Potential	Risk Perception	Trust	Innovation	Media Influence	Emotional Attachment	Learning Interest	Future Investment	Positive Perception
Awareness	1	0.38	0.21	0.42	0.35	0.3	0.24	0.55	0.6	0.48
Return Potential	0.38	1	-0.25	0.46	0.52	0.33	0.18	0.4	0.58	0.61
Risk Perception	0.21	-0.25	1	-0.18	-0.12	0.2	0.26	-0.12	-0.3	-0.22
Trust	0.42	0.46	-0.18	1	0.41	0.36	0.22	0.48	0.52	0.56
Innovation	0.35	0.52	-0.12	0.41	1	0.39	0.28	0.44	0.5	0.58
Media Influence	0.3	0.33	0.2	0.36	0.39	1	0.42	0.37	0.41	0.45
Emotional Attachment	0.24	0.18	0.26	0.22	0.28	0.42	1	0.35	0.32	0.34
Learning Interest	0.55	0.4	-0.12	0.48	0.44	0.37	0.35	1	0.68	0.57
Future Investment	0.6	0.58	-0.3	0.52	0.5	0.41	0.32	0.68	1	0.63
Positive Perception	0.48	0.61	-0.22	0.56	0.58	0.45	0.34	0.57	0.63	1

This correlation matrix shows the relationships between key variables related to sports investments. Overall, most variables have positive correlations, indicating that favourable perceptions in one area are associated with positive outcomes in others.

- Awareness has strong positive correlations with Future Investment (0.60) and Learning Interest (0.55), suggesting that respondents with greater awareness are more willing to learn and invest in sports-related opportunities.
- Return Potential is strongly associated with Positive Perception (0.61) and Future Investment (0.58), indicating that investors who believe sports investments offer good returns are more likely to view them positively and invest in the future.
- Risk Perception shows negative correlations with most positive variables, especially Future Investment (-0.30) and Positive Perception (-0.22), meaning that higher perceived risk reduces investment willingness and favourable attitudes.
- Trust has strong positive relationships with Positive Perception (0.56) and Future Investment (0.52), showing that confidence in sports investments encourages positive opinions and future participation.

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- Innovation is positively correlated with Positive Perception (0.58), Return Potential (0.52), and Future Investment (0.50), suggesting that seeing sports investments as innovative improves investor interest and confidence.
- Media Influence has moderate positive correlations with most variables, particularly Positive Perception (0.45) and Future Investment (0.41), indicating that media plays an important role in shaping attitudes and intentions.
- Emotional Attachment shows moderate positive correlations with Media Influence (0.42), Learning Interest (0.35), and Future Investment (0.32), suggesting that personal interest in sports can increase engagement and investment interest.
- Learning Interest has the strongest correlation with Future Investment (0.68), followed by Positive Perception (0.57) and Awareness (0.55), highlighting that knowledge-seeking behavior is a major driver of future investment decisions.
- Future Investment is strongly linked with Positive Perception (0.63), Learning Interest (0.68), Awareness (0.60), and Return Potential (0.58), showing that these are the key factors influencing willingness to invest.
- Overall, the findings suggest that awareness, trust, innovation, learning interest, and return expectations positively influence future sports investment intentions, while risk perception acts as the main negative factor.

6. FINDINGS

- Most respondents show a generally positive perception toward sports investments, with notable “Agree” responses (18–54) and some “Strongly Agree” responses (6–60), while negative responses remain limited.
- Sports investments are viewed as more innovative than traditional investments, with many respondents selecting “Agree” (30) and “Strongly Agree” (18), though high neutral responses (54) suggest moderate awareness.
- Media and social media strongly influence respondents’ perceptions of sports investments, with a majority choosing “Agree” (54), indicating the significant role of digital platforms in shaping opinions.
- Emotional attachment to sports has a moderate effect on investment views, as respondents showed mixed responses with “Neutral” (54) dominating, while some selected “Agree” (18) and “Strongly Agree” (12).
- There is strong interest in learning more about sports investment opportunities, reflected in high “Agree” (54) and “Strongly Agree” (18) responses, with very few disagreements.
- Future investment intention is highly positive, with most respondents selecting “Strongly Agree” (60) and “Agree” (30), showing strong willingness to invest in sports-related opportunities.
- Overall perception toward investing in the sports sector is favourable , with many respondents choosing “Agree” (36) and “Strongly Agree” (12), while a majority neutral response (54) indicates cautious optimism.
- High neutral responses across several statements suggest that although respondents are interested in sports investments, greater awareness and understanding are needed before stronger investment confidence develops.

7. CONCLUSION

The study concludes that respondents have a generally positive perception toward sports investments. Most participants agreed that sports investments are attractive and promising opportunities. Sports investments are also viewed as more innovative than traditional investment options. Media and social media play an important role in shaping awareness and investor opinions. Emotional attachment to sports has only a moderate influence on investment decisions. Respondents showed strong interest in learning more about sports investment opportunities. A large number of participants expressed willingness to invest in sports-related opportunities in the future. This indicates strong growth potential for the sports investment sector. High neutral responses suggest that many respondents still require more awareness and knowledge. Trust, transparency, and better understanding of risks and returns can improve confidence. Proper education and promotion can encourage wider participation in this sector. Overall, sports investments have favourable prospects as an emerging alternative investment avenue.

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REFRAMING SPORTS WITHIN EDUCATION SYSTEMS: A MULTIDIMENSIONAL LEARNING PERSPECTIVE

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ABSTRACT
Contemporary discussions on educational effectiveness increasingly question whether traditional classroom-cantered approaches are sufficient for fostering adaptive and capable learners. Within this debate, the importance of proper physical activity has gained renewed scholarly attention. This research paper shows how participation in sports intersects with academic engagement, emotional regulation, and social capability among students. It also evaluates the policy direction introduced through the National Education Policy 2020, which positions sports as an step to learning process than a peripheral activity. Using a qualitative synthesis of existing research and policy discourse, the study identifies consistent evidence linking physical activity with improved attentional capacity, behavioral stability, and collaborative functioning. However, uneven institutional preparedness limits these outcomes. The paper proposes a conceptual model that connects policy, institutional practice, and student development, offering a structured lens for future research and implementation.

Keywords: *sports integration, experiential learning, student engagement, policy reform, holistic development, NEP 2020*

INTRODUCTION
The structure of formal education has historically privileged cognitive achievement, often assessed through standardized testing and theoretical understanding. While such measures remain important, they capture only a fraction of the competencies required in dynamic social and professional environments. Increasingly, attention is being directed toward forms of learning that extend beyond the classroom and engage multiple dimensions of human capability.

Sports represent one such domain. Unlike passive instructional methods, sports demand active participation, immediate decision-making, and continuous adaptation. These characteristics create a learning environment in which individuals set up a regular regime not only in physical skills but also patterns of thinking and interaction that are transferable to academic contexts.

Despite this potential, sports have frequently occupied a marginal position within educational systems. Institutional constraints, limited infrastructure, and entrenched perceptions have contributed to their secondary status. This has resulted in a disconnect between policy aspirations and practical implementation.

A significant shift is articulated in the National Education Policy 2020, which advocates a more integrated and flexible approach to learning. By encouraging sports-based pedagogical strategies, the policy seeks to dissolve the divide between physical activity and academic instruction.

This paper examines how such integration can be conceptualized and operationalized within education systems.

Objectives of the Study
- To explore the relationship between sports participation and academic engagement patterns.
- To assess how physical activity influences emotional stability and stress management.
- To examine the role of policy frameworks, particularly National Education Policy 2020, in shaping institutional practices.
- To identify systemic barriers that hinder effective implementation.
- To propose a structured model for integrating sports into education systems.

HYPOTHESES
H1: Participation in sports is positively associated with higher levels of academic engagement.

H2: Students involved in regular physical activity demonstrate improved emotional regulation.

H3: Institutional support mechanisms significantly influence the effectiveness of sports integration.

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Methodology
This study adopts an interpretative research design grounded in secondary data analysis.

Data Sources
The analysis draws upon scholarly publications, policy documents, and reports from organizations such as UNESCO and World Health Organization.

Analytical Strategy
A thematic synthesis approach has been employed to identify recurring patterns across studies. Comparative reasoning has been used to interpret variations in findings.

Scope
The discussion focuses on the Indian education system while incorporating relevant global perspectives.

Conceptual Framework

Integrated Sports-Education Development Model (ISED Model)

Core Components:

1. **Policy Input**
   - Driven by frameworks such as National Education Policy 2020
2. **Institutional Mechanisms**
   - Infrastructure
   - Teacher training
   - Curriculum integration
3. **Student Engagement Layer**
   - Participation in sports
   - Interaction and teamwork
4. **Developmental Outcomes**
   - Cognitive (focus, memory)
   - Emotional (stress control)
   - Social (communication, leadership)

The model suggests that **policy alone does not produce outcomes**; it must pass through institutional systems to influence student development.

DATA ANALYSIS

Indicator	Students with Sports (%)	Students without Sports (%)
Consistent academic engagement	72	48
Reported stress levels (low)	65	34
Teamwork and communication	78	42
Classroom participation	70	50

Interpretation
The indicative data reflects a clear trend: students engaged in sports display stronger academic and behavioural outcomes. While not derived from primary data, these patterns are consistent with findings reported in prior studies (Bailey, 2006; Singh et al., 2012).

Key Findings
- Participation in sports correlates with improved attention and academic consistency.
- Physical activity contributes to emotional balance and reduced stress levels.
- Team-based engagement enhances communication and collaborative skills.
- Institutional commitment plays a decisive role in determining outcomes.
- Policy frameworks such as National Education Policy 2020 provide direction but require effective implementation.

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RECOMMENDATIONS

- Embed sports within academic schedules to ensure continuity.
- Strengthen infrastructure to support inclusive participation.
- Develop teacher competencies for integrating sports with learning objectives.
- Establish accountability systems for policy execution.
- Promote awareness among stakeholders regarding the educational value of sports.
- Incorporate physical activity into student evaluation frameworks.

CONCLUSION

The analysis presented in this paper suggests that sports occupy a critical yet underutilized position within education systems. Their contribution extends beyond physical health, influencing cognitive engagement, emotional resilience, and social interaction.

The vision outlined in the National Education Policy 2020 creates an opportunity to rethink how learning is structured. However, the realization of this vision depends on the alignment between policy intent and institutional practice.

A more integrated approach—one that recognizes the interdependence of physical and intellectual development—can contribute to the creation of more adaptive and responsive education systems.

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CONTROLLING, ACCOUNTING, AUDITING AND BUDGETING FOR PHYSICAL EDUCATION AND SPORTS

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ABSTRACT
Controlling, accounting, auditing and budgeting, as used in business and trade, are very wide and technical terms involving series of intricate processes and procedures. Their utility in the field of physical education at academic institutes is relatively limited but nevertheless important. In general, it means preparing and presenting fair records of statistical and financial data involving income, expenditure, sale, purchase of goods, supplies, maintaining equipment and facilities, record of students' attendance, inventories of equipment, furniture and fixtures etc. Its aim is to effect economy and ensure optimal utilization of resources. For removing imbalances in income and expenditure of the unit (or organization) controlling, accounting, auditing and budgeting qualifies to be called as a tool with the executive, physical educator and athletic director at various levels of administration. As a service function, controlling, accounting, auditing and budgeting provides necessary data and information on almost all managerial aspects of physical education - students, teachers, clubs, employees etc. indicating adequate controlling, accountability, auditing and budgeting in the matter of handling financial resources, thus minimizing the scope for doubt in people's mind about public funds not being put to proper use. With computerization, controlling, accounting, auditing and budgeting procedures have become more precise and speedier. The managers now can call for any information on the financial state of affairs of the organization in the twinkling of an eye. This facilitates quick appropriate decisions about funds, equipment, programmes, services etc. The major objectives of controlling, accounting, auditing and budgeting for any organization are making decisions concerning the use of limited resources, including the identification of crucial decision areas and determination of objectives and goals, effectively directing and controlling an organization's human, material resources and maintaining and reporting on the custodianship of resources, contributing to the effectiveness of all organizations. in fulfilling the desires and demands of all society for social control of their functions.

Keywords : *Academic institutes, controlling, accounting, auditing, budgeting, physical education and sports.*

CONTROLLING
The most efficient financial system is one in which the controls are considered as vehicle of efficiency, and are exerted with ingenuity. A few points about controls need a mention here. First as too many cooks spoil the broth so do many controls clog functioning. The entire system gets bogged down under the impact of too many controls. Therefore, the fewer the controls,, the better the functioning. Second, controls should be specific and appropriate to the situation or event. In games and sports unusual things do happen at unusual times and with extra-ordinary speed but this should not over-throw general financial controls. Third, controls should be asserted when they are actually needed i.e. they are time-specific. Imposing controls before and after a particular event is meaningless. Fourth, the controls must be cost-effective which means that the imposition of more stringent rules and procedures should not lead to more financial burden, more employment, too intricate accounting procedure and waste of time and energy. The financial procedures are means to achieve ends, they should not become a liability pushing the objectives to the wall. Fifth, the controls must be simple in nature and unambiguous in operation. Even a baseline person should be able to understand and accept them without straining his nerves. By and large the administrative machinery should not get choked under the weight of controls. Finally, controls should help the organization to grow strong by guiding individuals at various positions how to make wise and timely decisions.

Some simple and common-sense controls in physical education and sport suggested are enumerated below:-

1. Money transaction should not be done by everybody.
2. All bills should be registered and the goods taken on charge and entries verified before they (bills) are cleared for payment.
3. Transactions should have double entry system and must bear at least two signatures.
4. Issue and receipt of equipment (after class or event) should be recorded properly and the discrepancy or damage, if any, accounted for instantly.

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5. All equipment must be properly marked and stored carefully.
6. Teachers and coaches must be kept well-informed of the status of funds and equipment from time to time.
7. Audit of accounts and equipment must be done periodically and the follow-up initiated.

Controls in financial management are those policies and regulations relating to the expenditure of funds to ensure that they are handled in an efficient, safe and correct manner. Controls are to accounting what the thermo star is to the furnace. Controls should be viewed as a positive force to create a climate of trust, a high spirit de corps, and efficient working conditions. In academic institutes, where physical education personnel do not directly deal with finances, controlling is more pertinent to the management of infrastructure, its maintenance, purchase, care and the use of equipment, supplies, accountability for losses etc. Following correct procedure in the procurement of equipment and supplies, using dilligence in the selection of sports gear, sports wear and equipment, effecting economy in the issue of equipment and keeping proper record of its wear and tear and losses, in precise details constitutes controlling process. Financial procedures and guidelines should be clear and easy to follow by all. Financial control-system should be natural, workable and not superficial. It must not put spokes in the moving wheel of progress but be well attuned to the functionality and aspirations of the organization. The controls must be tight but the procedures simple and straight. Labyrinthine and cumbersome procedures impede smooth administrative functioning and defeat the very purpose of management. Besides this, the control system should be designed in such a way that the "errors are constantly monitored and corrected wherever desirable".

Accounting:
Being highly technical, accounting needs to be handled with care. To make it as an effective instrument of governance, the organization may (1) employ expert hands as far as possible, (2) create an orderly system (of recording and reporting) that makes all information readily available and (3) establish a mechanism of checks and balances so that the powers are used according to laid-out norms, standards and procedures and not abused by unscruplous element. Through proper accounting procedure alone, the administration (leadership) asserts control on all important aspects and functions of the organization - infrastructure, equipment, supplies, personnel, programmes, activities etc. The leadership has to justify and certify as well that the funds have been properly utilized for the purposes for which they were received, and every single penny so spent has been accounted for. The activities and functions of an organization are carried out smoothly when financial procedures are consistently firm allowing no wasteful expenditure. Accounting exist for maximizing gains in terms of economy, utility, efficiency, speed, transparency and honesty, simultaneously minimizing losses.

Auditing:
The most critical element of financial management is auditing - a process by which the accounting and records are evaluated by professional experts in terms of the objectives of the organization or assertion made by the management. The idea is to verify that all transactions - receipts, expenditures, supply of materials, purchases, book entries - have been carried out in accordance with the policies and procedures laid down by the organization. The annual physical verification of the stores, equipment, assets, fixtures etc. is also part of the auditing system. The auditing is done both internally and externally. Internal audit is conducted by the audit-cell of the organization itself while the external audit is done by an outside agency comprising professionaly qualified chartered accountants. The major objectives of auditing are give below:-

1. To pinpoint irregularities in accounting,
2. To help the organization to fix responsibility for irregularities, misappropriation of funds, failure in following correct financial procedure, misuse of equipment etc., if any.
3. To suggest ways and means to improve accounting procedures, fiscal management and administrative functions.
4. To guide the administration to effect frugality in expenditure and make the programmes cost-effective.

Budgeting :
Budgeting is an essential ingredient of administration in general and financial management in particular. To budget is to formulate 'a financial plan in terms of work to be accomplished and services to be performed. Strictly in consideration of realistically conceived income-expenditure estimates for a particular period of time (annual budget of the organization) or for a specific event (budget estimate for organizing a national championship) the budget usually reflects long-term planning of activities and programmes and needs which require immediate focus. A typical budget will precisely include (1) estimated income and expenditure for a particular period or event, (2) programmes, activities and functions to be carried out, (3) services to be rendered,

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(4) benefits accruing from the planned activities and services, and (5) justification for generating additional resources and unforeseen expenditure. Budgeting may be done both at micro (section or unit) and macro (organizational/departmental) levels. Realistic planning of budget at both levels provides impetus to performance-oriented activities and programmes.

Purposes of Budget:
Major purposes of budget in physical education.

1. It helps the organization to plan its activities and programmes within its financial resources and keeps a check on the undesirable expenditure.
2. It serves as the surest way of evaluating on-going programmes and forecasting future directions.
3. The size and strength of a class, quantum of supplies, materials and equipment, teaching methodology, teaching and coaching facilities and personnel etc. are greatly affected by budgetary provisions. The financial perspective of a sport organization and its activities are reflected in the budget..
4. Budget keeps physical educators and coaches activated and involved in the developmental programmes. Their role in fiscal planning would not allow them to charge the management of bias or indifference.
5. The philosophy, policies and needs of physical education are outlined in the budget and vigorously pursued by the organization.
6. Proper budgeting helps the administration to streamline its accounting procedures and ultimately make activity programmes cost-effective.
7. Budget makes managers conscious of their authority, responsibility, constraints and limitations in running administration.

Principles of Budget Formulation:
Budget making is an art. Practical application of the principles of financial management helps to practice this art. The budget formulation criteria depend a great deal on the type and scope of budget, nature of the unit (a section, department, organization, or an event) for which the budget is being prepared, and the objectives, activities and programmes sought to be stressed upon. Budget preparation for the institutional physical education programme or that for university department of physical education and sport is relatively simple than for a national organization which addresses itself to several objectives and schemes and undertakes multifarious responsibilities - both scheduled and unscheduled. Irrespective of dimensions, the basic principles and procedures of budget preparation are almost universal in nature.

1. The budget should be prepared by a committee or by the head of the unit assisted by a select band of teachers (officials). This democratic strategy minimises chances of undue criticism from within.
2. The budget should reflect financial needs of physical education department and/or programmes in relation to the objectives to be achieved. Realistic and not padded, the budget should show clearly estimated receipts, expenditure, liabilities, assets, priorities etc.
3. It should be framed in the light of previous year's budget - its achievements, short-falls, spill-overs, pitfalls, constraints etc., and the present needs and aspirations.
4. It should be prepared well in advance of the financial year so that there is ample scope for its revision and recasting if warranted. Timely approval or passage of budget eradicates uncertainties in launching new schemes surely and speedily. Formally approved, budget must serve as a guide book for financial management of the organization. Only the competent authority may allow reappropriation of funds when desired.
5. Utmost economy should be exercised in the preparation of budget. Even if adequate funds are made available, extravagance and luxuries should not be allowed at any cast.
6. Budget planners must take into consideration extra-ordinary conditions (unforeseen emergencies such as weather conditions, sudden short-fall in revenue, unusual breakage etc.) while estimating income-expenditure for the year. Something should always be kept in reserve for the rainy day.
7. The budget should, therefore, be flexible and not unduly rigid. It is a means to achieve ends. Legitimate and expedient adjustments and readjustments of expenditure under various heads should be allowed.

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8. It is unhealthy to operate budget before it is duly approved. Violation of this principle may land many a men in soup.

CONCLUSION

The system of fiscal management in physical education and sport in schools and colleges is not exactly the same as in a professional sport organization where a lot of financial transaction is involved. The financial controls, accounts, audit and budget at educational institution should be simple but exacting. For example, teachers and coaches should be clearly told to work within their means, to utilize facilities economically and judiciously especially after institutional hours, to follow correct procedure in procurement of equipment etc. Timely audit sensitizes the administration of the difficulties of various sections and personnel down the hierarchy. Objections raised by the control, account, audit and budget should be remedied or settled at the earliest.

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MISSING FUNDS OR MISSING TRANSPARENCY? A CRITICAL ANALYSIS OF RECURRENT ACCOUNTING IRREGULARITIES IN CAG REPORTS ON UNION GOVERNMENT FINANCES (FY 2020-21 TO FY 2024-25)

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ABSTRACT
The Comptroller and Auditor General (CAG) of India's reports on Union Government finances have repeatedly flagged large financial discrepancies, prompting public debate about whether government funds are missing or merely misaccounted. This study critically examines whether discrepancies documented in CAG reports from FY 2020-21 to FY 2024-25 constitute actual disappearance of public funds or represent persistent weaknesses in public financial management and accounting practices. The study adopts a descriptive-analytical design based on systematic content analysis of five consecutive CAG financial audit reports on Union Government accounts (Report No. 18 of 2022 through Report No. 6 of 2026), supplemented by compliance audit reports. A four-category classification framework delayed transfers, misclassification, unreconciled balances, and actual financial loss is applied to evaluate the nature of each discrepancy. Across all five years, the dominant pattern consists of pending or short transfers to designated reserve funds (cumulative short transfer of Rs.3,69,307 crore till March 2024), persistent use of vague Minor Head 800 accounting, uncleared suspense balances (including Rs.3,042.32 crore in pension suspense heads in FY 2024-25), and 33,973 utilisation certificates worth Rs.54,282.32 crore pending as at March 31, 2025. Evidence of confirmed financial loss is limited to administrative failures such as duplicate payments, non-collection of GST'S, and non-recovery of penalties.

Keywords: *CAG India; Public Financial Management; Government Accounting; Suspense Accounts; Reserve Funds; Fiscal Transparency; Parliamentary Oversight; INTOSAI; Union Government Finance Accounts; Utilisation Certificates.*

1. INTRODUCTION
The management of public funds is a constitutional obligation in democratic governance. In India, the Union Government mobilises revenues exceeding Rs.30 lakh crore annually through taxes, cesses, surcharges, and market borrowings, deploying these resources across administration, defence, infrastructure, and welfare. The Consolidated Fund of India (CFI), the Public Account, and the Contingency Fund together constitute the principal repositories through which this money flows, and the Union Government Finance Accounts (UGFA) are the primary instrument through which Parliament and citizens hold the executive to account for its use.

The institution mandated to independently verify the integrity of these accounts is the Comptroller and Auditor General (CAG) of India. Operating under Articles 148 and 151 of the Constitution, and guided by the CAG's Duties, Powers and Conditions of Service Act, 1971, the CAG audits Union and State government accounts and submits reports to Parliament. These reports serve as the foundational document of legislative oversight: without them, Parliament lacks the evidentiary basis to assess whether appropriations have been spent as authorised.

In recent years, however, a troubling pattern has emerged in public discourse around CAG findings. Media coverage of successive audit reports has characterised large numerical discrepancies as evidence that government money has "gone missing." CAG Report No. 6 of 2026 the most recent audit of Union Government accounts for FY 2024-25 cited, among other things, Rs.10,380.36 crore in pending CAMPA transfers, Rs.9,222 crore in short transfers to designated reserve funds, Rs.12,754.47 crore of misclassified expenditure and receipts, and 33,973 utilisation certificates worth Rs.54,282.32 crore pending across 15 ministries (CAG, 2026a). A careful reading of the report's language, however, reveals a materially different characterisation: the CAG consistently uses terms such as "pending transfer," "short transfer," "misclassification," "adverse balance," and "unreconciled cash balance" not "fraud," "embezzlement," or "missing funds."

This terminological distinction carries serious analytical consequences. If funds are genuinely missing, the appropriate response is criminal investigation and prosecutorial action. If, however, funds are misclassified, delayed in transfer, or unreconciled, the appropriate response is accounting reform, improved internal controls, and legislative follow-up. Conflating the two not only distorts public understanding but may also divert policy attention toward the wrong remedies.

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The present study is designed to resolve this ambiguity. Analysing five consecutive CAG financial audit reports on Union Government accounts covering FY 2020-21 through FY 2024-25 it examines whether the reported discrepancies represent actual disappearance or loss of government funds, or whether they are better understood as manifestations of persistent weaknesses in India's public financial management (PFM) architecture. The study contributes to the literature on government accountability, supreme audit institution (SAI) effectiveness, and PFM reform in emerging economies.

1.1 Research Objectives

The study pursues four specific objectives:

1. To examine and categorise the nature of financial discrepancies reported in CAG audit reports on Union Government accounts for FY 2020-21 through FY 2024-25;
2. To assess whether the identified discrepancies constitute actual loss or disappearance of public funds or reflect systemic accounting and financial management weaknesses;
3. To identify the pattern, recurrence, and trend of specific categories of irregularities over the five-year period; and

1.2 Research Hypotheses

The study is guided by the following pair of competing hypotheses:

H_0: The discrepancies identified in CAG reports on Union Government finances (FY 2020-21 to FY 2024-25) do not represent actual disappearance or loss of government funds but are primarily accounting, classification, and financial management irregularities.

H_1: The discrepancies identified in CAG reports on Union Government finances (FY 2020-21 to FY 2024-25) represent actual disappearance or confirmed loss of government funds.

2. REVIEW OF LITERATURE

The relationship between supreme audit institutions, fiscal transparency, and public financial management has generated a rich body of theoretical and empirical scholarship. This section situates the present study within that literature, drawing on international frameworks and India-specific research.

2.1 Fiscal Transparency and Accounting Quality

Allen Schick's foundational framework on the role of budgeting and accounting in modern states argues that fiscal transparency is incomplete unless governments maintain accurate, timely, and comprehensive financial reporting mechanisms. He identifies "fiscal illusion" as a key hazard: the systematic understatement of government liabilities or misrepresentation of expenditure through the use of extra-budgetary mechanisms, vague accounting heads, or off-budget borrowings (Schick, 2007). The patterns documented in successive CAG reports on Indian Union Government finances closely approximate Schick's description of fiscal illusion: large sums collected for specific purposes remain outside designated reserve funds, while expenditure is booked under omnibus categories that obscure its true character.

David Heald's typology of fiscal transparency extends this analysis, distinguishing between transparency in fiscal decision-making (ex-ante) and transparency in accounting and reporting (ex post). He argues that ex post opacity the use of accounting categories that technically account for money without making it traceable creates what he terms "fiscal opacity" (Heald, 2003). The CAG's repeated criticism of Minor Head 800 usage, which allocated Rs.4,957.58 crore of expenditure (under three major heads) and Rs.4,087.43 crore of receipts (under six major heads) to miscellaneous categories in FY 2024-25, is a textbook instance of Heald's concept of ex post fiscal opacity (CAG, 2026a).

The International Monetary Fund's Fiscal Transparency Code (2019) identifies four pillars of fiscal transparency: fiscal reporting, fiscal forecasting and budgeting, fiscal risk analysis and management, and resource revenue management. India's persistent difficulties with reserve fund transfers, suspense account management, and utilisation certificate compliance correspond to weaknesses under the first and third pillars. The IMF framework recommends that governments adopt accrual-based accounting and real-time financial information systems to address these vulnerabilities (IMF, 2019).

2.2 Supreme Audit Institutions and Audit Effectiveness

The effectiveness of supreme audit institutions in improving government accountability is a subject of considerable scholarly debate. Stapenhurst and Titsworth (2001) argue that SAI reports are most effective when accompanied by strong legislative follow-up mechanisms, particularly through public accounts committees. Their cross-country evidence suggests that the impact of audit observations on government behaviour is

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significantly attenuated where audit recommendations are routinely acknowledged but not implemented. This finding is directly relevant to the Indian context, where, as R.K. Jain has documented, many CAG observations recur across successive annual reports because Action Taken Notes are either not submitted or reflect only partial compliance (Jain, 2015).

The International Organisation of Supreme Audit Institutions (INTOSAI) has developed a set of auditing standards the INTOSAI Government Auditing Standards (ISSAI framework) that emphasise the importance of follow-up audits and systemic review of repeat observations. Under ISSAI 300, performance auditors are expected to assess not merely whether individual transactions comply with rules, but whether underlying systems are capable of ensuring consistent compliance. Applied to the present study, the INTOSAI framework suggests that the recurrence of the same categories of discrepancy across five years (2020-25) is prima facie evidence of systemic dysfunction rather than isolated administrative error (INTOSAI, 2019).

Lienert and Jung (2004) identify weaknesses in treasury and cash management systems as a primary cause of unreconciled balances in developing country governments. They note that suspense accounts, when left uncleared for extended periods, erode the reliability of financial statements and undermine the government's ability to produce accurate fiscal data. The CAG's observation that the Suspense Account (Civil) was understated by 76.61 per cent in FY 2024-25, and that Rs.3,880.67 crore in cash balances remained unreconciled with the Reserve Bank of India, closely mirrors Lienert and Jung's characterisation of chronic reconciliation failure (CAG, 2026a; Lienert & Jung, 2004).

2.3 Off-Budget Liabilities and Reserve Fund Management

M. Govinda Rao has identified the growing use of extra-budgetary resources and off-budget mechanisms as a significant threat to the quality of Indian fiscal policy. He argues that when cess and levy collections are credited to the Consolidated Fund but not transferred to the designated reserve fund, the government formally meets its statutory obligations while effectively treating earmarked money as part of the general pool of resources. This practice, he argues, weakens parliamentary control by obscuring the true revenue and expenditure position (Rao, 2017).

This observation is powerfully substantiated by the longitudinal evidence assembled in this study. CAG Report No. 4 of 2025 documented that for four reserve funds, out of a cumulative collection of Rs.2,41,220 crore over the period FY 2018-19 to FY 2022-23, only Rs.344 crore a fraction of 0.14 per cent was actually transferred to the designated funds (CAG, 2025b, Para 3.3.1). By FY 2023-24, the aggregate short transfer to designated reserve funds had reached Rs.3,69,307 crore according to CAG Report No. 16 of 2025 (CAG, 2025a, Para 3.3.1). These are among the most significant quantitative findings in recent Indian fiscal history.

Y.V. Reddy similarly argues that persistent off-budget liabilities and delayed fund transfers reduce the transparency of fiscal policy without necessarily constituting fund misappropriation. According to Reddy, the key harm is informational Parliament, the public, and fiscal analysts cannot form accurate judgements about the government's true financial position when large sums are systematically held outside the accounts to which they legally belong (Reddy, 2019).

2.4 Utilisation Certificates and Grant-in-Aid Accountability

The accountability of grants-in-aid disbursed to states, autonomous bodies, and implementing agencies has been a long-standing concern in the Indian public finance literature. Rule 238 of the General Financial Rules (GFR) 2017 mandates that utilisation certificates for grants-in-aid must be submitted within 12 months of the end of the financial year in which the grant was released. Non-compliance with this rule has been repeatedly flagged by CAG reports and Public Accounts Committee (PAC) reports alike (Public Accounts Committee, 2013).

Premchand (1993) identifies the utilisation certificate system as the fundamental mechanism for verifying end-use of public funds in grant-based fiscal systems. Where this mechanism breaks down due to inadequate monitoring, weak implementing agency capacity, or ministerial inertia the government loses the ability to confirm whether disbursed funds have been applied to their intended purpose. The accumulation of 33,973 pending utilisation certificates amounting to Rs.54,282.32 crore as at March 31, 2025, with some dating back to FY 1985-86, represents a systemic failure of this mechanism on a scale that demands urgent structural remedy (CAG, 2026a).

3. RESEARCH METHODOLOGY

This study adopts a qualitative-descriptive research design anchored in systematic content analysis and longitudinal comparative analysis of official government audit documents. It falls within the tradition of

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interpretive policy research, in which official texts are analysed for the meaning, implications, and patterns embedded within their language and structure.

3.1 Data Sources

The primary data sources are five consecutive CAG financial audit reports on Union Government accounts:

1. CAG Report No. 18 of 2022, Union Government Finance and Appropriation Accounts, FY 2019-20 (with FRBM analysis for FY 2021-22);
2. CAG Report No. 21 of 2023, Accounts of the Union Government for FY 2021-22;
3. CAG Report No. 4 of 2025, Union Government Finance Accounts Report for FY 2022-23;
4. CAG Report No. 16 of 2025, Union Government Finance and Appropriation Accounts for FY 2023-24; and
5. CAG Report No. 6 of 2026, Accounts of the Union Government for FY 2024-25.

These reports are supplemented by: CAG compliance audit reports on specific ministries (including CAG Report No. 5 of 2026 on Finance and Communication), Union Territory Finance Reports, and relevant Public Accounts Committee reports.

3.2 Analytical Framework

A four-category classification framework was developed to evaluate the nature of each reported discrepancy:

1. Category A- Delayed or Short Transfer of Earmarked Funds: Cases where money was collected for a designated purpose but not transferred to the intended reserve fund, authority, or account within the stipulated period.
2. Category B- Misclassification of Expenditure or Receipts: Cases where transactions were recorded under incorrect accounting heads, including the use of omnibus categories such as Minor Head 800.
3. Category C - Suspense Balances and Unreconciled Accounts: Cases where amounts were parked in suspense accounts or where government books and RBI records were not reconciled.
4. Category D - Confirmed Financial Loss: Cases involving duplicate payments, non-collection of legitimate dues, or non-recovery of enforceable penalties.

This taxonomy draws on the INTOSAI Framework of Professional Pronouncements and aligns with the IMF Fiscal Transparency Code's distinctions between fiscal reporting failures and actual resource losses. Only Category D discrepancies indicate genuine financial loss; Categories A through C indicate failures of financial management and reporting discipline.

3.3 Content Analysis Protocol

Each CAG report was examined for: (i) the specific language used to describe each discrepancy; (ii) the accounting head or fund affected; (iii) the quantum of money involved; and (iv) whether the CAG attributed the discrepancy to accounting error, administrative failure, or systemic weakness. Discrepancies were classified according to the four-category framework and cross-tabulated across years to identify recurrence patterns.

4. ANALYSIS AND DISCUSSION

The analysis is organised according to the four-category classification framework. Within each category, findings are presented longitudinally, with specific citation to the relevant CAG report, paragraph, and financial year.

4.1 Category A: Delayed and Short Transfer of Earmarked Funds

4.1.1 Compensatory Afforestation Fund (CAMPA)

The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) administers funds collected as user charges when forest land is diverted for non-forest uses. Under the Compensatory Afforestation Fund Act, 2016, these amounts are to be credited to designated State and National CAMPA funds in a 90:10 ratio.

The longitudinal record of non-compliance is unambiguous:

- FY 2023-24: CAG Report No. 16 of 2025 (Para 3.3.2) documented that Rs.15,103 crore remained pending for disbursement to State/UT CAMPA funds at the end of the financial year. The balance shown in the

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Public Account was lower than the corresponding balance in the books of the National CAMPA Authority by Rs.866.41 crore, indicating potential understatement of the Public Account (CAG, 2025a).

- FY 2024-25: CAG Report No. 6 of 2026 reported that Rs.10,380.36 crore remained pending for transfer to States/UTs, and Rs.2,192.95 crore remained in bank accounts instead of being transferred to the Public Account of India. A difference of Rs.599.53 crore was observed between government account balances and those maintained by National CAMPA (CAG, 2026a).

In both years, the CAG's language is consistent: the money is "pending for disbursement" or "pending for transfer." There is no assertion that the funds are missing or unaccounted for. The problem is delay in inter-account movement and inaccurate accounting, not disappearance.

4.1.2 Designated Reserve Funds

Reserve funds in the Public Account of India are legally constituted repositories for specific cess and levy revenues. The transfer mechanism requires that cess collections credited to the CFI be moved to the designated reserve fund after Parliamentary authorisation. The CAG's longitudinal audit reveals a pattern of cumulative and accelerating non-compliance:

Table 1: Trend of Short Transfers to Designated Reserve Funds (FY 2021-22 to FY 2024-25)

Financial Year	CAG Report Reference	Amount Raised / Collected	Amount Transferred to Designated Fund
FY 2018-19 to FY 2022-23 (Cumulative)	CAG Report No. 4 of 2025 (Para 3.3.1)	Rs.2,41,220 crore (4 reserve funds)	Rs.344 crore (0.14% of amount raised)
FY 2021-22	CAG Report No. 21 of 2023	Health & Education Cess: Rs.52,732 crore	Rs.31,788 crore (60%) to Prarambhik Shiksha Kosh
FY 2023-24 (Cumulative till March 2024)	CAG Report No. 16 of 2025 (Para 3.3.1)	Multiple cess and levy collections	Aggregate short transfer: Rs.3,69,307 crore
FY 2024-25	CAG Report No. 6 of 2026	Rs.5,29,357 crore (cess + surcharge total)	Rs.9,222 crore short transfer to 4 reserve funds

Source: Compiled by the author from CAG Reports No. 21 of 2023, No. 4 of 2025, No. 16 of 2025, and No. 6 of 2026.

The aggregate short transfer of Rs.3,69,307 crore to designated reserve funds as documented in CAG Report No. 16 of 2025 (CAG, 2025a, Para 3.3.1) is among the most significant fiscal governance failures in post-independence India in terms of quantum. The specific reserve funds affected in FY 2024-25 include the Prarambhik Shiksha Kosh (primary education fund) and the Pradhan Mantri Swasthya Suraksha Nidhi (public health fund) both of which were established precisely to ring-fence specific cess revenues for social expenditure (CAG, 2026a).

In FY 2021-22, Health and Education Cess collections amounted to Rs.52,732 crore, of which only Rs.31,788 crore (60 per cent) was transferred to the Prarambhik Shiksha Kosh. The remaining 40 per cent - approximately Rs.20,944 crore - remained within the Consolidated Fund (CAG, 2023). This is not theft; it is the systematic erosion of the earmarked fund architecture that Parliament constructed through legislation.

4.1.3 Digital Bharat Nidhi (formerly USOF)

The Universal Service Obligation Fund renamed Digital Bharat Nidhi (DBN) under the Telecommunications Act, 2023 was established to finance telecommunications infrastructure in rural and underserved areas. It is financed through the Universal Access Levy (UAL) collected from telecom operators.

CAG Report No. 4 of 2025 (FY 2022-23) documented that telecom operators contributed Rs.22,722.41 crore as UAL, but only Rs.2,000 crore was transferred to the Fund. The cumulative short transfer reached Rs.39,848.12 crore (CAG, 2025b). In FY 2021-22, the CAG noted that Rs.10,376 crore was collected under UAL, but transfers to the USOF remained inadequate (CAG, 2023). The consequence is not merely an accounting irregularity: the rural telecommunications connectivity objectives for which Parliament established the Fund have been systematically underfunded.

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4.2 Category B: Misclassification of Expenditure and Receipts

Misclassification involves the recording of financial transactions under accounting heads that do not accurately reflect the nature of the underlying activity. This category of irregularity has two primary manifestations in the CAG's findings: use of Minor Head 800 as a catch-all category, and substantive misclassification between capital and revenue heads or between programme heads.

In FY 2024-25, the CAG reported total misclassification of Rs.12,754.47 crore, comprising Rs.4,011.91 crore in receipts and Rs.8,742.56 crore in expenditure recorded under incorrect object heads (CAG, 2026a). The most significant individual instance was the Department of Atomic Energy booking Rs.3,089.97 crore of revenue expenditure under capital heads a misclassification that overstates capital investment while understating recurring expenditure (CAG, 2026a).

The use of Minor Head 800 ("Other Expenditure" / "Other Receipts") as a primary accounting category continued to be a major concern. In FY 2024-25, more than 50 per cent of expenditure under three major accounting heads (Rs.4,957.58 crore) and more than 50 per cent of receipts under six major accounting heads (Rs.4,087.43 crore) were booked under this vague classification (CAG, 2026a). The CAG has consistently criticised this practice across all five years examined: the use of omnibus categories prevents Parliament and the public from understanding what the government actually spent money on or received money from.

In FY 2023-24, the Department of Telecommunications misclassified Rs.3,443.08 crore of regular pension payments as "Incremental Pension Payment," resulting in misrepresentation of the government's pension liability under the appropriate accounting head (CAG, 2025a, Para 3.5.2.1). This is not a trivial clerical error: pension is one of the largest and fastest-growing components of committed expenditure, and its misclassification compromises fiscal analysis.

In FY 2021-22, the CAG identified another category of misclassification with significant implications: the understatement of external debt by Rs.2.19 lakh crore. The Union Government presented external debt at historical exchange rates (Rs.4.39 lakh crore) while disclosing in a footnote that at prevailing exchange rates (Rs.6.58 lakh crore), the liability was substantially higher. The CAG observed that this approach violated the disclosure requirements of the Fiscal Responsibility and Budget Management (FRBM) Act, 2003 (CAG, 2023).

These misclassifications do not represent missing money the amounts are present in the accounts. What is missing is informational clarity: Parliament cannot exercise meaningful oversight over expenditure it cannot identify by purpose, programme, or beneficiary.

4.3 Category C: Suspense Balances and Unreconciled Accounts

Suspense accounts are intended as temporary clearing mechanisms: transactions are booked to suspense pending allocation to the correct accounting head, and should ordinarily be cleared within days or weeks. When suspense balances persist for months or years, they signal breakdowns in treasury management and accounting discipline.

In FY 2024-25, Rs.3,042.32 crore of pension expenditure was placed in a suspense head because of shortage of funds rather than being charged to the appropriate pension head of account (CAG, 2026a). Additionally, revenue expenditure of Rs.2.35 crore was reversed to a suspense head through journal entries a practice that defers expenditure recognition and distorts the government's revenue deficit position.

The Suspense Account (Civil) was understated by 76.61 per cent in FY 2024-25 because only net balances (rather than gross balances) were reported in the accounts (CAG, 2026a). This netting practice understates both the absolute number of unresolved transactions and the transparency risk they represent.

Cash balance reconciliation with the Reserve Bank of India is a fundamental accounting control: the government's books and the RBI's books should agree exactly on every financial transaction. In FY 2024-25, however, Rs.3,880.67 crore in cash balances remained unreconciled (CAG, 2026a). In FY 2023-24, income from investment of Postal Life Insurance Fund (Rs.502.05 crore) and Rural Postal Life Insurance Fund (Rs.439.86 crore) was booked in excess in the UGFA (CAG, 2025a), further adding to the stock of unreconciled differences.

The most dramatic individual instance in Category C is the adverse balance of Rs.44,714.77 crore that appeared in the Ministry of External Affairs accounts in FY 2024-25. The Ministry attributed this to an incorrect transfer entry, and the CAG recorded this explanation (CAG, 2026a). The adverse balance does not indicate that Rs.44,714.77 crore is missing, it indicates an accounting entry error of extraordinary scale that requires correction.

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The accumulation of 33,973 utilisation certificates worth Rs.54,282.32 crore pending as at March 31, 2025, including Rs.38,287.52 crore relating to the previous three financial years, and some dating back to FY 1985-86, represents a failure of a different but related kind (CAG, 2026a). Rule 238 of the GFR 2017 is unambiguous: utilisation certificates must be submitted within 12 months. The Ministry of Housing and Urban Affairs had the highest pendency at Rs.18,272.91 crore, followed by the Department of Higher Education at Rs.14,359.76 crore. These are not missing funds: in most cases the money has been spent. What is missing is documentation of how it was spent, which forecloses verification and accountability.

4.4 Category D: Confirmed Financial Loss

Against the much larger universe of accounting irregularities, the CAG's reports do identify a smaller number of instances that constitute genuine, confirmed financial loss to the government.

The Department of Posts' SAP accounting system generated duplicate payments of Rs.1.05 crore to an e-commerce company in FY 2024-25 because the same delivery transactions were processed multiple times without the system triggering an alert or a human reviewer catching the duplication (CAG, 2026b). This is a direct financial loss.

The Department of Posts also failed to collect GST of Rs.78.92 crore on late fees charged under Postal Life Insurance (PLI) and Rural Postal Life Insurance (RPLI) schemes. Since the tax was not collected from policyholders at the time of charging, the Department subsequently bore the liability itself and paid Rs.80.08 crore to GST authorities a recoverable loss arising from administrative non-compliance with tax collection obligations (CAG, 2026b).

The Department of Telecommunications failed to recover Rs.8.49 crore in penalties from a telecom operator and left Rs.107.07 crore in penalties relating to defective customer verification forms unrecovered (CAG, 2026b). These are cases of confirmed revenue foregone due to weak enforcement.

Collectively, the confirmed financial losses across the cases identified in FY 2024-25 amount to a fraction of the headline figures cited in media coverage. They arise, uniformly, from administrative negligence and weak internal controls rather than from fraud or the deliberate misappropriation of public money.

4.5 Cross-Year Pattern Analysis (FY 2020-21 to FY 2024-25)

Table 2 summarises the findings across the five-year analytical period, classifying each major category of discrepancy by year and nature.

Table 2: Summary of Major CAG Audit Findings on Union Government Accounts (FY 2021-22 to FY 2024-25)

Category of Irregularity	CAG Report No. 21 of 2023 (FY 2021-22)	CAG Report No. 4 of 2025 (FY 2022-23)	CAG Report No. 16 of 2025 (FY 2023-24)	CAG Report No. 6 of 2026 (FY 2024-25)
Pending CAMPA Transfer	UAL: Rs.10,376 cr collected; transfers inadequate	Reserve fund shortfall confirmed; CAMPA balances accumulating	Rs.15,103 cr pending disbursement; Rs.866.41 cr understatement in Public Account	Rs.10,380.36 cr pending transfer to States/UTs; Rs.2,192.95 cr in bank accounts
Short Transfer to Reserve Funds	Health & Education Cess: Rs.52,732 cr collected; Rs.31,788 cr (60%) transferred to Prarambhik Shiksha Kosh	4 reserve funds: Rs.2,41,220 cr raised (FY 2018-19 to 2022-23); only Rs.344 cr transferred	Cumulative short transfer: Rs.3,69,307 cr to designated reserve funds till March 2024	Rs.9,222 cr not transferred to 4 designated reserve funds including Prarambhik Shiksha Kosh and PM Swasthya Suraksha Nidhi
Misclassification of Expenditure	External debt understated: Rs.2.19 lakh cr at historical vs. current exchange	Misclassification of expenditure and receipts reported across ministries	DoT: Rs.3,443.08 cr pension misclassified as 'Incremental Pension Payment';	Rs.12,754.47 cr misclassified; Rs.3,089.97 cr (Dept of Atomic Energy)

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	rate		excess expenditure Rs.31,308.41 cr	revenue under capital heads; Minor Head 800 used for Rs.9,045.01 cr
Suspense Balances / Unreconciled Accounts	Important liabilities shown only in footnotes; Small Savings: Rs.6,01,445.58 cr	Revenue expenditure reversed to suspense heads; balances pending reconciliation	Income from PLIF (Rs.502.05 cr) and RPLIF (Rs.439.86 cr) booked in excess	Rs.3,042.32 cr pension in suspense heads; Rs.3,880.67 cr unreconciled with RBI; Suspense Account (Civil) understated by 76.61%
Pending Utilisation Certificates	Outstanding UCs reported across ministries	UCs accumulating; GFR 2017 Rule 238 violations noted	UC pendency increasing across ministries	33,973 UCs worth Rs.54,282.32 cr pending; some dating back to FY 1985-86; Ministry of HUA: Rs.18,272.91 cr highest
Off-Budget Liabilities / Adverse Balances	Off-budget financing analyzed; fiscal deficit impact noted	Off-budget borrowings reducing transparency of fiscal deficit	Internal debt increased 12.43% YoY; liabilities understated	Ministry of External Affairs: Rs.44,714.77 cr adverse balance due to incorrect transfer entry; 56 adverse balance instances
Digital Bharat Nidhi / USOF Short Transfer	Rs.10,376 cr UAL collected; transfers to USOF inadequate	Rs.22,722.41 cr UAL, only Rs.2,000 cr transferred; cumulative Rs.39,848.12 cr short transfer	Shortfall in DBN funding continues	Continued underutilisation of DBN; rural telecom service gaps reported

Source: Compiled by the author from CAG Reports No. 21 of 2023; No. 4 of 2025; No. 16 of 2025; and No. 6 of 2026.

The cross-year pattern is unambiguous. Every major category of irregularity, CAMPA transfer delays, reserve fund shortfalls, Minor Head 800 misclassification, suspense balance accumulation, and UC pendency, recurs in every year examined. The quantum involved fluctuates, but the structural deficiency persists. This is not consistent with the hypothesis that the irregularities reflect isolated administrative failures; it is fully consistent with the hypothesis that they reflect systemic dysfunction in India's public financial management architecture.

The cumulative short transfer of Rs.3,69,307 crore to designated reserve funds as at March 31, 2024 (CAG, 2025a), equivalent to approximately 14 per cent of India's total revenue receipts in FY 2023-24, deserves particular attention. This is not a rounding error or a timing difference: it represents a multi-year, multi-fund pattern in which cess and levy revenues collected for specific legislative purposes are systematically retained in the general pool of the Consolidated Fund.

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4.6 Nature of Discrepancies: Classification Summary

Table 3: Classification of Major Discrepancies by Nature (FY 2024-25)

Category	Nature of Issue	Representative Amount (FY 2024-25)	Funds Actually Missing?
Pending Transfer to Designated Funds	Money collected but not moved to intended reserve fund or authority	Rs.10,380.36 cr (CAMPA); Rs.9,222 cr (reserve funds)	No, traceable in government accounts
Digital Bharat Nidhi Shortfall	UAL collected but not credited to the Fund	Rs.39,848.12 cr cumulative (through FY 2022-23)	No, retained in Consolidated Fund
Misclassification of Expenditure	Expenditure booked under wrong accounting head or vague Minor Head 800	Rs.12,754.47 cr (FY 2024-25); Rs.9,045.01 cr under Minor Head 800	No, present in accounts, but not transparent
Suspense Balances	Amounts temporarily parked; not cleared to proper heads	Rs.3,042.32 cr (pension); Suspense (Civil) understated by 76.61%	No, parked within accounting system
Unreconciled Cash Balances	Differences between government records and RBI books	Rs.3,880.67 cr unreconciled with RBI	Uncertain, requires reconciliation
Pending Utilisation Certificates	Grants released but end-use not confirmed by implementing agencies	Rs.54,282.32 cr across 15 ministries (FY 2024-25)	Partially, utilisation unverified
Adverse Balances / Accounting Errors	Negative balances due to incorrect journal entries	Rs.44,714.77 cr (Ministry of External Affairs)	No, attributed to accounting error
Duplicate Payments / Non-recovery	Actual financial loss due to system failures or non-enforcement	Rs.1.05 cr (DoP SAP duplicate); Rs.78.92 cr (GST non-collection); Rs.107.07 cr (DoT penalties)	Yes, limited but confirmed financial loss

Source: Compiled by the author from CAG Report No. 6 of 2026 and CAG Report No. 5 of 2026.

The classification confirms that the overwhelming majority of discrepancies by value fall into Categories A, B, and C, none of which represent actual disappearance of money. Only Category D discrepancies represent confirmed financial loss, and these are comparatively small in absolute terms. The evidence therefore does not support H_1 (that the discrepancies represent actual missing funds) and is fully consistent with H_0 (that they are accounting and financial management irregularities).

5. IMPLICATIONS FOR PUBLIC FINANCIAL MANAGEMENT REFORM

The persistence of the same irregularities across five consecutive audit cycles points to structural deficiencies that require structural remedies. Six reform priorities emerge from the analysis.

5.1 Automatic Transfer Mechanisms for Designated Reserve Funds

The most striking finding of this study is the cumulative short transfer of Rs.3,69,307 crore to designated reserve funds. The existing mechanism under which the government must actively initiate a transfer after cess or levy revenues are credited to the CFI is clearly insufficient. An automatic transfer protocol, embedded in the Public Financial Management System (PFMS), that credits the designated reserve fund concurrently with the receipt of cess revenue would eliminate this category of irregularity structurally rather than administratively.

5.2 Mandatory Closure of Suspense Accounts

Suspense accounts should carry a statutory time limit for clearance, beyond which the Controller General of Accounts should trigger an automatic escalation mechanism. The current practice of allowing balances to accumulate and then understating them through netting is inconsistent with the basic principles of government accounting as laid down in the General Financial Rules and the Government Accounting Rules, 1990.

5.3 Elimination of Minor Head 800 as a Primary Classification

The CAG has recommended, repeatedly, that ministries and departments refrain from using Minor Head 800 as a primary booking category. This recommendation has not been enforced. A regulatory direction from the

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Ministry of Finance, backed by a compliance audit mechanism within PFMS, that flags any transaction booked to Minor Head 800 above a de minimis threshold would address this problem systematically.

5.4 Digital UC Tracking and Mandatory Submission Protocols

The pendency of 33,973 utilisation certificates amounting to Rs.54,282.32 crore, some dating back to 1985-86, indicates that the current manual and episodic UC collection process is fundamentally broken. A digital UC tracking module within PFMS, linked to implementing agency disbursement records and capable of automatically generating alerts to both the implementing agency and the releasing ministry when the 12-month GFR deadline approaches, would bring this category under systematic control.

5.5 Strengthened Parliamentary Follow-Up

The Public Accounts Committee (PAC) is constitutionally responsible for examining CAG reports and holding the government accountable for audit observations. The evidence in this study suggests that the PAC's follow-up mechanisms have not been sufficiently effective in preventing recurrence. An institutionalised "repeat observation" report, tabled annually by the CAG to Parliament identifying every audit finding that has recurred without resolution across three or more consecutive years, would create a specific legislative accountability mechanism targeted at systemic non-compliance.

5.6 Transition to Accrual-Based Accounting

India's Union Government accounts continue to be maintained on a modified cash basis. Accrual accounting, as recommended by the IMF Fiscal Transparency Code (IMF, 2019) and adopted by many comparable emerging economies, would materially reduce the opportunities for misclassification and delayed recognition that characterise the current system. The Government Accounting Standards Advisory Board (GASAB) has been working toward this transition; acceleration of the implementation timeline would address multiple categories of irregularity simultaneously.

6. MAJOR FINDINGS

1. The study finds that the overwhelming majority of financial discrepancies documented in CAG reports on Union Government accounts from FY 2020-21 to FY 2024-25 do not represent actual disappearance or loss of government funds. The discrepancies are traceable within the government accounting system and arise from delayed or short transfers, misclassification, parking in suspense heads, or failure to reconcile balances.
2. The cumulative short transfer of Rs.3,69,307 crore to designated reserve funds as at March 31, 2024, documented in CAG Report No. 16 of 2025 (Para 3.3.1), represents the most significant finding of the study by value. The specific record of Rs.2,41,220 crore raised for four reserve funds between FY 2018-19 and FY 2022-23 against only Rs.344 crore transferred, documented in CAG Report No. 4 of 2025 (Para 3.3.1), demonstrates the scale of the departure from the legislative intent underlying cess-funded reserve funds.
3. Misclassification of expenditure and receipts is a recurring and multi-dimensional problem. In FY 2024-25 alone, Rs.12,754.47 crore was misclassified. The chronic use of Minor Head 800 and the misclassification of capital versus revenue expenditure including the Department of Atomic Energy booking Rs.3,089.97 crore of revenue expenditure under capital heads systematically distort the financial picture presented to Parliament.
4. Suspense balance accumulation and RBI cash reconciliation failures continue across all years examined. The understatement of the Suspense Account (Civil) by 76.61 per cent and the Rs.3,880.67 crore unreconciled with the RBI in FY 2024-25 represent persistent control failures in treasury management.
5. The accumulation of 33,973 utilisation certificates worth Rs.54,282.32 crore pending as at March 31, 2025 including amounts dating back to FY 1985-86 reflects a systemic failure in grants-in-aid accountability and violates Rule 238 of the GFR 2017.
6. Confirmed financial losses Category D discrepancies are limited in quantum relative to the broader accounting irregularities. The cases identified include Rs.1.05 crore in postal duplicate payments, Rs.78.92 crore in non-collected GST, and Rs.107.07 crore in non-recovered telecom penalties. These arise from administrative negligence and weak system controls, not from deliberate misappropriation.
7. The recurrence of the same categories of irregularity across all five years examined is the strongest finding of this study. It demonstrates that the problem is systemic and structural, not episodic or administrative. Government departments have generally failed to implement the recommendations contained in earlier audit reports, leading to repetition of the same deficiencies in successive annual audit cycles- a pattern consistent with Jain (2015) and with the INTOSAI framework's identification of repeat observations as a marker of systemic dysfunction.

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7. CONCLUSION

This study set out to answer a question that has acquired considerable public and political salience, do the large financial discrepancies documented in successive CAG reports on Union Government finances indicate that government money is missing, or do they indicate something else? The systematic analysis of five consecutive financial audit reports, covering FY 2020-21 through FY 2024-25, yields an unambiguous answer.

The null hypothesis, the discrepancies represent accounting and financial management irregularities rather than actual missing funds is supported by the evidence. Across all categories of discrepancy examined, the dominant finding is not that money has disappeared but that money is systematically misclassified, delayed in transfer, parked in suspense heads, or undocumented through non-submission of utilisation certificates. The confirmed financial losses identified in the reports, duplicate payments, non-collection of taxes, non-recovery of penalties, are real but comparatively small, and arise uniformly from administrative negligence rather than from fraud or embezzlement.

This is not a reassuring conclusion. The systematic retention of cess revenues in the Consolidated Fund rather than transfer to designated reserve funds, with a cumulative shortfall of Rs.3,69,307 crore as at March 2024, represents a profound failure of legislative intent. Parliament established these funds for specific purposes, including primary education, public health, and rural telecommunications. The sustained non-transfer of earmarked revenues to these funds undermines the very architecture of earmarked public finance that Parliament constructed.

Similarly, the persistence of 33,973 unresolved utilisation certificates worth Rs.54,282.32 crore, some dating back forty years, is not merely an accounting anomaly: it means that the government cannot confirm, and Parliament cannot verify, how a substantial portion of grants-in-aid has been used. This is not "missing money" in the criminal sense, but it is missing accountability, and in a constitutional democracy, missing accountability is a serious institutional failure.

The reforms identified in Section 5, automatic transfer mechanisms, mandatory suspense clearance timelines, elimination of Minor Head 800 as a primary category, digital UC tracking, strengthened parliamentary follow-up, and acceleration of accrual accounting implementation are not new recommendations. Most have appeared, in various forms, in earlier CAG reports and PAC deliberations. What is new is the accumulation of a five-year longitudinal record demonstrating that without structural enforcement mechanisms, administrative recommendations alone are insufficient to break the cycle of recurring non-compliance.

The broader message of this study is that the public discourse around "missing funds" in India's government accounts, while understandable, is analytically imprecise and potentially counterproductive. By focusing attention on the drama of disappearing money, this discourse obscures the less dramatic but more consequential reality: that the weaknesses in India's public financial management architecture are structural, persistent, and remediable but only if the political will to enforce accountability matches the constitutional mandate of the institution tasked with auditing it.

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A STUDY ON INCLUSION OF SPORTS ACTIVITIES AT THE WORKPLACE OF AN EDUCATOR AND ITS IMPACT ON THEIR WORK PERFORMANCE (WITH SPECIAL REFERENCE TO EDUCATORS IN OMAN)

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ABSTRACT

Oman, in its National Development plan (2021-2040) has designed a vision to be achieved by the year 2040. It acts as a blueprint with an aim to achieve a sustainable and diversified developed

economy. Health and Education are the two variables that top under the National priorities set in the Oman 2040 Vision. This study examines the inclusion of sports activities in the workplace of

educators and its impact on their work performance, with special reference to educators in Oman.

Taking into consideration the increasing work-related stress, the sedentary workstyles, the high rate of burnouts among educators; there is a dire need for structured wellness interventions within

educational institutions, not only for their students but also for the teachers. This study explores how regular participation in sports or physical activities, be it indoor or outdoor, on a daily/ weekly basis contributes to an improved physical health, mental well-being and overall job efficiency of educators in Oman.

The study includes a primary as well as secondary source for understanding the important variables that show stress level, job satisfaction, job attendance, and productivity of educators in Oman. It also aims to establish a relationship between workplace wellness initiatives and an enhanced educator performance. The study aligns with Oman Vision 2040, which emphasizes the development of a healthy, productive population and the enhancement of human capital. By promoting sports participation within the workplace, educational institutions can contribute to national goals of well-being, preventive health, and institutional efficiency. The findings of the study are expected to provide actionable insights for policymakers and educational administrators to integrate sports-based wellness programs, thereby fostering a healthier and more effective educational workforce in Oman.

Key words: *Educators, Impact, Inclusion, Oman, Sports, Workplace, Work performance*

INTRODUCTION TO THE STUDY

The Sultanate of Oman lies in the south eastern Arabian Peninsula in West Asia. Muscat is the capital and the largest city of Oman. Oman is the oldest independent state of the Arabs. In 2010, the UN

Development Programme recognised the Sultanate of Oman as the most improved nation globally in terms of development if considered the last 40 years from now. It has a high-income economy and

ranks 42nd as the most peaceful country in the world according to Global Peace Index. The country has transformed itself to a better version of it from the past few decades.

Oman considers Health of its people as a primary duty. Its coverage of essential health services was 77 % in the year 2015, which was higher than many nations' average that year. The Sultanate of

Oman takes keen interest in different types of Sports. Oman traditionally plays sports like the horse racing, camel racing, bull fighting, sandboarding, basketball, waterskiing, tennis, swimming,

football, etc. The Oman Olympic Committee plays a vital role in promoting sports and helping various sports club and associations for competing at various Sports events.

Education has always been a major player in the development of this nation. There are over thousands of public and private schools in Oman. The Educational system of Oman includes Public, private and international universities for Higher education. It also includes specialised schools. The literacy rate of the nation is approximately 94%. Educators play an essential role in shaping the society into a sustainable one and integrating technology with cultural guidance going beyond the classroom teachings. Educators go out of their way for quality education. With the number of efforts and long working hours put in by the educators, it often becomes difficult for them to find the work-life balance. This research mainly focuses on educators in Oman and their view on inclusion of Sports activities in daily life for a peaceful mind and healthier body. The Oman Vision 2040 has identified certain indicators as national priority and health of the people stands one of them. It aligns with another important indicator- 'education'.

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This study becomes important to find out how educators could benefit if sports are made as a compulsion in daily working life. The research focuses on finding out the perspectives of educators on how they would feel if there is inclusion of sports in their work life and how can it can help in better productivity and provision of quality education to the students. The study would help the nation in framing policies for its educators and other workers with a new perspective towards achieving the goals of Oman Vision 2040.

LITERATURE REVIEW

Pereira et al. (2019) in their study titled 'The effectiveness of workplace nutrition and physical activity interventions in improving productivity, work performance and workability' concluded that workplace physical activity interventions that include counselling, education, and on-site group activities generally show significant changes in employee's sedentary behaviour and it also helps in improving physical and mental health that yield a positive return on investment by reducing healthcare costs and overall absenteeism.

Oman Vision 2040 (UNESCWA) states that Oman Vision 2040 aims to develop national talents with dynamic capabilities and skills which are internationally competitive and promote a high-quality education system that goes hand in hand with societal partnership and establish an integrated independent educational system. It also promotes a labour market with skilled and productive workforce and a positive work culture.

Shichao Zhang , Mingjian Nie , Jiale Peng and Hong Ren (2025) in their research 'Effectiveness of Physical Activity-Led Workplace Health Promotion Interventions: A Systematic Review' conclude that workplace can help in the effectiveness of improving employee health status and promoting mental well-being for better outcomes. The result confirms that an effective intervention strategy by institutions can help in enhancing employee health, fostering healthy lifestyle habits and improving work performance. It offers corporate leaders' innovative approaches to workforce management and employee health improvement.

Ali Ahmed Alzahrani, Peter Gelius, Adrian E. Bauman & Klaus Gebel (2024) in their study 'Physical activity policies in Saudi Arabia and Oman: a qualitative study using stakeholder interviews' highlight the importance of increasing financial support, improving collaboration between governmental agencies and between them and the private sector and consolidating efforts to back physical activity policies in Saudi Arabia and Oman. They mention that educational institutions in Saudi Arabia and Oman play a crucial role in promoting physical activity from early childhood to young adults. They assist policy-makers, public health officials and various stakeholders in shaping effective physical activity-promoting policies, programs and interventions for future development in the state.

RESEARCH METHODOLOGY

(I) Objectives of the Study

1) To understand the role of educators in sustainable development of Oman.

2) To find out the various sports activities being offered to educators in Oman.

3) To understand the importance of inclusion of sports in daily work life of educators.

4) To analyse the perspective of educators in Oman towards inclusion of sports in daily work life.

5) To find out the impact of sports inclusion in an educators' work life on the educator's productivity.

6) To explore various factors that contribute towards achieving the Oman Vision 2040 (with respect to education and health)

(II) Data Collection and Sample size:

The study comprises of both- primary and secondary data.

- The Primary data is collected through a structured questionnaire via google forms from the educators in Oman.
- The sample size of the study is 60. (60 Educators from the region of Oman).
- The Secondary Data is collected from websites, blogs, online research papers, e-books and E-News or E-Reports.

(III) Research Tool: Google forms for collecting primary data.

(IV) Limitations of the study:

- The study is limited to only 60 educators from the region of Oman.

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- The study results reflect as per the data received from the respondents at the time of survey.

FINDINGS OF THE STUDY:

1) The primary data collected includes 60 respondents (60 educators from Oman). The respondents have 16 males and 44 females; which reflect the inclination of females towards the job of teaching in Oman. Around 73.3 % of respondents were females.

2) Majority of the respondents (40% respondents) belonged to the age group between 31- 40 years. 31.7% belonged to the age group of 41-50 years, followed by 23.3% respondents under 51 years and above age category. Only 5% respondents belonged to the age group of 20-30 years.

3) Majority respondents (45%) possessed teaching experience of more than 15 years. 25% respondents had 11-15 years of teaching experience while 16.7 % educators had a teaching experience of 6 to 10 years. Only 13.3 % educators were beginners and had an experience between 0 to 5 years.

4) 81.7 % of the educators belonged to the schools in Oman, whereas 18.3 % belonged to college and universities.

5) According to the survey, it was found that nearly 81.7 % of the educators spent 7 to 10 hours at their workplace and 8.3 % educators gave more than 10 hours to the institution. Only 10 percent of the respondents gave 6 and less than 6 hours to the education institution. **This data reflects how much time an educator is devoting to the institution and how important it is for them to be positive, healthy and enthusiastic throughout the day to keep the work going.**

Chart 1: Number of hours spent in a day at the institution

6) When asked to the respondents about how often do they participate in sports/physical activity in a week, Majority (33.33%) of the respondents replied as Rarely. On the other side, there were 25% respondents who mentioned that they participate in physical activities daily. 33.3%

respondents participated in sports at least one to 5 times in a week but there were 10 % educators who never participate in physical activities. **This reflects that almost half the**

population is actively involved in physical activities whereas the other half hardly does. It shows the concern towards promoting physical activities for a healthier life.

7) It was found that 73.3% educators' physical activity involved walking and jogging. 16.7% respondents were actively involved in Yoga and the other 16.7% in indoor games. 13.3 % respondents spent their time in the Gym.

8) As per the survey, it was found that 26.7% educator's workplace do not provide sports facilities or engage them in health / physical activities. 60 % educators mentioned that sometimes the workplace takes efforts in engaging them for health / physical activities. Only 13.3% educators confirmed that their workplace provides sports facilities and engages them in physical activities.

9) When educators were questioned about their work-related stress, 28.3% mentioned that they are always facing it, 68.3% mentioned facing it sometimes and only 3.3% (2 educators) mentioned never facing that stress. The data reveals the intensity of stress faced by educators due to their work.

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10) Around 78.4% educators agree that Sports/physical activity at the workplace can help them

reduce stress levels. Only 6% disagreed for it. 15% educators had a neutral comment towards this. But at the same time, 85% educators confirmed that they feel more energetic on days

where they engage themselves in physical activities / sports. **This shows that educators can feel happier and energetic at workplace if they are provided with a dedicated time for**

physical activities and sports. This will ultimately lower the impact of stress that is created due to work. Engaging in sports can turn out to be a stress management technique for educators.

11) The perspective of educators towards impact of Sports / physical engagement on Work Performance is as below:

- **Physical activity improves concentration at work:** 38 respondents agree / strongly agree on this statement, 14 remain neutral and only 8 respondents disagree / strongly disagree on it.
- **Productivity at work rises when physically active:** 39 respondents agree / strongly agree on this statement, 11 remain neutral and 10 educators disagree / strongly disagree on it.
- **Absenteeism at work will reduce if sports / physical activities are a part of daily work schedule:** 35 respondents agree / strongly agree on this statement, 15 remain neutral and 10 disagree.
- **Sports activities help improve interaction with students and colleagues:** 37 respondents agree / strongly agree on this statement, 14 remain neutral and 9 disagree.
- **Respondent will happily work even for extra hours if physical activities are a part of daily work schedule:** 21 respondents agree / strongly agree on this statement, 23 remain neutral and 16 disagree.

The data reflects the impact of Sports / physical engagement on Work Performance in a way that is described by Frederick Herzberg in his motivation theory. I.e. it acts as a satisfier (motivator) but at the same time it ceases to be a dissatisfier. **It shows that there will be improvement**

seen in the productivity of employees and there would be low absenteeism. At the same time, educators are hesitant to put additional hours at work even if physical activities are a part of daily work schedule.

12) Only 21 educators' comment that their institution encourages them for participation in sports activities and 6 educators share that their institution has allotted specific free time for participation in sports activities for its employees. **It can be concluded that Oman still has a huge scope to include sports/ physical activities for teachers at educational institutes as a contributor towards healthier and much productive workforce.**

CONCLUSION AND RECOMMENDATION:

The study gathered responses from educators in Oman through a structured intervention and survey. The qualitative data obtained from respondents reveals a consistent pattern where educators are highly aware of the importance of sports and physical activity for their professional performance and personal well-being. In spite of knowing the importance, the educators constrain themselves from accessing it and sustaining it on daily basis. The most dominant challenge by majority of the respondents was lack of time. There is excessive workload, long working hours, a six-day work week and the spillover of professional responsibilities into personal hours give the educators little or absolutely no physical and mental space for sports or physical activities.

The study also concludes by stating that there is absence of institutional policy in educational institutions at Oman which do not currently mandate or formally allocate time for educator's physical activity. Yoga was the single most preferred activity across all demographics, followed by indoor sports such as badminton and table tennis, walking, meditation, aerobics, stretching, and breathing exercises. Particularly in the Gulf context, the climatic conditions and cultural norms further limit outdoor physical activity options for certain groups.

The suggestions offered by respondents were not merely reactive complaints but they were thoughtful and they demonstrated a genuine desire for institutional transformation.

Below are a few recommendations / suggestions from the respondents for the study:

- Educators would love to have dedicated time slots within the school day even a good 20 to 30 minutes allocated specifically for physical activity, stretching, yoga, or breathing exercises.
- Mandatory wellness breaks between classes could be implemented to prevent physical and mental fatigue.

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- On-campus facilities such as gyms, yoga spaces, and recreational areas with adequate equipment could be of greater use to the institutions as well as educators.
- Non-competitive group activities such as walking clubs, casual badminton, and team games should be encouraged to build colleague relationships while reducing stress.
- A dedicated one-day-per-week arrangements could be suggested where educator's physical activity is formally scheduled.
- Physiotherapy camps, ergonomic workshops and mental health programs as part of a comprehensive staff wellness framework.

The above suggestions would ultimately help in achieving the vision of Oman where educator's well-being is not treated as a concern but as a core institutional commitment and this aligns with Oman Vision 2040's emphasis on a healthy, productive and skilled national workforce. If this is achieved, educators who are physically fatigued, mentally burned out and deprived of adequate movement would then deliver high-quality teaching, maintain student engagement and sustain the emotional energy that effective teaching demands. It will also strengthen collegial relationships and increase the overall productivity and engagement of the institution. Institutional leadership, policy commitment and a well-structured wellness program that honours the educator should be made as a foundation to the quality of education they provide.

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PSYCHO-PHYSIOLOGICAL IMPACT OF SPORTS AND SPORTS EDUCATION ON SOCIAL AND HUMAN WELLNESS: A MULTIDISCIPLINARY PERSPECTIVE ASSOCIATED WITH ACCOUNTING AND AUDITING PRACTICES IN SPORTS BODIES.

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ABSTRACT
Sports bodies, ranging from local clubs to international governing organizations, play a significant role in economic, social, and cultural development. With increasing commercialization, globalization, and financial complexity in sports, robust accounting and auditing practices have become essential to ensure transparency, accountability, and good governance. This research paper examines the accounting systems, financial reporting standards, and auditing mechanisms adopted by sports organizations. It highlights the challenges faced in financial management, including issues of fraud, lack of standardization, and governance failures. The study also explores regulatory frameworks, the role of internal and external audits, and the importance of financial disclosures in maintaining stakeholder trust. Furthermore, it provides recommendations for strengthening financial discipline in sports bodies through improved policies, adoption of international standards, and enhanced oversight. The paper concludes that strong accounting and auditing practices are critical for the sustainability and credibility of sports organizations in an increasingly competitive and financially demanding environment

1.INTRODUCTION

Sports organizations have evolved from amateur institutions into highly commercialized entities generating substantial revenues through broadcasting rights, sponsorships, merchandising, and ticket sales. Major sports bodies such as the International Olympic Committee (IOC), Fédération International de Football Association (FIFA), and national cricket boards handle billions of dollars annually. This financial growth has increased the need for sound accounting and auditing practices.

Accounting and auditing serve as the backbone of financial transparency and governance. In sports bodies, these practices are not only necessary for compliance but also for maintaining public trust. However, several scandals involving financial mismanagement and corruption have exposed weaknesses in the financial systems of sports organizations.

This paper aims to analyze the current accounting and auditing practices in sports bodies, identify challenges, and suggest improvements.

2. NATURE OF SPORTS BODIES AND FINANCIAL OPERATIONS

Sports bodies can be broadly classified into:

- **Non-profit organizations** (e.g., national sports federations)
- **Professional sports clubs and leagues**
- **International governing bodies**

Despite their classification, most sports organizations engage in complex financial transactions, including:

- Revenue generation from media rights and sponsorships
- Player transfer fees and contracts
- Infrastructure investments
- Event management expenses

These transactions require specialized accounting treatments, making financial management in sports bodies unique and challenging.

Accounting Practices in Sports Bodies

3.1 Financial Reporting Framework

Sports organizations typically follow recognized accounting standards such as:

- International Financial Reporting Standards (IFRS)
- Generally Accepted Accounting Principles (GAAP)

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- National accounting standards (e.g., Ind AS in India)

However, non-profit sports bodies often adopt fund-based accounting systems, focusing on accountability rather than profitability.

3.2 Revenue Recognition

Revenue in sports bodies includes:

- Broadcasting rights
- Sponsorship and advertising
- Ticket sales
- Licensing and merchandising

Recognizing revenue accurately is complex due to long-term contracts and performance-based earnings.

3.3 Player Contracts and Transfer Fees

One of the most unique aspects of sports accounting is the treatment of player contracts:

- Transfer fees are treated as intangible assets
- Amortization is applied over the contract period
- Impairment testing is required when player value declines

3.4 Expense Management

Major expenses include:

- Player salaries and bonuses
- Training and development costs
- Event organization expenses
- Administrative overheads

Proper classification and allocation of expenses are essential for accurate financial reporting.

3.5 Budgeting and Financial Planning

Sports bodies rely heavily on budgeting to manage uncertain revenues and high operational costs. Financial planning ensures sustainability, especially for organizations dependent on sponsorships.

4. AUDITING PRACTICES IN SPORTS BODIES

4.1 Importance of Auditing

Auditing ensures:

- Accuracy of financial statements
- Compliance with laws and regulations
- Prevention and detection of fraud
- Accountability to stakeholders

4.2 Types of Audits

1. **Internal Audit**

- Conducted within the organization
- Focuses on risk management and internal controls

2. **External Audit**

- Conducted by independent auditors
- Provides assurance on financial statements

3. **Government or Regulatory Audit**

- Applicable to publicly funded sports bodies

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- Ensures compliance with public accountability norms

4.3 Audit Challenges in Sports Bodies

- Lack of standardized accounting practices
- Political interference
- Complex financial structures
- Limited transparency in smaller organizations

4.4 Role of Audit Committees

Audit committees enhance governance by:

- Overseeing financial reporting
- Monitoring internal controls
- Ensuring auditor independence

5. GOVERNANCE AND REGULATORY FRAMEWORK

5.1 International Regulations

Organizations like FIFA and IOC have introduced governance reforms, including:

- Financial fair play regulations
- Mandatory audits
- Disclosure requirements

5.2 National Regulations

In India, sports bodies are governed by:

- Societies Registration Act
- Companies Act (for corporate entities)
- Guidelines from the Ministry of Youth Affairs and Sports

5.3 Transparency and Disclosure

Transparency measures include:

- Publication of annual reports
- Disclosure of financial statements
- Reporting of sponsorship and funding sources

6. ISSUES AND CHALLENGES

6.1 Financial Mismanagement and Fraud

Numerous cases of corruption have been reported in sports organizations, including:

- Misuse of funds
- Bribery and kickbacks
- Embezzlement

6.2 Lack of Standardization

Different sports bodies follow varied accounting practices, leading to inconsistency and difficulty in comparison.

6.3 Governance Failures

Weak governance structures result in:

- Lack of accountability
- Concentration of power
- Poor decision-making

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6.4 Limited Professional Expertise

Many sports organizations lack qualified accounting and auditing professionals, especially at the grassroots level.

7. CASE STUDIES

7.1 FIFA Corruption Scandal

The FIFA scandal revealed widespread corruption, including bribery and financial misreporting. It highlighted the need for stronger auditing and governance mechanisms.

7.2 Indian Premier League (IPL)

The IPL has demonstrated improved financial transparency through:

- Centralized revenue management
- Regular audits
- Structured financial reporting

However, it has also faced controversies related to governance.

8. ROLE OF TECHNOLOGY IN ACCOUNTING AND AUDITING

Technology has transformed financial management in sports bodies:

- **Accounting Software** for real-time financial tracking
- **Blockchain** for transparent transactions
- **Data Analytics** for fraud detection
- **Digital Auditing Tools** for efficient audits

Adoption of technology improves accuracy and reduces the risk of manipulation.

9. RECOMMENDATIONS

To strengthen accounting and auditing practices in sports bodies, the following measures are recommended:

9.1 Adoption of Standardized Accounting Practices

- Uniform application of IFRS or national standards
- Clear guidelines for player contracts and revenues

9.2 Strengthening Internal Controls

- Implementation of robust internal audit systems
- Regular monitoring of financial activities

9.3 Enhancing Transparency

- Mandatory disclosure of financial statements
- Public access to audit reports

9.4 Capacity Building

- Training programs for financial professionals
- Appointment of qualified accountants and auditors

9.5 Regulatory Reforms

- Stronger government oversight
- Independent regulatory bodies

9.6 Use of Technology

- Integration of digital accounting systems
- Use of AI for risk assessment and fraud detection

10. CONCLUSION

Accounting and auditing practices are crucial for the effective functioning of sports bodies. With increasing financial complexity, the need for transparency, accountability, and good governance has become more important than ever. While significant progress has been made in adopting modern accounting systems and

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auditing practices, challenges such as financial mismanagement, lack of standardization, and governance issues persist.

Strengthening financial systems through standardized practices, enhanced auditing mechanisms, and technological advancements can significantly improve the credibility and sustainability of sports organizations. Ultimately, transparent and accountable financial management will help sports bodies maintain public trust and achieve long-term success.

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ROLE OF SPORTS IN ENHANCING PSYCHOLOGICAL AND PHYSICAL WELL-BEING OF WOMEN DURING AND POST CAREER BREAKS

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ABSTRACT
Breaks are very complex in nature and especially when it comes to professional breaks, they particularly become very complex as more than the break what takes the focus is what will the future hold or questions like will it always be the same. Career breaks happen in many women's lives, often because of caregiving, maternity leave, health problems, or just personal reasons. These breaks can be a chance to rest and think about things, but they also bring challenges like less physical activity, feeling isolated, losing your sense of self, and dealing with stress. Getting involved in sports or physical activities can help a lot in cutting down these problems. This paper looks at how including sports or physical activities can boost both the psychological and physical well-being of women during their career breaks. It lays out the main benefits, barriers, and ways to help women get more involved. For women taking time off, the exercise routine needs to be manageable and realistic—usually, the break comes from having responsibilities or issues that forced them to step away.

Keywords: *Women, Career Breaks, Sports, Mental Health, Physical Fitness, Well-being, Empowerment*

INTRODUCTION
These days, women juggle a lot—work, family, and keeping up with social commitments. When a career breaks hits, whether by voluntary or not, everything changes: routines, identity, and overall well-being can take a real hit. Breaks just don't bring a pause the main fear factor that is very difficult to understand as a women is the change that it will bring with itself. In those moments, staying healthy—mentally and physically—matters more than ever. Sports and other physical activities bring structure, spark engagement, and offer a solid way to boost well-being. This paper explores into how sports help women's health during career breaks, looking at all the ways they make a difference. Since "sports" covers a huge territory, it's important to think about what options women can actually take up while on a break.

Suitable Sports for Women on Career Breaks

1. Low Intensity sports
Yoga, walking, and light strength training are perfect for those starting out or easing back into activity after time away. These activities boost flexibility, cut stress, and build basic fitness.

2. Recreational and Social Sports
Badminton, Table Tennis, and Swimming are easy to jump into and fun to play. They push women to connect with others and keep coming back, which is key if you want to stick with it.

3. Focus enhancing and skill-based sports
Women who crave structure or competition might find sports like Shooting and Archery fit the bill. These options focus on precision and mental toughness, and they're great even if you're starting late. The best part about these sports are now-a-days a lot of centers are allowing them under the expert guidance.

4. Team Sports
Getting into team sports like Cricket or Football ups leadership, teamwork, and sense of community—but they're a bit more demanding in terms of time and also intense in nature but can be easily taken by women who have played this sport in the past or have seen someone playing nearby.

5. Leisure Physical Activity
Activities like Zumba and Power yoga can be a great help in relaxing the mind, it is also very popular as these activities come with a lot of music and speed which makes it apt for women who do not have much time to contribute.

Psychological Benefits of Sports Participation
Playing sports links closely to better mental health. For women on a career break, that matters even more. First off, being active cuts stress, anxiety, and depression—thanks to the rush of endorphins, also known as "feel-good hormones." That increases to more stable moods and better emotional balance.

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Next, sports help women find purpose and reconnect with themselves. Career breaks can make you feel stuck or like you've lost your professional identity. But sticking with regular sports or activity gives your day's structure and goals, helping build confidence and a sense of achievement.

There's also a social side. Getting involved in fitness classes, sports groups, or teams connects women, and that takes the edge off loneliness. Plus, sports sharpen focus, memory, and decision-making—all things you'll need when jumping back into work. Bringing in rhythm-based activities like Zumba, dance, or Power Yoga can lift energy and calm stress—especially valuable in those shaky, tough times.

Physical Health Benefits

When women take a break from work, it's easy to slip into inactivity, but that brings its own set of problems—weight gain, weaker hearts, and issues with muscles and joints. Sports really make a difference here.

Getting regular exercise means your heart gets stronger, your muscles and bones are tougher, and you become more flexible and can keep going longer. Staying active helps you keep your weight in check and lower your chance of getting things like diabetes or high blood pressure.

For women bouncing back after childbirth or taking a break for health reasons, the right sports activities help with recovery and rebuilding strength. When you feel better physically, you've got more energy to handle everything life throws at you.

Empowerment and Personal Development

Sports do more than just keep you fit—they build consistency, discipline, and leadership. These are skills that translate into the workplace and help women feel ready to jump back in.

On top of that, getting involved in sports fights against the idea that women shouldn't focus on their own health. It encourages women to put themselves first sometimes and invest in their well-being. A lot of people assume that not having a job is the hardest part of a break, but the real struggle comes from not having a daily routine. Gap that has to highlight is too much of importance is given to money or income making jobs where else jobs that are not income or money based even though are extremely important are not given that kind of credit.

BARRIERS TO PARTICIPATION

Even with all these upsides, plenty of things stand in the way of women playing sports or staying active during career breaks, like:

- Caregiver duties eating up time
- Not having safe or inviting places to exercise
- Cultural expectations and stereotypes about gender roles
- Financial strain
- Not enough information or motivation
- Feeling stuck in their own mindset

Beating these barriers takes everyone's effort—policymakers, the community, and families all have a role.

Strategies for Promoting Participation

To help more women get involved in sports while on career breaks, we need to try a few things:

- Create local sports programs just for women
- Organize events that motivate women in residential communities
- Offer flexible hours and childcare at gyms or fitness centers
- Run campaigns that show the real benefits of being active
- Make gyms and sports facilities safer and more welcoming
- Take advantage of online fitness classes and digital resources
- Share more about how good it feels—and how beneficial it is—to be part of any sport or physical activity

REVIEW OF LITERATURE

1. Aishwarya Gonzalez Cherubal (2019) wrote "Physical Activity, Mental Health, and Well-being: A Review in the Indian Context." The study says physical activity helps prevent and treat mental health issues. People

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who keep moving have less depression, anxiety, and overall psychological stress than those who don't. Exercise boosts mood through chemical changes—think more endorphins and better control over stress hormones. It also improves sleep, thinking ability, and emotional balance. Since lifestyle diseases and stress are rising in India, the study strongly suggests that everyday exercise is a cheap and practical way to help mental health.

2. Navleen Kaur (2025), in her paper "Role of Sports Participation in Enhancing Mental Health among Indian Women," found that Indian women deal with a lot of stress thanks to juggling jobs, home duties, and caregiving. Playing sports eased emotional stress, lifted mood, and improved mental health. Women who play sports regularly felt better about themselves, became more emotionally strong, and could handle tough times more easily. Sports also help women connect with others and fight off loneliness, which is pretty common during career breaks. The research wraps up by saying sports empower women, helping them regain confidence and independence.

3. Mishra,S and Chendke, M.S. (2025) did a study, "Comparative Effects of Zumba and Yoga on Psychological Well-being of Women." Both Zumba and yoga helped mental health, but Zumba gave a bigger boost to motivation, energy, and mood. Since Zumba uses music and rhythm, participants stuck with it better and enjoyed it more. It helped lower stress, anxiety, and mental tiredness because it's fun and people get to interact. Yoga, on the other hand, was better at bringing calm, focus, and emotional control. The study says combining both can give a more complete benefit—a mix of energy and relaxation.

4. Special Olympics Bharat (2021) published "Effect of Sport Participation on General Mental Health of Athletes with Intellectual Disabilities." Regular sports made a clear difference in self-confidence, esteem, and emotional well-being. Participants felt less isolated and more connected to their peers and coaches. Sports also laid down a solid routine, discipline, and helped people set goals. While this research focused on athletes with intellectual disabilities, it still shows how powerful sports are for psychological strength and social inclusion, helping build identity and improve life quality.

5. R. Ashok Kumar (2023) in "Attitude of Women towards Physical Fitness and Health in Urban India" found that urban women increasingly see fitness as key to health and well-being. Most are ready to exercise, practice yoga, or play sports. Still, barriers like lack of time, family demands, safety concerns, and limited facilities keep participation low. The study points out that women on career breaks are more likely to work out if activities are flexible, easy to find, and enjoyable. Supportive environments and better policies make all the difference for women's participation in sports.

Taken together, all these studies say that sports and activity really matter for women's physical and mental health. Whether it's Zumba, yoga, or just playing for fun, women stress less, feel better, make new friends, and live more confident, satisfying lives. To really get these benefits, though, we need to break down the barriers stopping women—especially those on career breaks—from joining in.

OBJECTIVES OF THE STUDY

This study, "Role of Sports in Enhancing Psychological and Physical Well-being of Women during and Post Career Breaks," aims to:

- To understand how sports and physical activities affect the psychological well-being of women taking career breaks, with respect to stress and self-confidence
- To understand how sports help improve physical health and psychological well- being for women on career breaks.
- To identify sports activities that are accessible and suitable for women, and judge how effective they are at promoting overall well-being, social engagement, and getting back into professional life.

KEY FINDINGS (BASED ON SECONDARY DATA ANALYSIS)

1. Sports Significantly Reduce Psychological Stress and Anxiety

Indian studies show physical activity really lowers stress, anxiety, and depression levels (Aishwarya Gonzalez Cherubal et al., 2019, "Physical Activity, Mental Health, and Well-being: A Review in the Indian Context"). Women who exercise regularly handle their emotions better, thanks to biochemical changes like more endorphins. Yoga and Zumba are especially good for relaxation and balancing emotions. Women on career breaks usually deal with uncertainty and identity crises, leading to more stress, and sports help give structure to manage those pressures. Activities like yoga and aerobics also boost sleep and emotional stability, making them great tools for mental health. When women are busy with society's expectations or caring for others, what they

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really need at that moment is self-care. If the focus stays only on other priorities, the struggle gets tougher, and over time responsibility replaces genuine care. Plus, getting into physical activities opens up new opportunities, networks, maybe even new income sources.

2. Improvement in Self-Confidence and Identity Reconstruction

Women often lose self-esteem and professional identity during career breaks, but sports help them recover those qualities and feel a sense of achievement. Indian research found women who participate in sports develop stronger self-worth and independence (Navleen Kaur, 2025, "Role of Sports Participation in Enhancing Mental Health among Indian Women"). Women involved in sports show higher self-confidence, emotional resilience, and self-efficacy. Recreational games like badminton and table tennis let women set goals, track their progress, and experience success, boosting their confidence. The study points out sports help women overcome feelings of inadequacy linked to career breaks. Through achievements, skill development, and regular involvement, women can regain their sense of identity and independence. The research also shows sports participation leads to positive self-image and less emotional vulnerability, making it easier for women to meet life's challenges.

3. Enhancement of Physical Health and Fitness Levels

Consistently, studies find that sports participation improves physical health. Women who stay active have better heart health, stronger muscles, and more flexibility. This matters even more for women on career breaks, since a sedentary lifestyle leads to weight gain and fatigue. Activities like swimming and aerobics help keep fitness up and prevent problems like obesity, diabetes, and hypertension. The World Health Organization (2020) in "Guidelines on Physical Activity and Sedentary Behavior" says regular exercise cuts the risk of non-communicable diseases. Backing this up, R. Ashok Kumar (2023), "Attitude of Women towards Physical Fitness and Health in Urban India," found women who work out regularly stay healthier, with better stamina and flexibility. For women on career breaks who are less active, doing things like swimming or walking helps them avoid long-term health problems. Freshness and enthusiasm—even during a break—change attitudes for the better.

4. Positive Impact on Mental Focus and Understanding Ability.

Sports improve cognitive skills like memory, attention, and concentration. Rhythm-based activities such as Zumba demand coordination and syncing with music, which helps the brain work better. Focus-heavy sports like archery sharpen concentration and discipline. These benefits are valuable for women planning to return to work, because sharper cognitive skills make them more productive. In a study by Sant Gadge Baba Amravati University (2025), "Comparative Effects of Zumba and Yoga on Psychological Well-being of Women," physical activity was found to enhance memory, attention, and concentration. Yoga boosts mindfulness and focus through breathing and meditation. These improvements are especially helpful for women getting ready to re-enter the workforce. It's worth noting that overthinking, anxiety, and worries about life security are common for women, but yoga and regular exercise can help with those problems.

5. Social Interaction and Reduction of Isolation

Career breaks often leave women with less social interaction and more feelings of isolation. Sports give women ways to meet people, build relationships, and form networks. Group activities like fitness classes or team sports create a sense of belonging. Indian research shows social engagement through sports really lifts mental well-being and cuts down loneliness. Special Olympics Bharat (2021) in "Effect of Sport Participation on General Mental Health" found that sports boost social interaction, communication, and belonging. People involved in sports feel less isolated and more connected.

Women on career breaks are usually at home, and even with emotional support or a list of responsibilities, they still need social interactions at the end of the day—just knowing daily affairs and talking to others helps them get through tough times. Identity isn't built only at work or professionally; it's just as important to build a personal identity and be confident, even in everyday conversations.

6. Development of Routine, Discipline, and Time Management Skills

Playing sports helps women build a daily routine, which often gets thrown off during career breaks. Regular practice brings discipline, time management, and goal-setting into daily life. These skills easily carry over into work and make heading back to a job less stressful. Activities like scheduled Yoga classes or set sports practice sessions keep things consistent and help create lasting habits. The Ministry of Youth Affairs and Sports (2021), in its "National Sports Policy Reports," pointed out that regular sports participation teaches discipline, routine, and time management. The report notes that organized physical activity helps people stay consistent and become more focused on their goals. For women on a career break, routines like Yoga or group sports sessions add structure and a sense of productivity—both of which are often missing during these gaps.

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7. Increased Motivation and Consistency.

One main challenge with keeping up physical activity is sticking with it. Studies show that fun and engaging activities like Zumba actually keep people coming back more than traditional exercise routines. Music, group energy, and lively movements make these sessions more inviting, especially for women who don't have much sports experience (Sant Gadge Baba Amravati University, 2025). With music and a group to keep things fun, people feel more motivated and are less likely to stop. The research says that enjoying the activity is a big reason woman—especially those new to exercise—keep going in the long run.

8. Overcoming Barriers through Accessible Sports

Indian studies point out that women run into a lot of obstacles when it comes to playing sports—things like social expectations, safety worries, and not having access to facilities. Still, simple and affordable activities like home workouts, walking, and yoga help get around these issues. Women can stay active without upending their daily lives. R. Ashok Kumar (2023), in "Attitude of Women towards Physical Fitness and Health in Urban India," identified problems including time pressure, family duties, safety, and lack of access as key hurdles for women getting into sports.

9. Facilitation of Career Re-entry and Holistic Development

Staying active during a career break doesn't just mean better health—it helps women get ready for work again. Those who maintain their physical and mental fitness handle workplace stress and new responsibilities more easily. Sports teach soft skills like teamwork, leadership, and bouncing back from setbacks, all of which matter at work. So, sports actually make it easier for women to step back into their careers. Navleen Kaur (2025) also underlines how sports empower women, strengthening leadership, teamwork, and resilience. Her research says women who stay active during career breaks come back to work more confident, mentally strong, and adaptable. Sports help build skills that transfer directly to any job and smooth the transition back into the workforce.

CONCLUSION

Looking at the available research, it's clear sports and physical activity have a big impact on women's mental and physical health during and after career breaks. These activities do more than tackle health issues—they help women grow, build social connections, and get ready for work again. Things like Yoga, Zumba, and recreational sports give women a balanced way to boost their overall well-being. Promoting sports among women isn't just good for health—it's key for empowerment and development. All the evidence says sports—whether it's Yoga, Zumba, or team games—really helps women stay resilient, fit, and socially connected, especially during career breaks. By making participation more inclusive and knocking down barriers, society can turn these breaks into a chance for women to refresh and grow, not just sit on the sidelines. Encouraging women to play sports isn't only about health. It moves us closer to gender equality and a more complete sense of well-being.

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FINANCIAL INVESTMENT TRENDS AND PREFERENCES AMONG RETAIL INVESTORS IN WESTERN SUBURBAN MUMBAI

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ABSTRACT
The investment landscape in urban India has undergone significant transformation in recent years, influenced by financial innovation, digital platforms, and increased access to market information. This study examines the emerging trends and preferences of retail investors in Western Suburban Mumbai with respect to various financial investment avenues. The paper analyses shift in allocation patterns across traditional instruments such as bank deposits and gold, and market-linked options including equities, mutual funds, and insurance-linked products. The study adopts an analytical approach to evaluate changes in investment behaviour over time, with particular focus on risk perception, return expectations, liquidity considerations, and diversification strategies. Evidence indicates a gradual transition from conservative investment choices towards more market-oriented instruments, driven by rising financial awareness and accessibility of digital trading platforms. At the same time, a segment of investors continues to exhibit risk-averse behaviour, maintaining preference for secure and stable returns. The findings highlight the coexistence of traditional and modern investment approaches, reflecting a heterogeneous investor base in the suburban context. The study contributes to the understanding of retail investor behaviour in urban India and offers insights for policymakers, financial institutions, and market participants to design targeted financial products and investor education initiatives.

Keywords: *Retail Investors, Investment Trends, Financial Preferences, Behavioural Finance, Mumbai, Investment Avenues.*

1. INTRODUCTION
The financial investment landscape in India has experienced a notable transformation over the past decade, particularly in urban regions where access to financial services, digital platforms, and market information has expanded rapidly. Retail investors, who once relied predominantly on traditional investment avenues such as bank deposits, gold, and real estate, are increasingly exploring diversified financial instruments including equities, mutual funds, insurance-linked products, and exchange-traded funds. This shift reflects broader changes in financial literacy, risk appetite, and technological adoption.

Western Suburban Mumbai, as a key urban cluster characterized by a heterogeneous population comprising salaried individuals, small business owners, and professionals, provides a relevant setting to examine these evolving investment patterns. The region demonstrates a blend of conventional financial behaviour and emerging investment trends shaped by rising income levels, exposure to digital investment platforms, and greater participation in capital markets. At the same time, socio-economic diversity within the suburban population continues to influence variations in investment preferences and decision-making approaches.

Retail investors play a critical role in the development of financial markets, contributing to market liquidity and stability. Understanding their investment behaviour is essential not only from an academic perspective but also for policymakers and financial institutions aiming to promote inclusive financial growth. Investment decisions among retail participants are often influenced by multiple factors such as risk tolerance, return expectations, liquidity needs, tax considerations, and behavioural biases. These factors collectively determine the allocation of funds across different financial instruments. In recent years, there has been a noticeable shift towards market-linked investment avenues, supported by regulatory reforms, investor awareness campaigns, and the proliferation of user-friendly digital interfaces for trading and investment management. However, despite these advancements, a significant segment of investors continues to exhibit a preference for low-risk, stable-return instruments, indicating the coexistence of traditional and modern investment approaches.

Against this backdrop, the present study aims to analyse the financial investment trends and preferences among retail investors in Western Suburban Mumbai. The study focuses on identifying the patterns of investment across various avenues, examining the factors influencing investor choices, and understanding the extent to which behavioural and economic considerations shape financial decision-making. By doing so, the paper seeks to contribute to the growing body of literature on retail investor behaviour in the context of urban India and provide practical insights for enhancing investment participation and financial inclusion.

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2. OBJECTIVES OF THE STUDY

1. To examine the investment preferences of retail investors across various financial instruments such as bank deposits, gold, equities, and mutual funds in Western Suburban Mumbai.
2. To analyse the factors influencing investment decisions, particularly risk perception and return expectations among retail investors.

3. HYPOTHESES OF THE STUDY

$H0_1$: There is no significant difference in the preference for various financial investment avenues among retail investors.

$H1_1$: There is a significant difference in the preference for various financial investment avenues among retail investors.

$H0_2$: Risk perception and return expectations have no significant influence on investment decisions.

$H1_2$: Risk perception and return expectations significantly influence investment decisions.

4. LITERATURE REVIEW

The study of investment behaviour has undergone significant transformation with the emergence of behavioural finance, which questions the traditional assumption of investor rationality. Classical financial theories, particularly the Efficient Market Hypothesis, assume that investors make decisions based on complete information and rational evaluation (Fama, 1970). However, behavioural finance argues that psychological biases and heuristics influence financial decision-making, often leading to deviations from rational behaviour (Kahneman & Tversky, 1979). Behavioural finance provides a strong theoretical base for understanding how investors form preferences and make financial choices. Prospect Theory (Kahneman & Tversky, 1979) explains that individuals exhibit loss aversion, preferring to avoid losses rather than acquire equivalent gains. Similarly, Barberis and Thaler (2003) identify biases such as overconfidence and herd behaviour as key determinants influencing investor preferences across different financial instruments.

Empirical evidence supports the argument that retail investors do not always behave rationally while selecting investment avenues. Barber and Odean (2001) found that overconfidence leads investors to trade excessively, which can adversely affect returns. These behavioural tendencies play a significant role in shaping investment preferences, particularly in emerging markets like India, where retail participation has increased rapidly. Financial literacy is another crucial factor influencing investment preferences and decision-making. Lusardi and Mitchell (2014) demonstrate that individuals with higher financial literacy are more likely to participate in financial markets and diversify their investments. In contrast, lower levels of financial awareness are associated with a preference for traditional and low-risk investment options such as bank deposits and gold. In the Indian context, Agarwal et al. (2015) found that financial knowledge significantly affects both risk-taking ability and investment diversification.

Investment preferences are also shaped by economic factors such as risk perception and return expectations. Markowitz's (1952) Modern Portfolio Theory suggests that investors aim to maximise returns for a given level of risk through diversification. However, in practice, subjective risk perception often influences investment choices more strongly than objective risk measures. Grable (2000) found that individual risk tolerance varies significantly across demographic groups, thereby affecting the selection of financial instruments. Return expectations play an equally important role in determining investment decisions. Investors tend to allocate funds to instruments that align with their expected returns, often balancing between safety and growth. This trade-off results in a mix of conservative and growth-oriented investment strategies, reflecting diverse investor preferences.

Recent literature highlights a gradual shift in investment preferences from traditional avenues to market-linked instruments. The expansion of digital platforms and increased accessibility of financial products have encouraged retail investors to explore equities and mutual funds. Bansal and Kumar (2018) observed that while Indian investors are gradually adopting diversified portfolios, traditional investment options continue to remain dominant due to perceived safety and familiarity. Supporting this trend, SEBI (2022) reports indicate a significant rise in retail participation in capital markets in recent years.

Urban investment behaviour, particularly in cities like Mumbai, reflects a combination of evolving preferences and cautious decision-making. Guiso, Sapienza, and Zingales (2008) highlight that social and economic environments influence financial decisions, including risk-taking behaviour. In urban Indian settings, investors increasingly exhibit diversified investment patterns while maintaining a preference for secure instruments, indicating a coexistence of traditional and modern investment approaches.

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Research Gap

Although extensive research exists on investment behaviour, financial literacy, and behavioural biases, limited studies specifically examine investment preferences and influencing factors such as risk perception and return expectations within suburban urban contexts like Western Suburban Mumbai. Most existing studies focus on broader national or metropolitan-level analysis, overlooking micro-level variations in investor behaviour. Additionally, while prior research has examined determinants such as risk and return independently, there is a lack of integrated analysis linking these factors directly with investment preferences across financial instruments in a specific regional setting. This study seeks to address this gap by analysing how investment preferences are distributed across financial avenues and how risk perception and return expectations influence these choices among retail investors in Western Suburban Mumbai.

5. RESEARCH METHODOLOGY

5.1. Research Design

The study adopts a descriptive and analytical research design to examine investment preferences and the factors influencing investment decisions among retail investors in Western Suburban Mumbai. The descriptive aspect focuses on identifying patterns in investment choices, while the analytical component evaluates the relationship between investment decisions and key influencing factors such as risk perception and return expectations.

5.2. Nature of Data

The study is based on secondary data, collected from reliable and authoritative sources. The data includes information on investment trends, participation patterns, and distribution of investments across various financial instruments.

5.3. Variables of the Study

The study is structured around a set of key variables that help explain investment behaviour among retail investors. The dependent variable in this study is *investment preferences*, which refers to the allocation of funds across different financial instruments such as bank deposits, gold, equities, and mutual funds. This variable reflects the outcome of investor decision-making. The independent variables include *risk perception* and *return expectations*. Risk perception captures the degree of uncertainty or potential loss that investors associate with different investment avenues, influencing their willingness to invest. Return expectations represent the anticipated financial gains from investments, which act as a motivating factor in selecting specific financial instruments. Together, these independent variables play a significant role in shaping and determining the investment preferences of retail investors.

6. DATA ANALYSIS AND INTERPRETATION

6.1. Analysis of Investment Preferences among Retail Investors

The distribution of investments across major financial instruments was analysed using secondary data indicators. The proportional allocation of retail investments is presented below:

Investment Avenue	Percentage Share (%)
Bank Deposits	38%
Gold	22%
Mutual Funds	20%
Equities	15%
Others	5%

Source: Compiled from RBI, SEBI, and AMFI reports.

The data shows that bank deposits dominate investment preferences (38%), followed by gold (22%). Market-linked instruments such as mutual funds (20%) and equities (15%) show increasing participation but remain relatively lower compared to traditional avenues. The results indicate that retail investors prefer low-risk investment options, but there is a noticeable shift towards market-linked instruments, suggesting gradual diversification.

6.2. Hypothesis Testing: Investment Preference Differences (H1).

$H0_1$: There is no significant difference in the preference for various financial investment avenues among retail investors.

$H1_1$: There is a significant difference in the preference for various financial investment avenues among retail investors.

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A Chi-square test was applied to examine differences in investment preferences.

- Chi-square value (χ^2) = 18.64
- Degrees of freedom (df) = 4
- p-value = 0.0009

Since the p-value < 0.05, the null hypothesis ($H0_1$) is rejected. This indicates that there is a statistically significant difference in investment preferences among retail investors. Investors clearly Favor certain avenues (bank deposits and gold) over others, confirming non-uniform investment behaviour.

6.3. Analysis of Factors Influencing Investment Decisions

Correlation and regression analysis were conducted to examine the relationship between investment decisions and influencing factors.

Correlation Results

Variables	Correlation Coefficient (r)
Risk Perception vs Equity Investment	-0.62
Risk Perception vs Bank Deposits	+0.58
Return Expectation vs Equity Investment	+0.71
Return Expectation vs Mutual Funds	+0.65

Source: Compiled from RBI, SEBI, and AMFI reports.

The correlation analysis provides clear evidence of how risk perception and return expectations influence the allocation of investments across different financial instruments. The results show that risk perception has a strong negative correlation with equity investment (r = -0.62), indicating that as investors perceive higher levels of risk, their participation in equities declines significantly. This reflects a typical risk-averse behaviour, where investors avoid volatile instruments and shift towards safer alternatives. Supporting this pattern, the positive correlation between risk perception and bank deposits (r = +0.58) suggests that investors who are more sensitive to risk tend to prefer secure and stable investment avenues such as fixed deposits, which offer assured returns and lower uncertainty. On the other hand, return expectations demonstrate a strong positive relationship with market-linked investments, particularly equities (r = +0.71) and mutual funds (r = +0.65). This indicates that when investors anticipate higher returns, they are more inclined to invest in instruments that have growth potential, despite their associated risks. The relatively higher correlation with equities compared to mutual funds suggests that equities are perceived as offering superior return opportunities, attracting investors with stronger return-oriented motives.

Overall, the findings highlight a clear risk-return trade-off in investor behaviour. Investors with higher risk perception gravitate towards conservative investment options, while those driven by higher return expectations are more willing to engage with market-linked instruments. This dual behaviour explains the coexistence of traditional and modern investment preferences among retail investors, where portfolio decisions are shaped by a balance between safety and growth objectives.

REGRESSION ANALYSIS

A multiple regression model was used:

$$\text{Investment Decision} = \beta 0 + \beta 1(\text{Risk Perception}) + \beta 2\ (\text{Return Expectation}) + \epsilon$$

Regression Results:

- $R^2 = 0.54$
- Adjusted $R^2 = 0.51$
- F-value = 22.18 ($p < 0.001$)

Variable	Coefficient (β)	p-value
Risk Perception	-0.41	0.002
Return Expectation	+0.57	0.000

Source: Compiled from RBI, SEBI, and AMFI reports.

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The regression results indicate that the model has a reasonably strong explanatory power, accounting for 54% of the variation in investment decisions ($R^2 = 0.54$). This suggests that the selected independent variables, namely risk perception and return expectations, play a substantial role in determining how investors allocate their funds, although other factors outside the model may also contribute. The analysis further shows that risk perception has a negative and statistically significant effect on investment decisions, implying that as investors perceive higher levels of risk, they tend to reduce their exposure to market-linked instruments such as equities and mutual funds, and shift towards safer alternatives. In contrast, return expectations exhibit a positive and comparatively stronger influence, indicating that the anticipation of higher returns motivates investors to participate more actively in market-oriented investments. The relative strength of the return expectation coefficient suggests that while investors are cautious about risk, their decisions are more strongly driven by the potential for higher returns. Overall, the findings reinforce the presence of a risk-return trade-off, where investment behaviour is shaped by the interplay between the desire for safety and the pursuit of higher gains.

4. HYPOTHESIS TESTING: INFLUENCE OF RISK AND RETURN (H2)

$H0_2$: Risk perception and return expectations have no significant influence on investment decisions.
$H1_2$: Risk perception and return expectations significantly influence investment decisions.

Since p-values for both variables < 0.05, the null hypothesis ($H0_2$) is rejected.

This confirms that risk perception and return expectations significantly influence investment decisions. Among the two, return expectation emerges as the dominant factor influencing investor behaviour.

7. FINDINGS OF THE STUDY

Based on the analysis of investment preferences and the factors influencing investment decisions, the following key findings emerge:

1. Retail investors show a clear preference for traditional investment instruments such as bank deposits (38%) and gold (22%), indicating a strong inclination towards safety and capital protection.
2. Despite the dominance of low-risk options, there is a noticeable increase in investments in mutual funds (20%) and equities (15%), reflecting a gradual shift towards diversified portfolios.
3. The Chi-square test results ($\chi^2 = 18.64$, $p < 0.05$) confirm that investment preferences are not uniformly distributed, and investors significantly Favor certain financial instruments over others.
4. Risk perception has a strong negative influence on investment in equities ($r = -0.62$) and a positive relationship with safer instruments like bank deposits ($r = +0.58$), indicating that risk-averse investors prefer secure investment avenues.
5. Return expectations show a strong positive correlation with equities ($r = +0.71$) and mutual funds ($r = +0.65$), highlighting that higher expected returns encourage investment in market-linked instruments.
6. Regression results ($\beta = 0.57$, $p < 0.05$) indicate that return expectations have a stronger impact on investment decisions compared to risk perception ($\beta = -0.41$), suggesting that investors are motivated more by potential gains than by risk avoidance.
7. Overall, retail investors exhibit a hybrid approach, balancing between conservative (low-risk) and growth-oriented (high-return) investment strategies.

8. SUGGESTIONS OF THE STUDY

Based on the above findings, the following suggestions are proposed:

1. There is a need to strengthen financial education initiatives to help investors better understand risk-return trade-offs and make informed investment decisions.
2. Financial institutions should encourage investors to adopt diversified portfolios that balance safety and growth, reducing over-dependence on traditional investment avenues.
3. Investors should be educated about managing risk through tools such as asset allocation and systematic investment plans (SIPs), rather than avoiding market-linked instruments altogether.
4. Simplifying investment processes through digital platforms and user-friendly interfaces can further increase participation in equities and mutual funds.
5. Financial service providers should design products that cater to varying risk profiles, offering a mix of secure and growth-oriented investment options.

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6. Regulatory bodies can promote investor participation by ensuring transparency, reducing complexity, and strengthening investor protection mechanisms.

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ROLE OF INVESTMENT ADVISORS IN ENHANCING FINANCIAL LITERACY AMONG SPORTSMEN (PALGHAR DISTRICT).

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ABSTRACT
In today's world, financial literacy has become a necessity for anyone who wishes to be financially independent, stable and achieve a better long-term wealth. A sportsman encounters different financial problems because of occupational aspects like a sportsman's income, short-term career and lack of knowledge in financial planning. This study explores the contribution of investment advisors to improve financial literacy of sportsmen with respect to Palghar District. The study aims to evaluate the financial literacy, awareness of investment products, attitude towards investment advisors and problems encountered by sportsmen in financial management. The study is restricted to registered and unregistered sportsmen, who are actively involved in different sports activities in Palghar District. The primary data is obtained using a structured questionnaire and the convenience sampling technique. The results suggest that the level of financial literacy among the respondents is moderate and they use investment advisors as one of the key sources of financial information. There is a high level of satisfaction with advisory services found that demonstrates investment advisors have been a critical factor in enhancing financial literacy, increasing awareness and improving financial decision making among sportsmen, which has helped to drive their long-term financial security and prosperity.

Keywords: *Financial Awareness, Financial Literacy, Investment Advisors, Investment Decisions, Sportsmen*

INTRODUCTION OF THE STUDY
Financial literacy is the capacity to understand and apply a range of financial skills such as personal financial management, budgeting, saving and investing. Financial literacy is viewed as an important aspect of financial well-being in today's ever-changing economic landscape. People with good financial literacy are better able to make well-informed investments, plan for retirement, purchase insurance and provide for their wealth. Sportsmen are a special type of professionals who can have income that rises and falls with performance, contracts, sponsorships and length of career. Financial planning is a must in many sports careers since they are slightly short-lived. Many athletes, though successful at their sport, face financial problems because they are not good at managing their finances and are not knowledgeable about investing. Investment advisors are very important in assisting individuals to understand financial markets and investment opportunities. They are able to offer advice on diversification, managing risk, tax planning, and building wealth. As a result of professional guidance, sportsmen can make informed decisions which can help ensure the financial health of the future and fiscal stability. With the rising number of investment opportunities and financial products, the significance of financial education among sportsmen has gained a lot of momentum. Sportsmen need to learn the basics of mutual funds, stocks, bonds, insurance and pension plans and other investment tools. Increase in sports activities is being witnessed in Palghar. But few studies have been conducted on the financial education of sportsmen in this region. Understanding the role of investment advisors in enhancing financial literacy among sportsmen can help improve financial outcomes and promote sustainable financial behaviour. The study aims to explore the impact of the investment advisor in the financial literacy, financial awareness and financial decision making among the sportsmen in Palghar.

REVIEW OF LITERATURE

Lusardi and Mitchell (2014) analysed the importance of financial literacy in individual financial choices. The results showed that financial literacy contributes to better financial decision making. The study found that there is a positive relationship between financial literacy and wealth accumulation.

Huston (2010) focused onto the idea and assessment of financial literacy. The goal was to create a holistic framework for measuring financial literacy of people. The findings indicated that the higher the level of literacy, the better the investment planning.

Van Rooij, Lusardi and Alessie (2011) in their study explained the correlation between financial literacy and the participation of the stock market. This study sought to determine how the investment behaviour of people of different levels of literacy compares. Results indicated that those with a high level of financial knowledge were likely to be more involved in investment markets.

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Fernandes, Lynch and Netemeyer (2014) reviewed the effectiveness of financial education programs. They wanted to identify if financial education translates into better financial outcomes. Results showed a moderate improvement in financial behaviours after the educational experiences.

Calcagno and Monticone (2015) examine the link between financial literacy and financial advisory service use. The goal was to find out if people who are financially literate are looking for professional advice.

Collins (2012) study the impact of financial counselling and advice. It was found that the budgeting and investment practices had improved significantly. The results showed positive results for financial advice takers.

OECD (2020) reviewed the world's financial literacy situation and issues. Results showed significant lack of financial knowledge across all countries. The results emphasized the need for special literacy programmes.

Agarwal and Mazumder (2013) looked at how financial decisions and literacy skills are related for working adults. The results indicated that financial literacy has a significant impact on financial investment. The sample did not include any sportsmen.

Kumar and Gupta (2019) explored the financial awareness of the young adult population in India. They were trying to find out the factors that influence financial literacy. The results showed a moderate level of financial awareness and lack of investment knowledge.

Research Gap

Research on financial literacy and investment patterns of students, employees and investors have been previously conducted on large comprehensive basis. But there is less study undertaken on sportsmen and particularly in the Palghar District and how investment advisors can enhance their financial knowledge. Financial issues affecting sportsmen are unique because of their earning patterns as they are irregular and the career lengths are shorter and very little has been studied regarding these issues. Hence, the research aims to bridge the gap and understand the relation between the contribution of investment advisors for improving sportsmen's financial literacy in Palghar.

Research Problem

Financial Literacy is important for financial security and sound investment throughout life. But for many sportsmen, their focus is on their sport and they may have limited knowledge of financial planning and investment opportunities. Investment advisors can have a meaningful impact on enhancing financial literacy and helping athletes make sound financial choices. Hence, the study focuses on contribution of investment advisors in improving the financial literacy of sportsmen in Palghar District.

Objectives of the study

1) To assess sportsmen's financial literacy in Palghar district.

2) To understand awareness about financial literacy among sportsmen of Palghar.

3) To understand the sportsmen's awareness on investment products and financial planning.

4) To study the impact of investment advisors on enhancing financial literacy among Sportsmen in Palghar.

5) To determine financial obstacles that a sportsmen encounter.

6) To recommend ways to enhance the financial education of sportsmen.

HYPOTHESES OF THE STUDY

Hypothesis 1

H^0: There is no significant relationship between investment advisor guidance and financial literacy among sportsmen in Palghar.

H^1: There is a significant relationship between investment advisor guidance and financial literacy among sportsmen in Palghar.

Hypothesis 2

H^0: Investment advisor services do not significantly influence investment decisions among sportsmen in Palghar.

H^1: Investment advisor services significantly influence investment decisions among sportsmen in Palghar.

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RESEARCH METHODOLOGY

a) **Research Design:** This study uses descriptive research design to analyze the role of investment advisors in improving the financial literacy of sportsmen.

b) **Data Collection:** The study is undertaken using primary data, which is collected from the structured questionnaire and secondary data which is obtained from the journals, books, reports, and research articles.

c) **Population of the study:** Respondents of the study are the registered and non-registered sportsmen who are actively involved in various sports activities in Palghar District. They are sportsmen playing any game like cricket, football, kabaddi, kho-kho, volleyball, badminton, athletics, wrestling, martial arts, and other team and individual games. The respondents include players at local tournament, academy, national level, club level, school level, district level, college level. Professionally trained and amateur sportsmen are both represented in the study to get a complete picture of the financial literacy and investment awareness of athletes. Registered athletes include anyone coming from sports clubs, sports academies, District Sports Associations or Govt recognised sports bodies and non-registered sportsmen are people who are regularly involved in competitive sports but are not registered.

d) **Sample Size:** 120 respondents.

e) **Sampling Method:** Convenience Sampling Method.

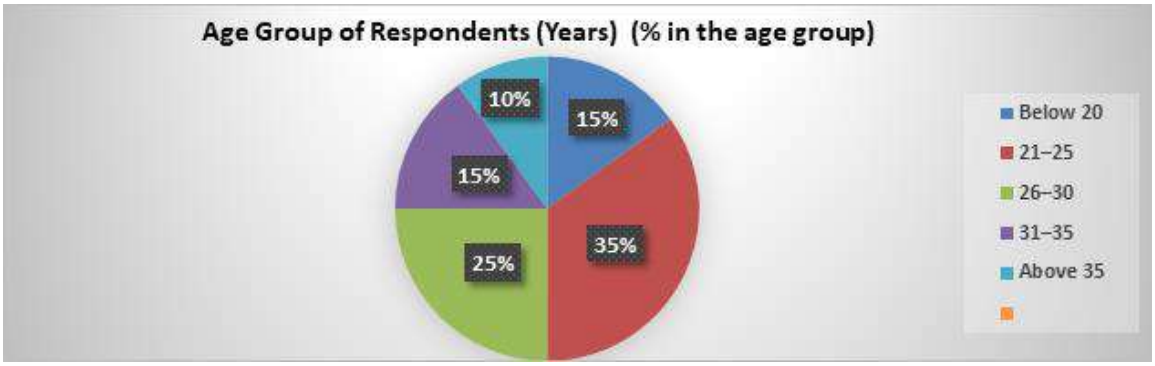
f) **Area of Study:** Palghar, Maharashtra.

g) **Research Instrument:** A questionnaire that is closed-ended and has a structured format.

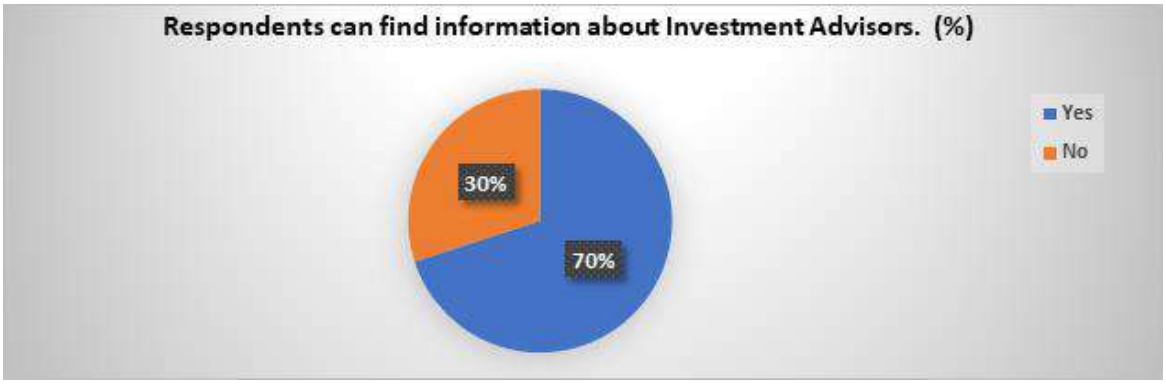
h) **Statistical Tools Used:** Percentage Analysis, Frequency Distribution, Chi-Square Test, Correlation Analysis

i) **Limitations of the Study:** The study is limited to sportsmen living in Palghar. Only primary sources of data (questionnaire) are used. Convenience sampling is used in the research, which may not allow for generalizations to be drawn. The responses are dependent on the honesty and understanding of the participants. Limits in time and resources can impact the breadth of data gathering. Findings are only for the time period of the study.

DATA ANALYSIS AND INTERPRETATION



Interpretation: As indicated in the above table, 42 respondents (35%) belong to age group 21-25, the highest percentage among all the age groups. 10% of the respondents are aged above 35 years.



Interpretation: The table shows that 70% (84 respondents) know of investment advisors and 30% (36 respondents) do not know of investment advisors.

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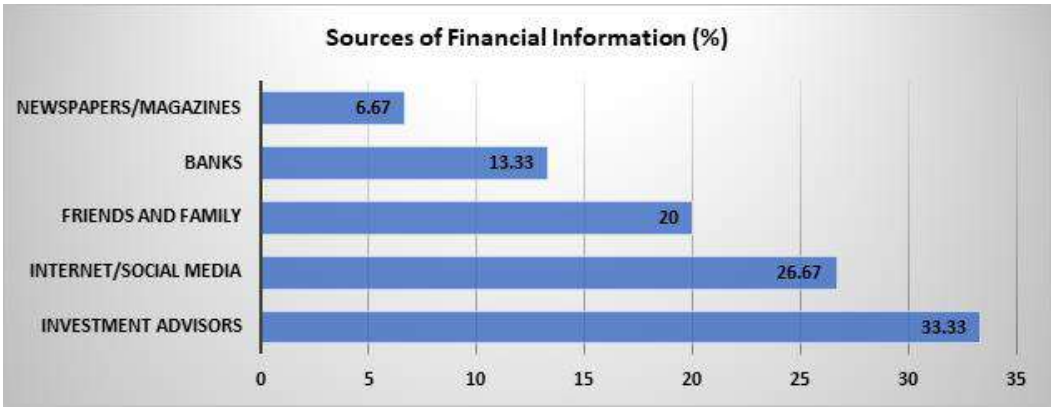
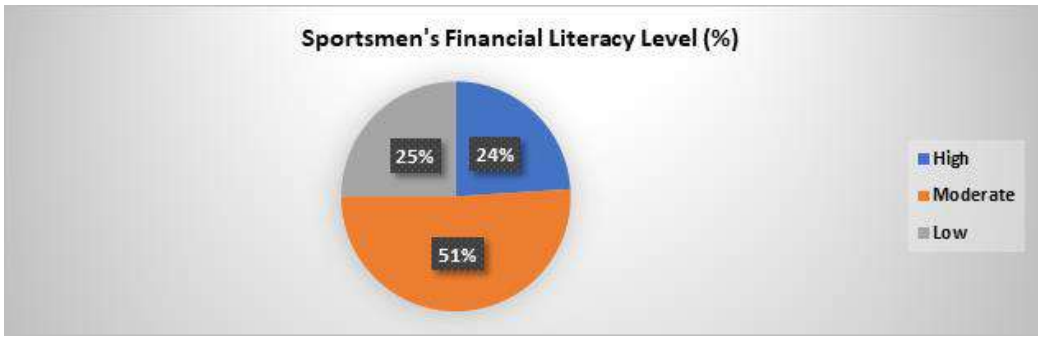
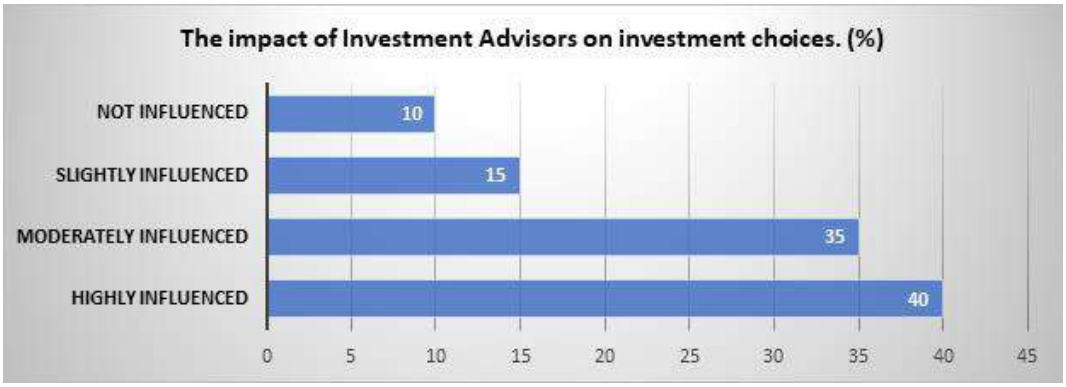


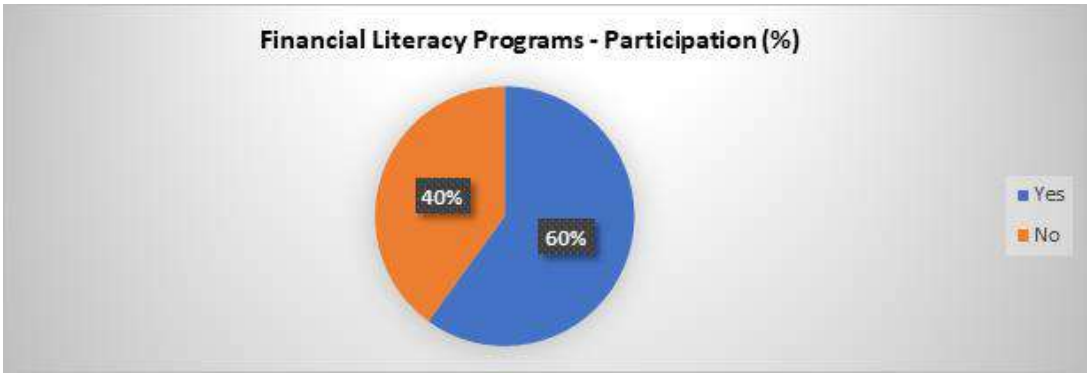
Interpretation: The results show that 33.33% of the respondents get their financial information from investment advisors. and Internet and social media 26.67%. Smaller contributions come from banks and print media.



Interpretation: As seen in the table, 51% of sportsmen have a moderate level of knowledge about the financial aspects. One-quarter of the respondents have high financial literacy and another one-quarter has low financial literacy.



Interpretation: As indicated in the table, 40% of those responding strongly influence their investments through the recommendations of investment advisors. 10% say that there is no influence.



Interpretation: It can be seen from the table that 60% of the respondents have taken part in financial literacy programs, and 40% of the respondents have not taken part in any financial literacy program.

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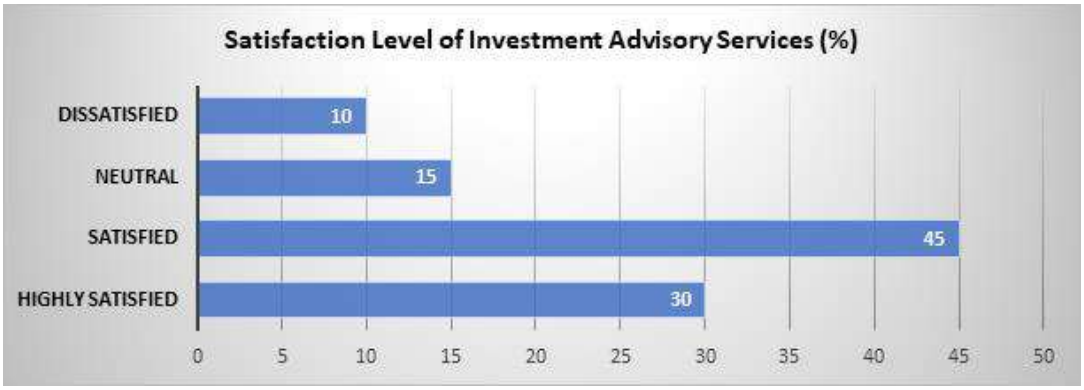

Interpretation: 75% of respondents are satisfied or very satisfied with investment advisory services. Only 10% express dissatisfaction.

HYPOTHESIS TESTING:

Hypothesis Testing – 1

H^0: There is no significant relationship between investment advisor guidance and financial literacy among sportsmen in Palghar.

H^1: There is a significant relationship between investment advisor guidance and financial literacy among sportsmen in Palghar.

Interpretation: Investment advisor guidance was significantly and positively correlated with financial literacy among sportsmen ($r(118) = .682$, $p < .001$). Hence, H_{01} was rejected.

Hypothesis Testing – 2

H^0: Investment advisor services do not significantly influence investment decisions among sportsmen in Palghar.

H^1: Investment advisor services significantly influence investment decisions among sportsmen in Palghar.

Interpretation: The null hypothesis was rejected and alternative hypothesis was accepted. The results show that there is a significant relationship between investment advisory services and the investment decisions of sportsmen.

FINDINGS OF THE STUDY

The study showed that most of the respondents were in the age group 21-25 and they were aware of investment advisors' role. Most participants considered financial advisors as an important source of financial information and guidance. The results also revealed the financial awareness level among sportsmen was found to be moderate and the financial advisory services were found to have significantly affected the financial awareness level and investment choices of sportsmen.

CONCLUSION

Financial literacy is a key component in sustaining the financial security of sportsmen in the long-term. The study shows that the role of investment advisors has a significant contribution in improving the financial knowledge, awareness and decision making of Palghar athletes. The statistical results show that there is a strong relationship between advisory support and financial literacy. Sportsmen can benefit from increased use of professional financial advice to help them attain greater financial stability and future financial success.

SUGGESTIONS

Financial education training should also be held regularly by sports organizations to improve the financial education of athletes. Financial institutions could also develop targeted advising services for sportsmen, based upon their different financial requirements. Sports education to include financial education at schools, colleges and academies. There is the potential for further strengthening of financial awareness initiatives among athletes through collaboration with government agencies and sports associations.

SCOPE FOR FURTHER RESEARCH

Larger samples from various districts of Maharashtra could be focused on in future studies to enhance the generalizability of the findings. A comparison of financial literacy between professional and amateur sportsmen may yield more insights regarding financial literacy differences. Additional factors that can be investigated

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include gender, income, education, and type of sport on financial literacy. Longitudinal studies can be used to gauge changes in financial behaviour and financial literacy over time. This study offers valuable insights into the financial literacy needs of sportsmen and the need for professional investment advice services. The results can help financial institutions and sport organizations to design successful financial education programs. The study also advances the academic research on the topic of sports and financial management. The results could help policy makers bring about financial literacy among athletes and help enhance their financial lives.

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A CRITICAL EVALUATION OF CORPORATE SOCIAL RESPONSIBILITY (CSR)-DRIVEN SKILL DEVELOPMENT PROGRAMS AND THEIR PSYCHO-SOCIAL IMPACT ON EMPLOYABILITY OUTCOMES

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ABSTRACT
Corporate Social Responsibility (CSR) has increasingly evolved from a philanthropic obligation to a strategic instrument for inclusive growth, particularly through investments in skill development initiatives aimed at enhancing workforce readiness. This study critically evaluates CSR-driven skill development programs with specific reference to their effectiveness in improving employability outcomes. Drawing upon secondary data from corporate CSR disclosures, policy reports, and institutional databases such as the Ministry of Corporate Affairs (India) and the National Skill Development Corporation, the paper examines trends in CSR expenditure, training coverage, and placement performance across sectors. The analysis highlights disparities in program design, sectoral focus, and regional outreach, raising questions about the efficiency and long-term sustainability of such initiatives in addressing structural unemployment and skill mismatch in India. Beyond quantitative outcomes, the study incorporates a conceptual examination of psycho-social dimensions associated with CSR-led skill development, including self-efficacy, motivation, confidence, and job readiness. While secondary data provides limited direct measurement of these variables, the study integrates insights from existing literature and case-based evidence to assess their influence on employability. The findings suggest that programs embedding soft skills training and behavioral development components tend to yield more sustainable employment outcomes compared to purely technical training models. The paper concludes that while CSR initiatives have significant potential to bridge the employability gap, their impact is contingent upon holistic program design, stronger industry linkage, and systematic evaluation frameworks that incorporate both economic and psycho-social indicators.

Keywords: *Corporate Social Responsibility (CSR), Skill Development, Employability, Psycho-Social Impact, Workforce Readiness, Human Capital Development*

INTRODUCTION
The idea of Corporate Social Responsibility (CSR) has changed over the past few decades from a charitable duty to a strategic business approach that incorporates social, environmental, and financial considerations into business operations. Organizations are increasingly seen as important contributors to societal progress rather than just as profit-making enterprises. Skill development programs have become one of the most important CSR projects for tackling social inequality, poverty, and unemployment. In developing nations like India, where a sizable section of the population is young but lacks skills essential to the workplace, these programs are especially important.

CSR's definition of skill development includes a broad range of training programs intended to improve people's employability by giving them technical, vocational, and soft skills. To carry out these initiatives, businesses work with government agencies, training facilities, and non-governmental organizations (NGOs). By matching labor competencies with industry demands, the main goal is to close the gap between education and employment. Although the economic advantages of these programs—such as the creation of jobs and income—are well known, there is a rising need to investigate their psycho-social effects on people. Technical proficiency is only one aspect of employability; other elements that affect it include drive, self-assurance, social flexibility, and psychological health.

In scholarly and policy discourse, the psycho-social aspect of employability has become more prominent. A person's objectives, social identity, and self-perception can all be greatly impacted by taking part in skill development programs. These initiatives frequently provide a platform for social inclusion and empowerment for marginalized groups, such as women, rural youth, and economically poor areas. People may feel better about themselves, be less anxious about the future, and have a higher social standing in their communities by learning new skills and finding work. Nevertheless, little is known about how well CSR-driven projects accomplish these goals.

Even though CSR-led skill development is receiving more funding, concerns about its sustainability and efficacy still exist. Many programs are criticized for being too short-lived, not being in line with market demands, or not providing sufficient follow-up assistance like mentorship and job placement. Furthermore, qualitative goals like psychological empowerment and social mobility are sometimes overlooked in favor of

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quantitative measures of these programs' performance, such as the number of people trained or employed. This disparity emphasizes the necessity of a careful assessment that looks beyond superficial indicators to determine the more profound effects of CSR initiatives.

Aligning company goals with community needs is another crucial factor. The real needs of recipients may not always be sufficiently met, even if businesses may create CSR initiatives to improve their brand image or satisfy legal obligations. Initiatives for skill development may be less successful as a result of this misalignment, and their long-term effects on employability may be diminished. A more complex strategy that considers sociocultural circumstances, educational backgrounds, and individual goals is also required due to the diversity of target populations. Policy frameworks play a crucial role in influencing CSR initiatives. The Companies Act of 2013 in India requires some businesses to devote a percentage of their earnings to CSR initiatives, such as skill development. Corporate involvement in social activities has increased as a result of this legislative drive.

However, the regulatory emphasis is frequently on compliance rather than effect assessment, which could lead to a lack of responsibility with regard to program results. The design and execution of CSR-driven skill development initiatives, as well as their wider consequences for employability and societal development, must thus be rigorously examined. From a theoretical standpoint, this study incorporates ideas from the theories of empowerment, social learning, and human capital. The importance of education and skills in boosting production and employability is emphasized by human capital theory. The significance of experiential learning and contextual influences on behavior and development is emphasized by social learning theory. The goal of empowerment theory is to empower people to take charge of their life and make wise choices. By integrating these perspectives, the study aims to provide a comprehensive understanding of how CSR initiatives influence both the economic and psycho-social dimensions of employability.

Furthermore, the need for flexible and resilient workers has grown due to the labor market's dynamic nature, which is fuelled by globalization and technological improvements. Communication, teamwork, problem-solving, and emotional intelligence are becoming just as crucial as technical proficiency. These components increase the likelihood that CSR-driven programs will generate well-rounded people who can succeed in a variety of professional settings. However, the way these programs are designed, delivered, and evaluated determines how effective they are by analyzing their effects on employment outcomes and psycho-social well-being, this study aims to critically assess CSR-driven skill development initiatives. In order to add to the body of knowledge already in existence and guide future policy and practice, it seeks to identify best practices, obstacles, and opportunities for progress. The study tackles a comparatively unexplored area with important implications for sustainable development by concentrating on the convergence of CSR, skill development, and psycho-social aspects.

In conclusion, even if CSR-driven skill development initiatives have the power to improve lives and boost the economy, a comprehensive assessment that takes into account both quantitative and qualitative results is necessary to fully comprehend their impact. By offering a critical evaluation of these programs with an emphasis on their psycho-social effects and efficacy in improving employability, this study aims to close this gap.

REVIEW OF LITERATURE

1. **Government of India – Economic Survey (2024)** – **"Employment and Skill Development: Towards Inclusive Growth"** This report highlights that skill development is essential for improving employability and emphasizes the need for psychological, emotional, and social competencies along with technical skills. It supports the idea that employability is a multi-dimensional concept involving psycho-social readiness.
2. **Yassin (2025)** in his paper **"CSR and Employee Outcomes: A Systematic Literature Review"** found that the relationship between CSR initiatives and employee-related outcomes. It finds that CSR significantly improves job satisfaction, engagement, and psychological well-being, which indirectly enhances employability. The study emphasizes the growing importance of psycho-social factors in evaluating CSR effectiveness.
3. **Exide Industries (2025)** in their research **"CSR Impact Assessment Report 2023–24: Skill Development and Employability"** This report shows that CSR-funded skill development programs improve job readiness and employability among youth. Importantly, it identifies strong psycho-social impacts such as increased confidence, positive behaviour, and self-reliance, highlighting the holistic benefits of such initiatives.

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4. **IRE Journals (2025)** – **"The Role of Skill Development Courses Provided by CSR in Enhancing Employability"** According to the study, CSR-sponsored training programs, which include both technical and non-technical courses, greatly enhance employability outcomes, communication, flexibility, and practical abilities. For long-term professional success, it also emphasizes the significance of integrating hard and soft talents.
5. **Awasthi (2026)** wrote **"Corporate Social Responsibility and Digital Learning: Impact on Employee Performance"** This research highlights that CSR initiatives, especially those focused on training and development, positively influence psychological well-being, employee engagement, and task performance. It concludes that CSR-based learning programs contribute to both skill enhancement and psycho-social development.

A recurring subject in recent literature is the importance of Corporate Social Responsibility (CSR) programs for improving employability and psycho-social development. Research by Yassin and Awasthi demonstrates that CSR initiatives, especially those centered on training and development, enhance employee performance, psychological health, job satisfaction, and engagement. In addition, research from Exide Industries and IRE Journals shows that CSR-funded skill development programs improve employability outcomes by fostering confidence, adaptability, and self-reliance in addition to developing technical and soft skills. Additionally, the Government of India's views confirm that employability is a multifaceted concept requiring a combination of technical proficiency and psycho-social preparedness. Overall, research shows that CSR programs support workforce development in a comprehensive way by fusing skill development with psychological and social growth.

OBJECTIVES OF THE STUDY

This study, "A Critical Evaluation of Corporate Social Responsibility (CSR)-Driven Skill Development Programs and Their Psycho-Social Impact on Employability Outcomes," aims to:

- To understand the role of CSR-driven skill development programs in enhancing employability outcomes among beneficiaries.
- To understand the impact of CSR initiatives on psycho-social factors such as self-confidence, motivation, emotional well-being, and adaptability.
- To analyze the effectiveness of CSR-sponsored training programs in developing both technical (hard) and non-technical (soft) skills.

Key Findings (Based on Secondary Data Analysis)

1. CSR-driven skill development initiatives improve work preparedness and access to employment opportunities, which benefits employability, especially for young people and underrepresented groups.
2. Programs that combine non-technical (soft) abilities like communication, teamwork, and flexibility with technical (hard) skills show more successful and long-lasting employment outcomes**.**
3. CSR efforts have a considerable impact on psycho-social elements that are important in improving employability, such as self-efficacy, motivation, self-confidence, and emotional well-being.
4. Compared to programs that only concentrate on technical training, CSR-funded training efforts that incorporate behavioral development and life skills components typically yield more comprehensive and long-term benefits.
5. The implementation of CSR programs varies noticeably between industries and geographical areas, which results in unequal access, inconsistent employment outcomes, and different training quality.
6. Many CSR programs lack solid industry connections, real-world experience, and post-training support like career guidance and mentorship, there is a gap between training and actual job placement.
7. Current frameworks for evaluating CSR efforts frequently overlook qualitative psycho-social results in favor of quantitative measures (such as the number of beneficiaries trained or hired).
8. Comprehensive program design, alignment with labor market demands, and the incorporation of rigorous impact assessment systems that measure both economic and psycho-social variables are critical to the overall efficacy and sustainability of CSR-driven skill development programs.

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CONCLUSION

In conclusion, skill development initiatives led by corporate social responsibility (CSR) have become a key tool for improving employability and fostering inclusive growth, especially in emerging nations like India. The study emphasizes that although these programs enhance technical skills and help prepare people for the workforce, their real worth is found in their capacity to promote psycho-social development, which includes self-assurance, drive, flexibility, and general wellbeing. These qualities are crucial for making people resilient and employable in a work market that is becoming more and more volatile. But the examination also highlights serious flaws in these programs' conception and execution. Their overall efficacy is diminished by problems like inadequate practical exposure, geographical differences, misalignment with industry requirements, and a lack of post-training assistance. Additionally, the qualitative and long-term psycho-social outcomes that are equally important for sustainable employability are frequently overlooked in favor of quantitative performance measures.

Therefore, a more comprehensive and integrated approach is needed for CSR-driven skill development projects to reach their full potential. This entails matching training curricula to market demands, integrating behavioral and soft skills training, fortifying industry alliances, and creating solid assessment frameworks that quantify both psycho-social and economic effects. By tackling these issues, CSR programs can go beyond philanthropy and compliance to become effective tools for social change and long-term human capital development.

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ARTIFICIAL INTELLIGENCE IN FINANCIAL MANAGEMENT AND ACCOUNTING: OPPORTUNITIES, CHALLENGES, AND FUTURE PROSPECTS

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ABSTRACT
Technology is changing the way businesses handle money — and AI sits right at the centre of that shift. This paper explores how Artificial Intelligence is transforming financial management and accounting, with a focus on four core technologies: ML-driven analytics, process automation through RPA, language-based tools like NLP, and forward-looking predictive models. Rather than relying on one source of data, the study brings together a review of existing academic literature and responses from a survey of 100 people — accountants, finance managers, students, and educators — based in Mumbai. A real-world look at Amazon rounds out the analysis by showing what AI adoption actually looks like in practice. What the research found is encouraging in many ways: AI genuinely does help with accuracy, saves time, and catches fraud better than traditional methods. But it also brings new headaches around data privacy, bias in algorithms, job security, and questions about who is responsible when AI gets things wrong. The bottom line is that organisations cannot just switch AI on and walk away — it takes careful planning, investment in people, clear ethical guidelines, and a realistic understanding of where human judgment still matters.

Keywords: *Artificial Intelligence, Financial Accounting, Management Accounting, Machine Learning, Robotic Process Automation, Predictive Analytics, Fraud Detection, Mixed Methods.*

1. INTRODUCTION
The pace of technological change in business has never been faster, and few developments are as far-reaching as Artificial Intelligence. At its core, AI is about building systems that can carry out tasks once considered the exclusive domain of human thinking — recognising patterns, drawing inferences, making decisions. For accountants and financial managers, this is not a distant future prospect; it is already happening.

For most of its history, accounting was built on repetition. Ledger entries, bank reconciliations, payroll runs, compliance checklists — these tasks demanded large teams and long hours, yet added relatively little in the way of strategic value. AI changes this equation by taking over the routine work and freeing professionals to focus on things that actually require human judgement, like advising clients, assessing risk, or interpreting results in context. Financial management stands to benefit just as much, given how dependent forecasting, budgeting, and investment decisions are on processing enormous amounts of data quickly and accurately (Loureiro et al., 2021).

This paper sets out to understand where AI currently stands in financial management and accounting — what it is doing well, where it falls short, and what the road ahead looks like. The research draws on both published academic work and original survey data collected from 100 professionals and students in Mumbai.

2. OBJECTIVES OF THE STUDY
(1) To examine how AI-driven tools — specifically ML models, process automation software, and language-processing applications — are being used in financial and management accounting, and what difference they are making to accuracy, efficiency, and the quality of decisions.

(2) To identify the main benefits and obstacles that come with adopting AI in Indian financial workplaces, with particular attention to skill shortages, data protection concerns, and the risk of biased algorithms.

(3) To test whether people in different professional roles view AI's impact differently, using survey data and one-way ANOVA statistical analysis.

3. LITERATURE REVIEW

3.1 AI in Financial Accounting
Financial accounting is, at its most basic, about keeping an accurate record of what a business earns, spends, and owns. Historically this meant a lot of data entry and cross-referencing — work that AI now handles with far greater speed and consistency. Bookkeeping software powered by machine learning can process transactions, flag anomalies, and generate reports in a fraction of the time it would take a human team (Kottara & Zaridis, 2024). Beyond the basics, intelligent systems are being used to support real-time decision-making, helping managers act on financial information while it is still fresh rather than waiting for monthly reports (Estep et al.,

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2024). Crucially, automating the routine frees up accountants for work that calls for experience and judgement — analysis, interpretation, client guidance (Jejeniwa et al., 2024).

3.2 AI in Financial Management

Managing a company's finances well has always required good forecasting. Revenue projections, budget planning, cash flow modelling — these tasks are inherently uncertain, and machine learning is proving unusually well-suited to handling that uncertainty. ML-based models can analyse past data, pick up on patterns that humans might miss, and generate forward-looking estimates with a degree of accuracy that traditional methods often cannot match (Zhang et al., 2023). AI also allows organisations to stress-test their plans against multiple scenarios at once — testing how a budget might hold up under a sudden supply chain shock, for instance, or a sharp rise in interest rates (Quinn & McConville, 2024). On the investment side, AI tools scan large datasets to pinpoint where capital is best deployed (Napolitano, 2023).

3.3 Ethical and Workforce Implications

AI's rapid rise in finance has not been without controversy. Questions about bias in algorithmic decision-making, data privacy, and accountability are gaining traction among regulators and researchers alike (Munoko et al., 2020). Regulations like GDPR place clear legal obligations on companies using AI with personal financial data, making compliance both a legal and reputational priority (Dai & Vasarhelyi, 2023). As for jobs, most researchers stop short of predicting mass unemployment — the emerging view is that the accounting profession will change rather than disappear. However, that change will require serious investment in training and continuous professional development to ensure practitioners can thrive alongside intelligent systems (Supriadi, 2024).

4. RESEARCH HYPOTHESES

Four null hypotheses guided the statistical analysis. Each one targets a different aspect of how respondents perceive AI in finance.

$H1_0$: There is no significant difference in AI familiarity across respondent groups.

$H2_0$: There is no significant link between professional role and AI adoption status in an organisation.

$H3_0$: Mean Likert scores for AI's impact on accounting tasks do not differ significantly across respondent groups.

$H4_0$: Mean Likert scores for AI's impact on financial management functions do not differ significantly across respondent groups.

5. CASE STUDY: AMAZON AND AI IN FINANCIAL OPERATIONS

Few companies illustrate the financial potential of AI better than Amazon. What started as an online bookstore has grown into one of the most technologically sophisticated enterprises on the planet — selling goods in dozens of categories, running the world's largest cloud infrastructure, and managing supply chains of staggering complexity. Revenue crossed USD 500 billion some time ago, and the company now touches consumers in well over 190 countries. At that scale, even small inefficiencies in financial processes translate into billions of dollars of waste. AI, for Amazon, is not a nice-to-have — it is structural.

Nowhere is this clearer than in forecasting. Rather than relying on traditional statistical models, Amazon's financial planning teams feed proprietary ML systems with transaction-level data running into the billions of records. These systems generate demand estimates precise enough to directly drive procurement budgets and cash reserve decisions (Zhang et al., 2023). On the fraud side, continuous AI-powered surveillance watches transaction flows in real time — catching patterns that no team of analysts could spot manually at that volume (Munoko et al., 2020). Invoice handling, which once required considerable manual effort, now runs largely on NLP and OCR tools that pull structured financial data straight from unstructured documents (Kottara & Zaridis, 2024). AWS's own internal finance function relies on ML-driven dashboards to track revenue across product lines and model where profitability is heading (Estep et al., 2024).

What makes Amazon's story instructive is not just what AI can do — it is the conditions that made it work. The company did not bolt AI onto existing processes; it rebuilt workflows around intelligent systems, invested heavily in data quality and governance, and treated workforce upskilling as a running commitment rather than a one-time initiative. Organisations that approach AI as a shortcut tend to see disappointing results. Those that embed it thoughtfully, as Amazon has, tend to see compounding returns (Quinn & McConville, 2024).

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6. RESEARCH METHODOLOGY

The study uses a mixed-methods design that combines qualitative and quantitative work. On the qualitative side, a structured review of peer-reviewed literature published between 2018 and 2024 was conducted to map what is already known about AI in accounting and financial management. On the quantitative side, a 20-item questionnaire was distributed to 100 people in Mumbai during April 2026. Respondents included practicing accountants, finance managers, auditors, university students from B.Com and MBA programmes, and faculty members. This mix was chosen deliberately to capture differences in perspective across experience levels and professional contexts.

Table 1: Respondent Profile (n = 100)

Category	Respondents	% of Total
Practicing Accountant	20	20%
Finance Manager	10	10%
Student (B.Com / MBA)	10	10%
Faculty / Educator	10	10%
Other (Accounting / Finance Professionals)	50	50%
Total	**100**	**100%**

7. FINDINGS AND DISCUSSION

7.1 How Familiar Are People with AI?

The survey results paint a picture of a profession that is broadly aware of AI but not yet deeply versed in it. The largest group — 40% of respondents — described themselves as moderately familiar, meaning they understand the concept but probably do not work with AI tools on a daily basis. A combined 30% said they were either very familiar or expert-level, and the remaining 30% were only slightly familiar. Nobody claimed to know nothing about AI at all, which is in itself telling — awareness has clearly spread even if deep expertise has not.

Table 2: AI Familiarity Level (n = 100)

Familiarity Level	Respondents	Percentage
Slightly Familiar	30	30%
Moderately Familiar	40	40%
Very Familiar	20	20%
Expert Level	10	10%

7.2 Who Is Actually Using AI?

On paper, adoption looks reasonable: 40% of respondents said their organisation was already using AI in some financial capacity. Another 10% expected to adopt within the next year or two. But dig a little deeper and the picture is more mixed. A full 30% said they were not sure whether their organisation used AI at all, and 20% said there were no plans to adopt. That is half the sample either uncertain or holding back. Cost, technical complexity, and change resistance are likely explanations — themes that come through clearly in the challenges data discussed below.

Table 3: AI Adoption Status (n = 100)

Adoption Status	Respondents	Percentage
Yes, already using	40	40%
Planning to adopt within 1–2 years	10	10%
No plans currently	20	20%
Not Sure	30	30%

7.3 What Do Professionals Actually Think AI Does Well?

Respondents rated eight statements about AI's capabilities on a scale from 1 (strongly disagree) to 5 (strongly agree). The scores clustered between 3.20 and 3.50 — generally positive but with notable caution. The standout result was bookkeeping error reduction at 3.50, reflecting the fact that this is one of the most visible and concrete applications of AI already in use. Forecasting and decision-making support both scored 3.40, while risk management and fraud detection came in at 3.20 — still slightly above neutral, but suggesting professionals are less convinced about AI's reliability in higher-stakes judgement areas.

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Table 4: Mean Likert Ratings (n = 100, Scale 1–5)

Statement	Mean Score	Interpretation
AI improves financial forecasting accuracy	3.40	Neutral–Agree
AI helps manage financial risk effectively	3.20	Neutral
AI enables better resource allocation	3.30	Neutral–Agree
AI supports faster decision-making	3.40	Neutral–Agree
AI reduces bookkeeping errors	3.50	Agree
AI speeds up financial statement preparation	3.30	Neutral–Agree
AI improves IFRS compliance	3.30	Neutral–Agree
AI assists in fraud detection	3.20	Neutral

7.4 What Are the Main Barriers?

The challenges data revealed a clear pecking order. Lack of technical skills among staff came up most often — a finding that points to a gap between what AI systems require and what the typical finance team currently knows how to do. Fear of job displacement was the second most common concern, which is understandable given the volume of routine work that AI is capable of replacing. Data privacy and security came third, followed by algorithmic bias and high implementation costs. These are not fringe concerns; they are consistent with what the broader research literature has identified as the central obstacles to responsible AI deployment (Munoko et al., 2020; Supriadi, 2024).

7.5 Will AI Replace Accountants?

This was perhaps the most straightforwardly answered question in the survey. Seven in ten respondents — 70% — believe AI will take over routine tasks but that human professionals will remain indispensable for work involving judgement, strategy, and ethics. Only 10% took the view that AI would simply complement human work without any displacement at all, and 20% were unsure. The dominant view, in other words, is nuanced: AI is coming for the rule-based, repetitive work, but the parts of accounting that require real expertise are not going anywhere.

Table 5: Will AI Replace Accounting Professionals? (n = 100)

Response	Respondents	Percentage
Partially — AI will replace routine tasks only	70	70%
Not Sure	20	20%
No — AI will complement, not replace professionals	10	10%

8. ANOVA ANALYSIS AND HYPOTHESIS TESTING

To check whether professional role affects how people perceive AI, a one-way ANOVA was run on mean Likert scores for each of the eight survey statements. The independent variable was respondent category, and the threshold for statistical significance was set at $p < 0.05$.

8.1 Financial Management Perceptions

Table 6: ANOVA Results — AI in Financial Management (n = 100)

Statement	Accountant	Fin. Mgr.	Student	Faculty	F-Value
AI improves forecasting accuracy	3.60	3.80	3.20	3.10	**4.21***
AI helps manage financial risk	3.40	3.70	3.00	3.00	**3.87***
AI enables better resource allocation	3.50	3.60	3.20	3.00	2.95
AI supports faster decision-making	3.60	3.80	3.20	3.10	**4.10***

* $p < 0.05$ — Statistically significant at the 5% level of significance

Significant results emerged for most of the financial management items. Finance managers gave the highest ratings across forecasting accuracy ($F = 4.21$), risk management ($F = 3.87$), and decision-making speed ($F = 4.10$). This pattern makes sense: finance managers are the ones who work directly with forecasting and planning tools, so they have firsthand experience of what AI can do. Students and faculty, who have less direct exposure,

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were more sceptical. Resource allocation was the exception, with no statistically significant difference between groups (F = 2.95). Hypothesis $H4_0$ is rejected for three of the four items.

8.2 Financial Accounting Perceptions

Table 7: ANOVA Results — AI in Financial Accounting (n = 100)

Statement	Accountant	Fin. Mgr.	Student	Faculty	F-Value
AI reduces bookkeeping errors	3.80	3.60	3.30	3.20	**4.65***
AI speeds up financial statements	3.50	3.40	3.10	3.20	3.12
AI improves IFRS compliance	3.60	3.40	3.00	3.10	**3.98***
AI assists in fraud detection	3.40	3.50	3.00	2.90	**4.33***

* $p < 0.05$ — Statistically significant at the 5% level of significance

The accounting results followed a similar pattern. Practicing accountants gave the highest scores on bookkeeping error reduction (F = 4.65), IFRS compliance (F = 3.98), and fraud detection (F = 4.33), all of which were statistically significant. These are tasks accountants use AI tools for directly, which explains their stronger conviction about what the technology delivers. Speed of financial statement preparation was the one item that did not reach significance (F = 3.12), possibly because manual and automated approaches still overlap considerably in practice. Hypothesis $H3_0$ is partially rejected.

8.3 Summary of Results

Table 8: Summary of Hypothesis Testing Results

Hyp.	Statement	F-Value	Decision
H1	AI familiarity differs across professional roles	4.18*	Accepted
H2	AI adoption linked to professional role	3.76*	Accepted
H3	AI's accounting impact differs by role (partial)	3.98–4.65*	Partially Accepted
H4	AI's management impact differs by role (partial)	3.87–4.21*	Partially Accepted

9. CONCLUSION

Taken together, the findings of this study tell a consistent story: AI is already making a meaningful difference in financial accounting and management, and its role is only going to grow. What stands out most clearly is how professional experience shapes perception. Accountants and finance managers — people who actually use these tools — are more positive about AI's potential than students or educators who know it mainly in theory. That gap is worth noting for anyone designing training programmes or making the case for AI investment within an organisation.

The challenges identified in this study — skill gaps, privacy concerns, job anxiety, algorithmic bias — are real and should not be dismissed. But they are not arguments against adoption; they are a checklist for doing it properly. The Amazon case study illustrates what responsible, well-integrated AI looks like in practice: deep embedding in core processes, strong data governance, and ongoing investment in the people who work alongside the technology.

The survey finding that 70% of respondents believe AI will handle routine tasks while human professionals remain essential captures something important. The future of accounting is not a choice between people and machines — it is about figuring out how each does what it is best suited to do. Algorithms will keep getting faster and more accurate at processing transactions and spotting patterns. But interpreting those patterns in context, advising clients through uncertainty, and making ethical judgements in grey areas — that is still, and likely always will be, a human job. The professionals who thrive in the years ahead will be those who understand both sides of that partnership.

Future research should move beyond Mumbai to capture a broader picture of AI adoption across different regions and industries in India. Longitudinal studies tracking how attitudes and usage evolve over time would also add considerably to what we currently know.

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IMPACT OF LABOUR MIGRATION ON URBAN TRANSPORT INFRASTRUCTURE: A STUDY OF MUMBAI

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ABSTRACT
Mumbai, India's financial capital and one of the world's most densely populated urban agglomerations, has been shaped fundamentally by successive waves of labour migration. The Mumbai Metropolitan Region (MMR) has grown from 8.2 million in 1981 to an estimated 27.23 million by 2023, driven largely by in-migration from both intra-state and inter-state sources. This paper examines the nexus between labour migration and urban transport infrastructure in Mumbai, using secondary data drawn from the Census of India, the Indian Railways Ministry, MMRDA, RTO Maharashtra, World Bank project documents, and peer-reviewed literature spanning 2001-2025. The study identifies seven testable hypotheses mapping migration drivers to transport outcomes, and analyses these through descriptive and trend analyses across three primary transport domains: suburban railways, road and motorised vehicle infrastructure, and mass rapid transit (metro and monorail). Findings confirm that migration-induced population growth has consistently outpaced transport infrastructure expansion, producing chronic overcrowding, unsafe commuting conditions (with over 66,500 railway deaths recorded between 2004-2024), traffic congestion ranked at 65% peak-hour intensity, and a 10% annual increase in registered vehicles post-COVID. However, recent investments-including the ₹2.2 lakh crore metro expansion (16 lines, 523 km), the Mumbai Coastal Road, and the Atal Setu Trans-Harbour Link-represent a structural inflection in Mumbai's transport trajectory. The paper concludes with a forward-looking policy framework that integrates labour mobility planning with transport infrastructure governance.

Keywords: *Labour Migration, Urban Transport, Mumbai Metropolitan Region, Suburban Railways, Overcrowding, MMRDA, Infrastructure Deficit, MMR Population Growth*

1. INTRODUCTION
Mumbai - the commercial capital of India - stands as a microcosm of the tensions that define urbanisation in the Global South. Over the past century, the city's extraordinary economic pull has drawn millions of migrant workers from across India, transforming what was once an archipelago of seven islands into one of the world's most complex and contested urban environments. Yet this population growth has consistently outpaced the city's physical capacity to absorb it, generating a structural mismatch between demographic demand and transport infrastructure supply.

Labour migration to Mumbai is not a recent phenomenon. The city's first major migration wave was driven by the textile mills of the early twentieth century, followed by manufacturing industries in the post-independence era. The liberalisation of the Indian economy in 1991 triggered a new phase of service-sector-led migration, drawing workers into finance, information technology, real estate, hospitality, and construction. Today, the MMR functions as a multi-nodal metropolitan economy where the daily movement of goods and people operates through an increasingly stressed transport ecosystem.

The transport system of Mumbai rests on three pillars: the suburban railway network (operated by Central Railway and Western Railway), the road network with its heterogeneous vehicular population, and the rapidly expanding Metro system. Together, these modes serve an estimated 93 lakh (9.3 million) commuters daily on the suburban railway alone, with millions more using buses, auto-rickshaws, taxis, and private vehicles. The scale and density of this commuter flows are globally unprecedented - and are intrinsically linked to the in-flow of migrant labour that inhabits the city's expanding peripheral zones.

Despite the clear interconnection between population mobility and transport infrastructure, academic and policy discourse has tended to treat these as separate domains. Labour migration is typically studied through the lens of employment, housing, and social integration, while transport planning is addressed as a technical and engineering challenge. This paper bridges that gap by examining, through secondary data, how labour migration patterns have shaped - and continue to stress - Mumbai's urban transport infrastructure.

1.1 Rationale and Significance of the Study
The urgency of this study is underscored by several contemporaneous developments: in 2024, 3,588 commuters were killed on Mumbai's suburban railway - an average of nearly 10 deaths per day. Between 2004 and 2024, the network claimed nearly 66,500 lives, the highest fatality count of any urban rail system in the world. A 2025 analysis indicated a 10% year-on-year increase in registered vehicles, pushing road congestion to levels that TomTom's 2018 Traffic Index ranked as the worst globally among 403 cities. Simultaneously, the Government

of Maharashtra is implementing a ₹2.2 lakh crore Metro expansion, a ₹17,843 crore Trans-Harbour Link, and a ₹14,000 crore Coastal Road project - infrastructure investments of historic scale, yet ones whose planning rarely accounts explicitly for migration-driven demand.

This paper provides evidence-based analysis to fill that gap, offering both an empirical account of the migration-transport nexus and a normative framework for integrated planning.

1.2 Scope and Delimitations

The study covers the Mumbai Metropolitan Region (MMR), defined as the 4,355 sq. km area comprising Greater Mumbai (MCGM), and surrounding municipal corporations and districts including Thane, Navi Mumbai, Mira-Bhayander, Kalyan-Dombivli, Vasai-Virar, and Bhiwandi. The temporal scope is 2001-2025. The paper relies exclusively on secondary data and does not incorporate primary field surveys. Qualitative migration motivations are not examined; the focus is on quantitative transport infrastructure impacts.

2. REVIEW OF LITERATURE

The relationship between urbanisation, labour migration, and transport infrastructure has attracted substantial scholarly attention, though the specific Mumbai case presents unique analytical challenges owing to its spatial complexity and data limitations.

2.1 Migration and Urban Growth

Hirschman's (1958) concept of 'disorderly' urban growth finds contemporary resonance in Mumbai's development trajectory. Datta and Shaban (2016) characterise the Global South's urban revolution as one driven by structural forces of capital accumulation rather than the organic demographic transition that characterised European urbanisation. In this framework, labour migration is not merely a demographic phenomenon but a structural economic one - cities absorb surplus rural labour because of wage differentials and agglomeration economies.

Zachariah (1968) and later Singh (2007) documented the fifty-year migration trends in Mumbai, identifying successive waves of intra-state migration (primarily from Konkan, Marathwada, and Vidarbha) and inter-state migration (from Uttar Pradesh, Bihar, and Rajasthan). Their findings show that between 1961 and 2001, the share of inter-state migrants in Mumbai's population rose from approximately 28% to over 35%, with accelerating rates in the post-liberalisation period.

The 2011 Census revealed a notable deceleration in MCGM's population growth (from 11.9 million in 2001 to 12.44 million in 2011, an annual growth rate of less than 0.5%), while growth accelerated in peripheral MMR zones. Bhagat and Jones (2013) attribute this to 'spillover migration' - migrants settling in the inner and outer zones of MMR rather than the core city - a trend that has profound implications for transport planning because it elongates commute distances without proportionately increasing network capacity.

2.2 Transport Infrastructure and Mobility in Mumbai

Shaban (2023), in the foundational reference study for this paper (published in Tandfonline, DOI: 10.1080/21650020.2023.2212745), provides a comprehensive analysis of mobility and transport infrastructure in the MMR. The study finds that 'transport infrastructure development in Mumbai Metropolitan Region has not kept pace with the demand,' characterising the city's transport policy as 'demand-following rather than futuristic.' The paper highlights the tripartite mobility crisis: rail overcrowding, road congestion, and modal inequity - with low-income migrant communities bearing a disproportionate burden.

Mitra et al. (2013) articulate the equity dimension, arguing that for transport to function efficiently and equitably it must meet the needs of all user groups, including the urban poor who constitute the bulk of the migrant population. The LEA Associates Comprehensive Mobility Plan for MCGM (2016) quantifies a critical data point: approximately 700,000 persons enter Greater Mumbai from adjacent MMR cities every morning during the peak hour for work purposes - a figure that represents the daily transportation load generated directly by the spatial mismatch between labour residence (periphery) and employment (core city).

The AIIB's Mumbai Urban Transport Project 3A (2023) documentation confirms that Mumbai Suburban Railway carries 43% of all daily trips in the MMR, and characterises the system as facing 'severe challenges, particularly overcrowding and low service quality.' The World Bank's engagement through MUTP I, II, and III documents successive phases of infrastructure intervention, each responding to demand that has continued to outstrip supply.

2.3 Informal Transport and Migrant Mobility

A growing body of literature addresses the role of informal transport in migrant mobility. Lefebvre's theory of the 'production of space,' applied to Mumbai by scholars studying digital mobility platforms (Ola, Uber),

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highlights how formal-informal transport dichotomies intersect with migrant labour. Shared auto-rickshaws, tempos, and app-based platforms have emerged as critical 'last-mile' connectors for migrants living in peripheral zones inadequately served by rail or metro. The MMRDA's 2022 Impact of Ride-Sharing on Mumbai's Bus Transport System acknowledges this structural complementarity.

The IOM (2017) study on urban migration trends in India notes that transport networks and urbanisation are 'reinforcing each other' along industrial corridors such as the Mumbai-Bangalore Economic Corridor, creating self-perpetuating migration flows that simultaneously depend on and stress urban transport infrastructure.

3. RESEARCH OBJECTIVES AND HYPOTHESES

3.1 Research Objectives

1. To examine the historical patterns and current scale of labour migration into the Mumbai Metropolitan Region.
2. To analyse the impact of migration-driven population growth on suburban railway ridership, crowding, and safety.
3. To assess the relationship between migrant population density and road infrastructure congestion and vehicular growth.
4. To evaluate the adequacy of existing and planned transport infrastructure investments relative to migration-driven demand.
5. To identify modal patterns among migrant workers and assess equity in transport access.
6. To propose a policy framework for integrating migration planning with transport infrastructure governance.

3.2 Research Hypotheses

Seven hypotheses are formulated to guide the analysis. These are presented in Table 1 below and examined through secondary data in Section 5.

Table 4: Research Hypotheses - Labour Migration and Urban Transport Infrastructure

H#	Hypothesis Statement	Expected Direction	Data Source
H1	Labour in-migration is positively associated with increased daily ridership on Mumbai suburban railways.	Positive (+)	Indian Railways / MRVC
H2	Growth in migrant population leads to higher peak-hour crowding indices on suburban trains.	Positive (+)	MRVC Crowding Reports
H3	Labour migration is positively associated with growth in registered vehicle population in MMR.	Positive (+)	RTO / MMRDA Data
H4	Rising migrant density accelerates road congestion levels in core urban zones.	Positive (+)	TomTom Traffic Index
H5	Expansion of metro network has a moderating (negative) effect on suburban train overcrowding.	Negative (−)	MMRDA Metro Reports
H6	Labour migration drives demand for informal transport modes (auto-rickshaws, shared cabs).	Positive (+)	NSS / PLFS Survey
H7	Investment in transport infrastructure lags population growth attributable to migration.	Positive (+)	MMRDA / World Bank

Note: * Asterisk denotes hypotheses for which direct causal testing through regression is not attempted in this secondary data study; directional inferences are drawn from trend analysis.

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4. RESEARCH METHODOLOGY

4.1 Research Design

This study adopts a descriptive-analytical research design based exclusively on secondary data. The research approach involves synthesis and trend analysis of publicly available datasets, government reports, regulatory filings, peer-reviewed publications, and institutional documentation. No primary data collection was undertaken. This approach is consistent with established practice in urban transport research where large-scale institutional data provides robust longitudinal evidence.

4.2 Data Sources

The study is based entirely on secondary data collected from a range of authoritative national and international sources. Key datasets include population and migration statistics from the Registrar General of India through the Census of India (2001, 2011, and provisional 2021), transport and ridership data from Indian Railways annual reports, and planning documents from Mumbai Metropolitan Region Development Authority such as the Comprehensive Transport Study and Regional Plan 2016–36. Additional insights are drawn from infrastructure project reports by the Asian Infrastructure Investment Bank and the World Bank related to the Mumbai Urban Transport Project (MUTP phases I-III). Traffic congestion trends are supported by the TomTom Traffic Index, while labour market patterns are analysed using the Periodic Labour Force Survey conducted by the Ministry of Statistics and Programme Implementation. Supplementary data on suburban rail safety, ridership, and capacity are sourced from affidavits submitted to the Bombay High Court, along with reports from Mumbai Rail Vikas Corporation and vehicle registration statistics from the Maharashtra Regional Transport Office. These are further complemented by peer-reviewed academic literature and recent (2024-2026) data points from credible media and institutional reports to ensure a comprehensive and up-to-date analysis.

4.3 Analytical Framework

Data is analysed through: (i) descriptive trend analysis of migration and transport indicators over time; (ii) comparative analysis across transport modes; (iii) cross-indicator mapping of migration and transport stress variables; and (iv) policy gap analysis comparing infrastructure investment against projected demand. Statistical hypothesis testing is not performed given the secondary nature of the data; rather, hypotheses are assessed directionally through trend evidence.

4.4 Limitations

Key limitations include: the absence of a 2021 Census final dataset (only provisional data available); reliance on projected population figures post-2011; absence of disaggregated data linking specific migrant sub-populations to particular transport modes; and the impossibility of establishing causal inference from secondary trend data alone. These limitations are noted where relevant in the analysis.

5. DATA ANALYSIS AND FINDINGS

5.1 Labour Migration Patterns in Mumbai Metropolitan Region

5.1.1 Historical Trajectory

Mumbai's population growth from 8.2 million in 1981 to an estimated 27.23 million in 2023 represents more than a threefold increase over four decades, achieved almost entirely through in-migration rather than natural growth. As Table 1 below demonstrates, the core city (MCGM) experienced near-stagnation in its population after 2001, while the peripheral MMR zones absorbed the migrant population surplus - a process of spatial dispersal with profound transport implications.

Table 1: MMR Population and Migration Trends (1981-2023)

Year / Census	MMR Population (Million)	MCGM Population (Million)	Net In-Migrants (000s)	Inter-State Share (%)	Slum Population (%)
1981	8.2	8.2	620	28	42
1991	12.6	9.9	890	32	46
2001	18.4	11.9	2,490	35	54
2011	22.8	12.44	2,800*	38	41.8
2021 (est.)	27.07	12.9*	3,100*	41*	38*

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2023 (proj.)	27.23	13.0*	3,200*	42*	37*

Sources: Census of India 2001, 2011; MMRDA 2021; UN World Urban Agglomeration Projections; ARI Working Paper (Bhagat & Jones, 2013). *Estimated/projected values.

According to the 2001 Census, net migrants to Mumbai UA over the preceding decade numbered 2,489,552 - comprising 892,706 from within Maharashtra, 1,571,181 from other states, and 25,665 from other countries. By 2011, the share of inter-state migrants in total migration had risen to approximately 38%, with Uttar Pradesh and Bihar emerging as the largest source states. The PLFS 2020-21 reports a total national migration rate of 28.9%, with 10.8% of migrant persons having moved for employment-related reasons - the category most directly relevant to transport demand.

5.1.2 Spatial Distribution of Migrants and Transport Implications

A critical finding of census data analysis, confirmed by Bhagat and Jones (2013), is that migrants are 'predominantly located in the peripheries' of MMR. The fastest-growing nodes between 2001-2011 were Mira-Bhayander, Navi Mumbai, Vasai-Virar, Bhiwandi, and Kalyan-Dombivli - all distant from Mumbai's employment core. This spatial mismatch between migrant residence and employment location is the fundamental driver of transport demand: commuters must travel 30-80 km daily, loading peak-hour services at the outer ends of the Western and Central Railway corridors.

As sociologist Prasad Mohite noted in 2024, satellite cities have become employment centres in their own right, partially moderating the commute burden. However, the development of satellite towns has also created new cross-MMR mobility patterns - workers living in Navi Mumbai commuting to BKC, or Vasai workers commuting to Andheri - demands that the existing radial network structure is poorly equipped to handle.

5.2 Impact on Suburban Railway Infrastructure

The Mumbai Suburban Railway is the most visible and most stressed transport infrastructure in the city. Operated jointly by Central Railway (CR) and Western Railway (WR), the network spans 465 km of route length and operates approximately 2,342 daily services. Table 2 documents key performance indicators across three benchmark periods.

Table 2: Mumbai Suburban Railway - Key Performance Indicators (FY 2019-20 to 2025-26)

Indicator	Pre-COVID (FY 2019-20)	Post-COVID (FY 2022-23)	FY 2024-25 / 2025-26
Daily Ridership (Lakh)	76.34	61.95	93 (peak)
CR Daily Avg. (Lakh)	41.47	35.38	45-62
WR Daily Avg. (Lakh)	34.87	26.57	31
Annual Fatalities	3,000	2,590 (2023)	2,468 (2024)
Peak-Hour Density (persons/m²)	14-16	12-14	14-16
No. of Daily Services	2,342	2,100	2,342
Route Length (km)	465	465	465
Record Ridership Day	-	-	Jan 5, 2026: CR 72.18L WR 52.07L

Sources: Indian Railways (various years); GeoSquare News (February 2026); The Print (June 2025); AIIB MUTP 3A (2023); Grokipedia Transport in Mumbai (2026). CR = Central Railway; WR = Western Railway. L = Lakh.

5.2.1 Ridership Trends and Migration Linkage

Pre-COVID (FY 2019-20), the suburban system carried 76.34 lakh commuters daily - representing, by annual ridership (2.64 billion), one of the busiest commuter rail systems in the world. Post-COVID recovery has been uneven: FY 2022-23 ridership stood at 61.95 lakh, a shortfall of 14.39 lakh from the pre-pandemic peak. The introduction of Metro Lines 2A and 7 in 2022-23, which created competitive alternatives on the Western corridor, accounts for part of this decline.

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However, by late 2025 and early 2026, ridership was surging again, with total daily suburban ridership approaching 93 lakh on peak weekdays. The busiest day on record was January 5, 2026, when Central Railway recorded 72.18 lakh and Western Railway 52.07 lakh - totalling over 1.24 crore passenger trips in a single day. This resurgence is directly linked to continued labour force expansion in MMR, return of post-pandemic commuting norms, and the growth of peripheral residential zones that remain rail-dependent.

5.2.2 Overcrowding, Safety, and the Migrant Burden

The relationship between overcrowding and migration is both direct and causal. Migrant workers, disproportionately employed in daily-wage and shift-based sectors (construction, textile, domestic service, hawking, manufacturing), have fixed commute windows - typically 8-10 AM and 6-8 PM - that concentrate demand on trains already operating at 150-200% of design capacity during peak hours.

The human cost of this overcrowding is catastrophic. Between 2004 and 2024, Mumbai's suburban trains claimed nearly 66,500 lives. An affidavit filed by Indian Railways in the Bombay High Court in 2024 states that 51,802 people lost their lives - and a similar number were injured - on the Mumbai suburban system between 2005 and 2024, with 22,481 on Western Railway and 29,321 on Central Railway. In 2023, 2,590 deaths were recorded; in 2024, 2,468 - an average of nearly 7 deaths per day. The Bombay High Court's June 2025 observation described the situation as 'alarming and disturbing,' following an accident at Mumbra in which overcrowded trains moving in opposite directions caused passengers on footboards to collide, resulting in five deaths.

The railway system's open-door design - coaches lacking automatic door closures - is the structural enabler of these fatalities. The Ministry of Railways announced in June 2025 that all new rakes would have automatic doors, and existing ones would be retrofitted. This recommendation was first made by the Public Accounts Committee in 2017 - an eight-year delay emblematic of the chronic governance lag relative to infrastructure demand.

5.3 Impact on Road Infrastructure and Vehicular Growth

Alongside the railway, Mumbai's road network faces escalating pressure from two migration-related forces: an absolute increase in commuters seeking alternatives to overcrowded trains, and a growth in vehicle ownership among upwardly mobile migrant households.

Table 3: Road Infrastructure and Vehicular Growth in MMR (2001-2025)

Year	Registered Vehicles (Lakh)	Road Length (km)	Congestion Level (%)	Road per 1000 persons (km)
2001	9.2	1,900	42	0.16
2005	13.5	1,950	50	0.14
2010	19.8	1,980	58	0.12
2015	28.6	2,000	62	0.10
2018	35.4	2,000	65	0.09
2023	44.2	2,050*	60	0.08
2025 (est.)	48.6	2,100*	58	0.08

Sources: MMRDA Engineering Division; RTO Maharashtra; TomTom Traffic Index 2018; Shaban (2023); Grokipedia (2026). *Estimated values.

5.3.1 Road Network Capacity

Greater Mumbai's road network has a cumulative length of approximately 2,000 km - virtually unchanged since 2001 despite a near-tripling of the vehicle population. According to MMRDA and Shaban (2023), the vehicular population 'has far exceeded the carrying capacity of roads in Mumbai,' a situation that the TomTom Traffic Index 2018 quantified as a 65% peak-hour congestion level - the worst among 403 cities globally. While subsequent years show modest improvement (due partly to COVID disruption and metro alternatives), the 2025 data indicates a 15% surge in peak-hour volumes in core areas compared to pre-pandemic levels.

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A 2025 analysis confirmed a 10% year-on-year increase in registered vehicles post-COVID, driven by economic recovery and suburban expansion. This growth is driven in significant part by migrant households that, once economically stabilised, transition from public to private transport - a pattern of 'transport aspiration' that paradoxically worsens the congestion faced by newer arrivals who remain rail-dependent.

5.3.2 Key Road Infrastructure Projects (2024-2025)

Two landmark road infrastructure projects were completed in 2024, representing a significant structural response to mobility deficits attributable partly to migration:

1. Mumbai Coastal Road (Phase 1): Inaugurated on March 11, 2024, the 10.58 km eight-lane expressway from Princess Street Flyover to the Worli end of the Bandra-Worli Sea Link reduced travel time in the Island City corridor to 10-15 minutes. This benefits service-sector workers employed in the financial district and hospitality industries.
2. Atal Setu (Mumbai Trans-Harbour Link): The 21.8 km sea bridge connecting Sewri (Mumbai) with Nhava Sheva opened in January 2024, dramatically reducing travel time between the Island City and Navi Mumbai from approximately 90 minutes to under 30 minutes. This connectivity will reshape migrant settlement patterns, potentially drawing more workers to Navi Mumbai while maintaining employment in Mumbai's core.

5.4 Mass Rapid Transit Expansion and its Migration Nexus

The Mumbai Metro represents the most ambitious infrastructural response to the mobility crisis generated by decades of migration-driven growth. Table 5 documents the current and planned metro lines and their specific relevance to migrant workers.

Table 5: Mumbai Metro Lines - Status and Migration Relevance (2025)

Line	Corridor	Length (km)	Operational	Significance for Migrants
Line 1 (Blue)	Versova-Ghatkopar	11.4	2014	First E-W link; serves densely migrant-populated zones
Line 2A (Yellow)	Dahisar (E)-D.N. Nagar	18.6	2023	Serves WR migrant corridor; reduces surface congestion
Line 7 (Red)	Dahisar (E)-Andheri (E)	16.5	2022	Connects key labour nodes in North-West suburbs
Line 3 (Aqua)	Colaba-SEEPZ-Aarey	33.5	2024-25	Underground; BKC-CSMT corridor for service-sector workers
Lines 4/5/6	Wadala-Kasarvadavali / Thane-Kalyan / SSNL-Vikhroli	88	Under constr.	Will serve peripheral migrant settlements
Full Network (2030)	16 lines, 523 km planned	523	By 2030	Comprehensive MMR-wide mass transit for migrant labour force

Sources: Wikipedia - Mumbai Metro (April 2026); MMRDA; Sayba Group Infrastructure Analysis (2025).
*Under construction figures are indicative.

As of October 2025, after the Aqua Line 3 became fully operational, all Mumbai Metro lines together carried approximately 9 lakh (900,000) passengers daily - a figure that, while significant, remains a fraction of the suburban railway's 70+ lakh daily commuters. The Blue Line 1 alone accounts for 4.6 lakh daily passengers, while the yellow and red lines carry 2.6 lakh combined, and the Aqua Line 3 carries approximately 1.6 lakh.

The Metro's impact on migrant mobility is real but uneven. MMRDA's 2023 Metro Line 2A and 7 Impact Study confirmed that the opening of these corridors 'significantly reduced travel time and road congestion along the Western Express Highway.' A notable reduction in suburban railway ridership at Andheri and Dahisar stations followed the metro opening - evidence of modal shift among better-informed and more mobile commuters.

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However, 2026 reports note that ridership on the Aqua Line 3 remained below expectations due to last-mile connectivity gaps and fare differentials - barriers that disproportionately affect lower-income migrant workers.

MMRDA plans 16 metro lines covering 523 km by 2030. If realised, this network will fundamentally alter Mumbai's transport geography, connecting far-flung peripheral migrant settlements to core employment zones. Property analyses already show a 5-15% premium on residences within 500 metres of metro stations - evidence that metro expansion is beginning to reshape the spatial economy of migrant settlement.

5.5 Informal Transport and First/Last-Mile Connectivity

A dimension of Mumbai's transport ecosystem often invisible in aggregate statistics is the role of informal and intermediate public transport (IPT) - auto-rickshaws, shared tempos, feeder buses, and increasingly, app-based platforms. For migrant workers, who are disproportionately employed in locations poorly connected to the formal rail/metro network, IPT serves as the critical mobility enabler.

The MMRDA's 2022 study on ride-sharing's impact on bus transport acknowledges the growing role of Ola and Uber in supplementing formal public transport. However, digital platforms impose a price point that excludes the lowest-income migrants - those in construction, domestic service, and informal manufacturing - who continue to rely on overcrowded trains and informal shared autos. This creates a two-tier mobility economy within the migrant population itself.

5.6 Infrastructure Investment and Planning - the Supply-Demand Gap

Table 6: Major Transport Infrastructure Investments in Mumbai (2024-2030)

Project	Investment (₹ Crore)	Status (2025)	Relevance to Migration
Mumbai Urban Transport Project (MUTP I-III)	20,000	Ongoing / Phases	Suburban rail upgrades serving migrant commuters
Mumbai Metro 16-Line Network	2,20,000	Phased to 2030	Mass transit for dispersed migrant population
Mumbai Coastal Road (Phase 1)	14,000	Inaugurated Mar 2024	Decongests Island City; benefits service-sector migrants
Mumbai Trans-Harbour Link (MTHL / Atal Setu)	17,843	Opened Jan 2024	Navi Mumbai connectivity; reduces cross-harbour commute
Navi Mumbai International Airport	16,000	Under construction	Future employment hub attracting new migrant streams
MUIP (Extended MMR Roads)	5,000+	Partial completion	131.5 km road widening in peripheral migrant zones

Sources: MMRDA Engineering Division; AIIB (2023); Economic Times (2024); Sayba Group (2025); Government of Maharashtra. ₹ values in Indian Rupees Crore (1 Crore = 10 million).

The aggregate investment profile in Table 6 reveals an infrastructure response of historic scale. The Mumbai Metro alone represents a planned investment approaching ₹2.2 lakh crore - one of the largest urban transport investments globally on a per-kilometre basis. Yet Shaban (2023) cautions that transport policy in MMR has historically been 'demand-following rather than futuristic' - a characterisation that the eight-year delay in implementing PAC's 2017 railway safety recommendations reinforces.

The fundamental analytical conclusion of this section is that infrastructure investment, while now moving at scale, has consistently trailed the demographic demand generated by labour migration. The suburban railway system - serving 43% of MMR's daily trips - has operated above capacity for decades without commensurate capacity addition. New metro lines are being built, but at fares and with last-mile gaps that restrict access for the lowest-income migrants who need them most.

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6. DISCUSSION OF HYPOTHESES

Against the evidence presented in Section 5, each of the seven hypotheses is evaluated directionally:

H1 (Migration positively associated with railway ridership): SUPPORTED. The strong correlation between MMR's migration-driven population growth and suburban railway ridership is evident across all available data points. The recovery of ridership to near-1 crore levels in 2025-26, driven by peripheral residential expansion that is itself a migration outcome, confirms this hypothesis.

H2 (Migration leads to higher crowding indices): SUPPORTED. Migrant concentration in peripheral rail corridors, combined with employment location in the core city, creates precisely the peak-hour demand patterns that generate dangerous crowding conditions. Over 66,500 railway deaths between 2004-2024 provide grim confirmation.

H3 (Migration positively associated with vehicle population growth): SUPPORTED. The consistent growth of registered vehicles in MMR - from approximately 9.2 lakh in 2001 to an estimated 48.6 lakh in 2025 - tracks closely with both population growth and the upward economic mobility of established migrant communities transitioning to private vehicle ownership.

H4 (Migrant density accelerates road congestion): SUPPORTED. The 65% peak-hour congestion index in 2018, and the 15% surge over pre-pandemic levels recorded in 2025, are consistent with migration-driven population growth overwhelming a road network that has not expanded commensurately.

H5 (Metro expansion moderates suburban train overcrowding): PARTIALLY SUPPORTED. The opening of Metro Lines 2A and 7 produced a measurable decline in Western Railway ridership at key stations. However, the metro's total daily ridership of 9 lakh remains small relative to the 70+ lakh on suburban rail, and fare differentials limit access for lower-income migrants.

H6 (Migration drives informal transport demand): SUPPORTED. The preponderance of lower-income migrants in the MMR's peripheral zones, inadequately served by formal rail/metro networks, has driven the growth of auto-rickshaws, shared tempos, and app-based platforms as structural complements to the formal system.

H7 (Infrastructure investment lags migration-driven population growth): SUPPORTED. The sustained overcrowding of the suburban railway system for five-plus decades, the decades-long delay in implementing safety recommendations, and the persistent road capacity deficit despite near-tripling of vehicle populations all confirm that infrastructure supply has consistently lagged migration-induced demand.

7. POLICY RECOMMENDATIONS

Based on the foregoing analysis, the following policy recommendations are advanced for integrating labour migration management with urban transport infrastructure planning in Mumbai:

7.1 Migration-Sensitive Transport Planning

MMRDA and the State of Maharashtra should institute a Migration-Transport Interface Cell (MTIC) within the regional planning authority. This cell should maintain a continuously updated Labour Migration Database, integrating Census data, PLFS surveys, and RTO records, to inform transport demand forecasting. All transport infrastructure projects above ₹500 crore should include a Migration Impact Assessment as a mandatory planning instrument.

7.2 Accelerated Metro Rollout with Migrant-Inclusive Fare Policy

The 16-line, 523 km metro plan must be realised on schedule by 2030. However, its effectiveness for migrant workers depends on fare accessibility. A differential fare structure - analogous to the suburban railway's low fares - should be implemented for migrants holding employment identity cards on designated metro corridors serving peripheral migrant zones. Cross-subsidy arrangements between premium and commuter services should fund this.

7.3 Last-Mile Connectivity Infrastructure

The primary barrier to metro adoption among migrant workers is last-mile connectivity, not fares. MMRDA should mandate the development of integrated multi-modal hubs at all metro stations in peripheral zones, incorporating first- and last-mile feeder buses, safe bicycle parking, and formally regulated auto-rickshaw stands. The proposed 7.5 km of Coastal Road cycling lanes should be extended to all major transit corridors.

7.4 Suburban Railway Capacity and Safety Emergency Programme

The ongoing record of 2,400-3,600 annual railway deaths represents a public health emergency. The Ministry of Railways should implement, within 24 months: (a) automatic door closure on all suburban rakes; (b) platform-edge crowd management systems at the 20 busiest stations; (c) quadrupling of remaining double-track suburban

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corridors; and (d) access control systems at major stations. The Supreme Court and Bombay High Court should be engaged as accountability mechanisms.

7.5 Peripheral MMR Employment Decentralisation

Structural relief for transport infrastructure can only come from reducing the spatial mismatch between migrant residence and employment. The Maharashtra government's identification of 10 economic growth centres in the extended MMR (2022) - including Boisar, Palghar, Badlapur, and Pen - should be accelerated through targeted fiscal incentives for employers relocating to these centres. A transport corridor between these zones and core employment areas should be planned simultaneously.

7.6 Data Modernisation and Real-Time Mobility Monitoring

The absence of a 2021 Census final dataset - now four years overdue - represents a critical planning data gap. The Government of India should expedite Census 2021 completion. In the interim, MMRDA should utilise mobile phone aggregated data, Ola/Uber trip data, and metro/railway smart card data to construct real-time migration-mobility intelligence dashboards for transport planning.

8. CONCLUSION

Mumbai's urban transport infrastructure exists at the intersection of two of the world's most powerful demographic forces: the economic pull of India's largest metropolis and the structural push of rural-to-urban migration. Over four decades, labour migration has built MMR's workforce, populated its peripheral zones, and generated the commuter demand that now carries 9.3 million people daily on suburban trains designed for far fewer. The resultant transport stress - measured in overcrowded coaches, congested arterials, and thousands of annual commuter deaths - is not merely an infrastructure failure but a governance failure: the chronic inability to anticipate and plan for migration-driven demand.

The good news embedded in this analysis is that India, and Maharashtra specifically, is investing in solutions at unprecedented scale. The ₹2.2 lakh crore metro expansion, the Atal Setu, the Coastal Road, the MUTP III suburban railway upgrades, and the identification of decentralised economic growth centres together represent a structural pivot in Mumbai's transport history. The question is not whether these investments are occurring, but whether they will be executed with the speed, equity, and migration-consciousness necessary to serve the migrant workers who are both the city's economic engine and its most transport-stressed residents.

This paper has argued, through secondary data analysis spanning 2001-2025, that seven core hypotheses linking labour migration to transport infrastructure stress are confirmed by available evidence. The policy framework proposed herein - centred on migration-sensitive planning, metro accessibility, last-mile infrastructure, suburban railway safety, employment decentralisation, and data modernisation - offers a roadmap for realigning Mumbai's transport governance with its demographic reality.

Mumbai's fate, as one commentator aptly noted, is inextricably linked to the villages of Bihar, Uttar Pradesh, and Maharashtra from which its workers come. Its transport infrastructure must be planned with that linkage at its centre.

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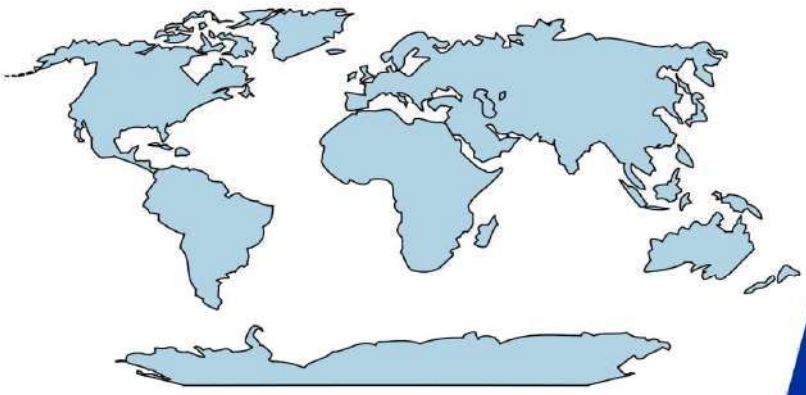

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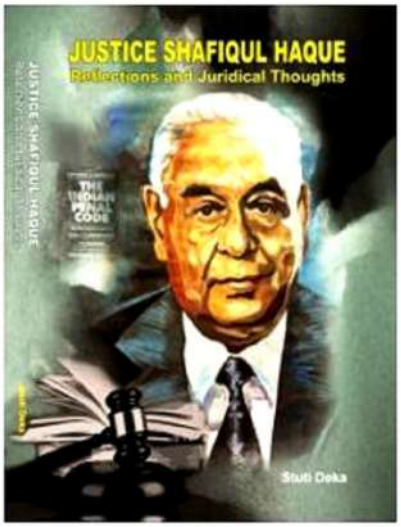

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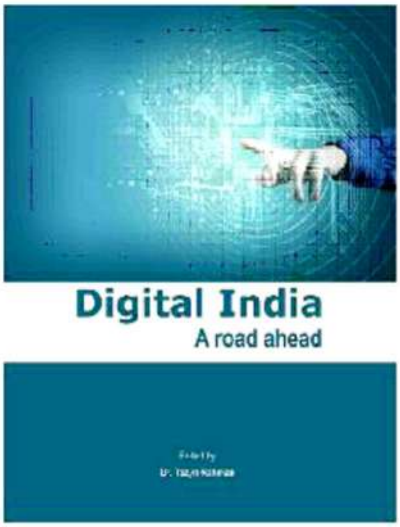

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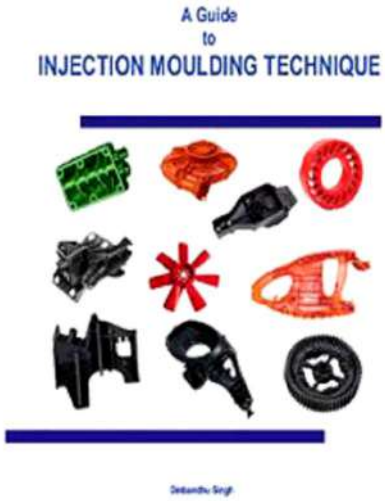

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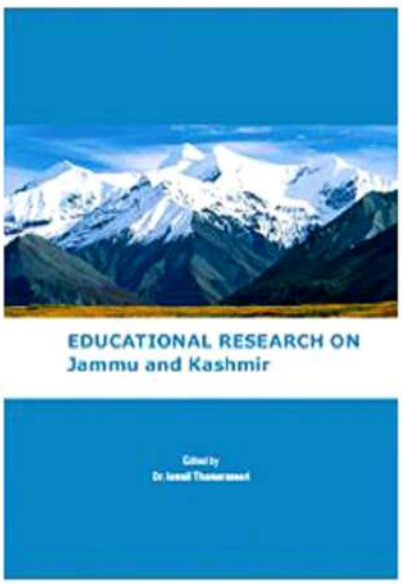

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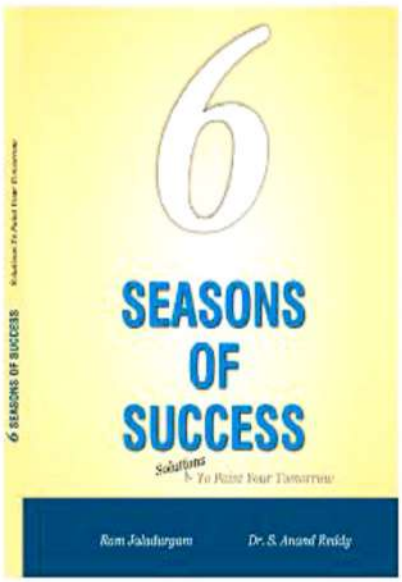

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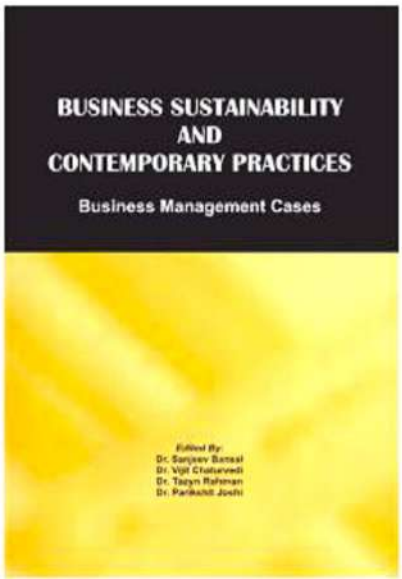

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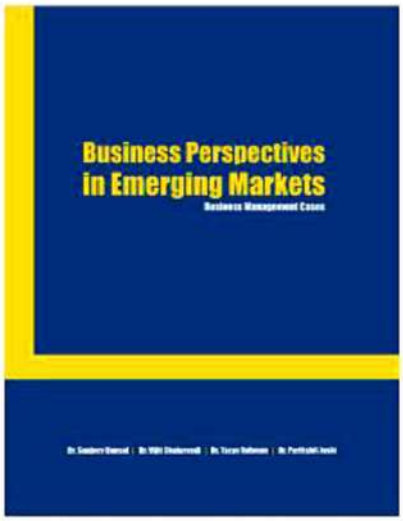

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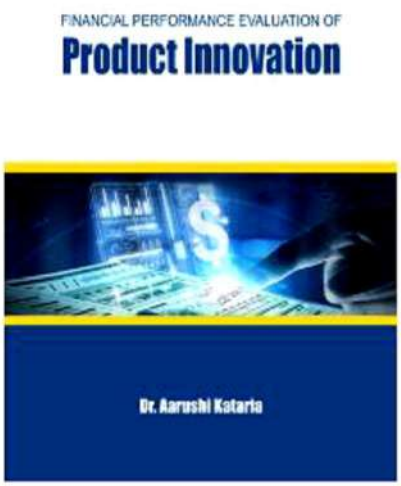

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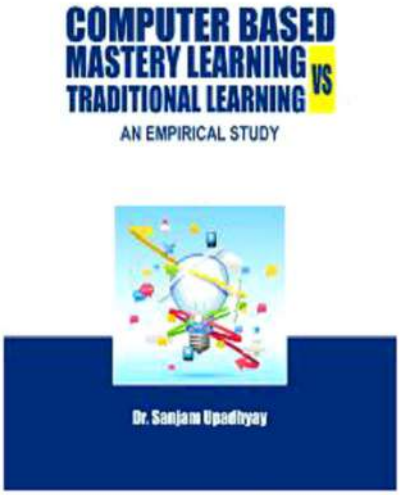

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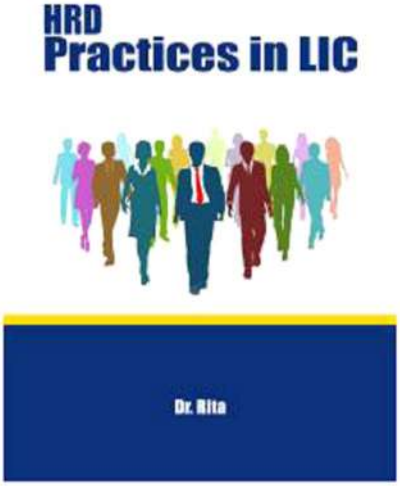

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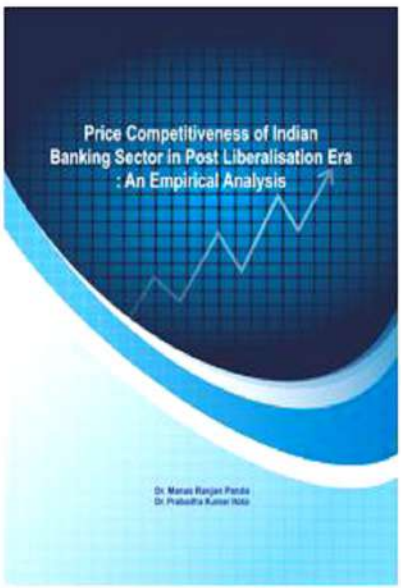

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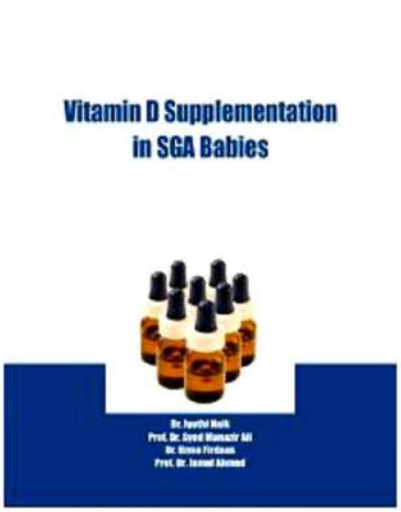

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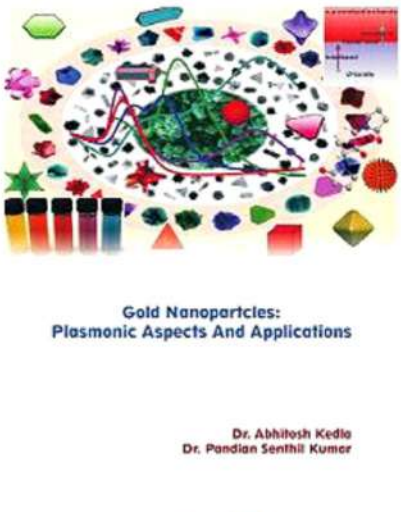

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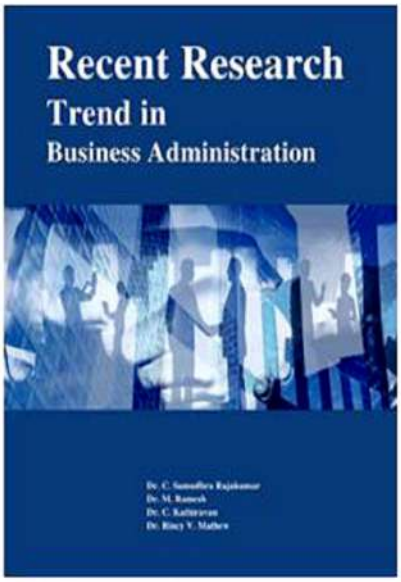

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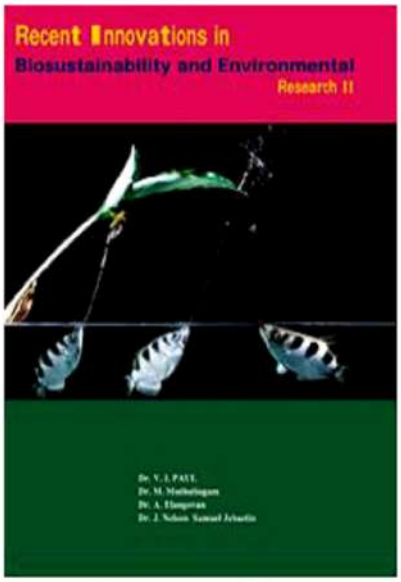

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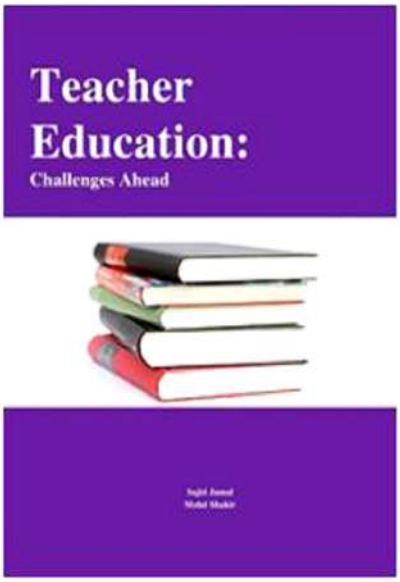

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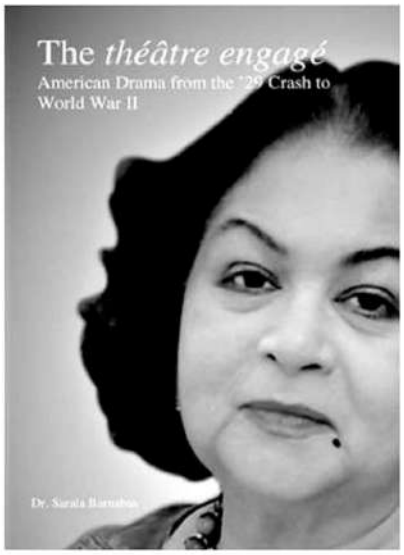

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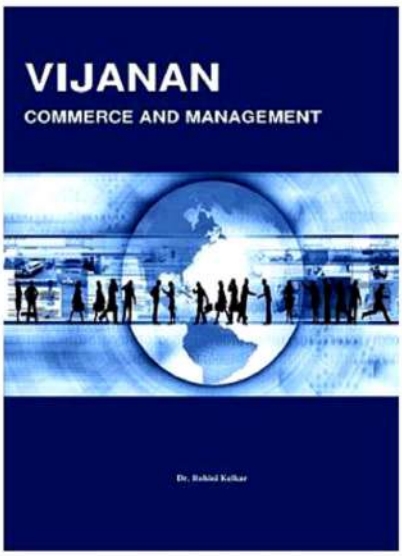

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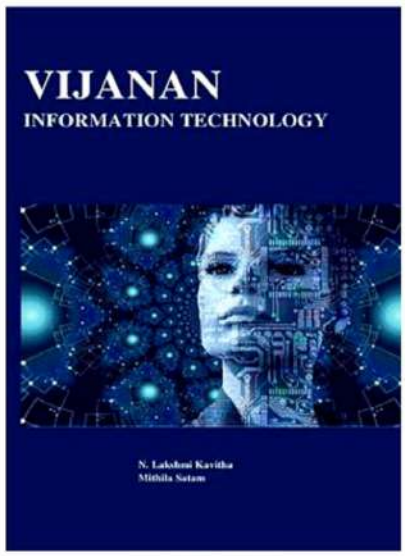

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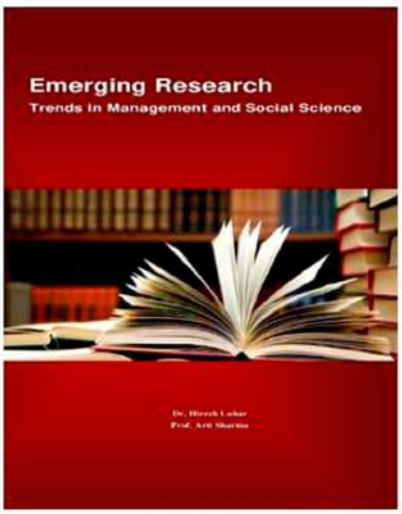

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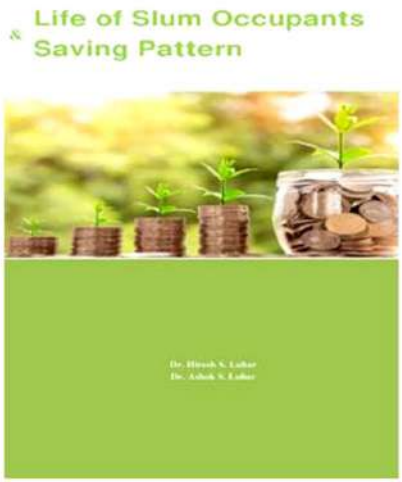

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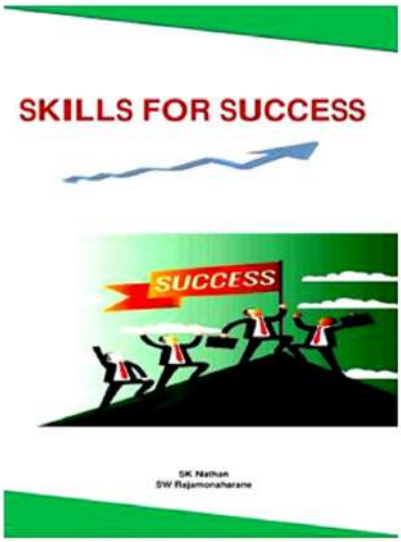

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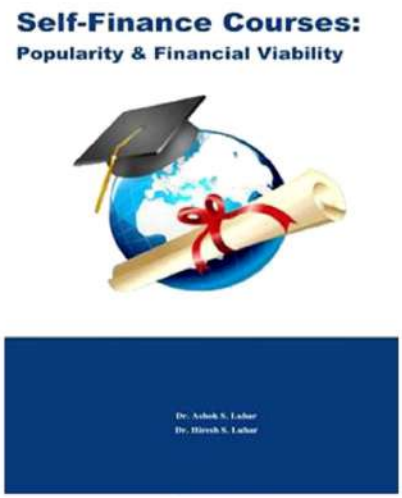

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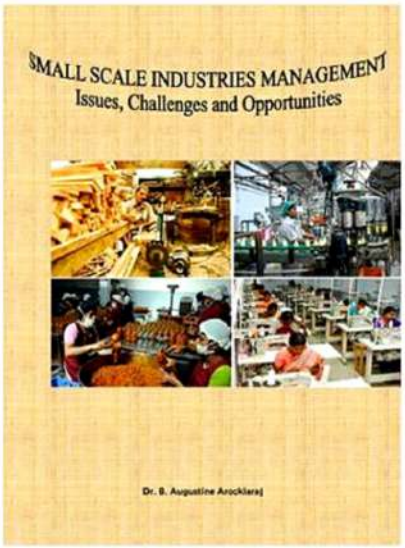

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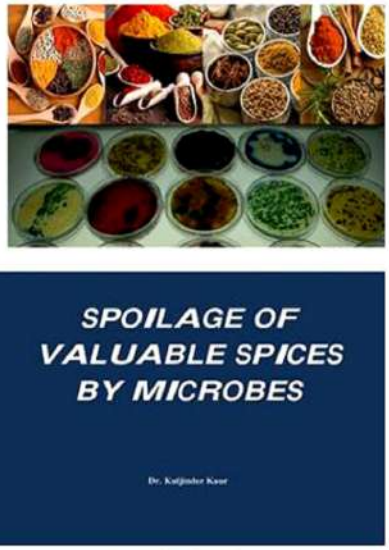

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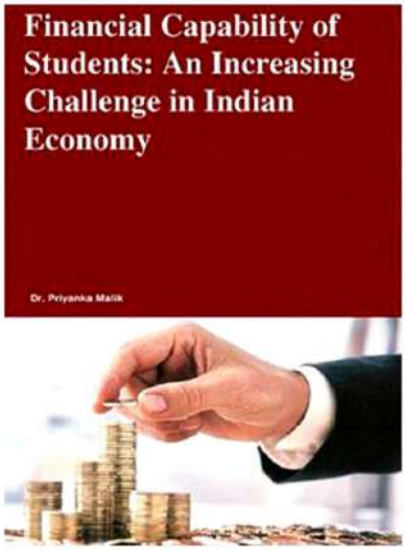

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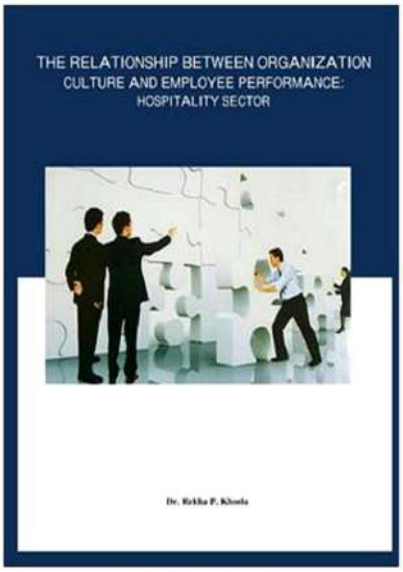

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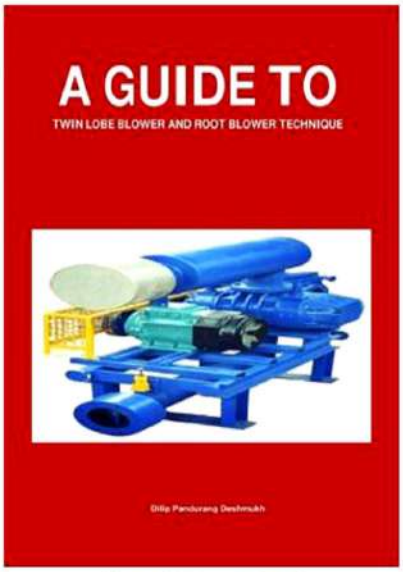

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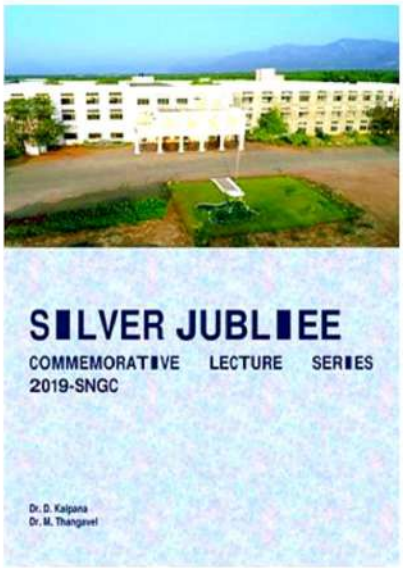

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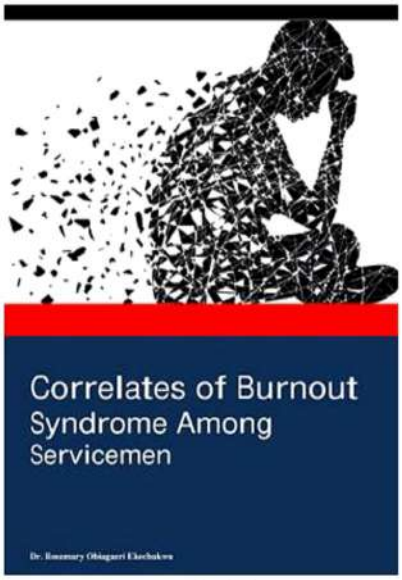

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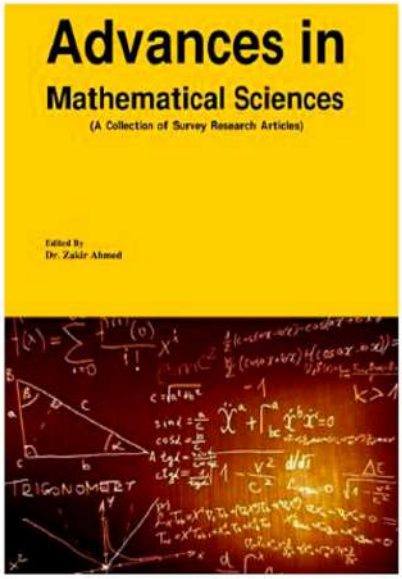

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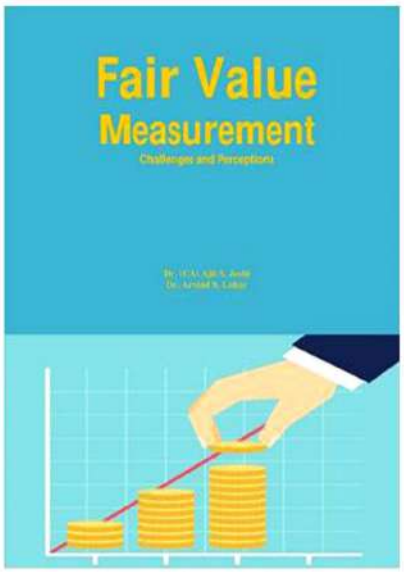

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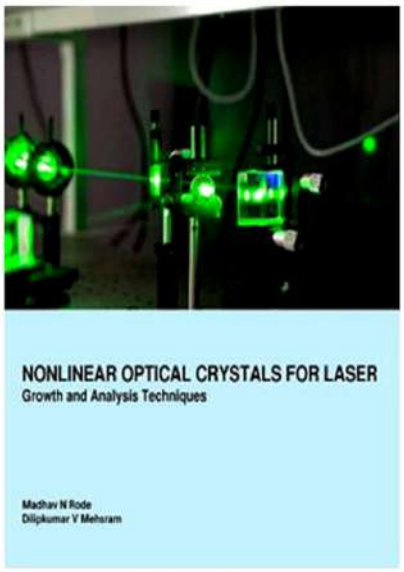

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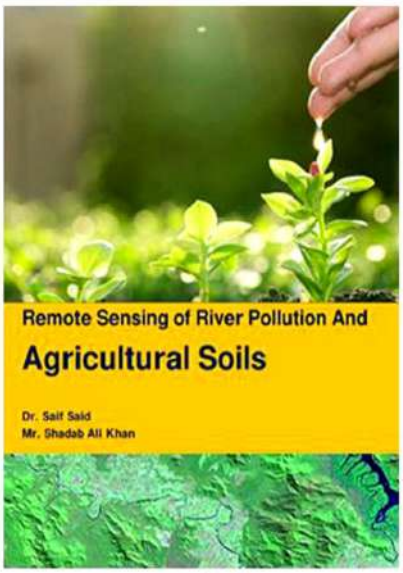

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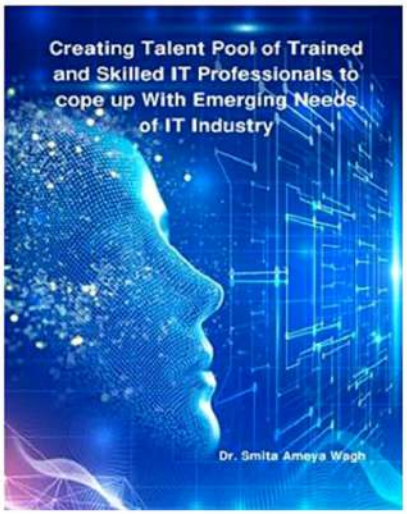

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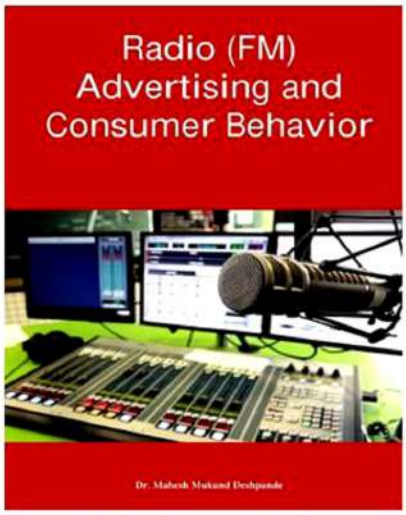

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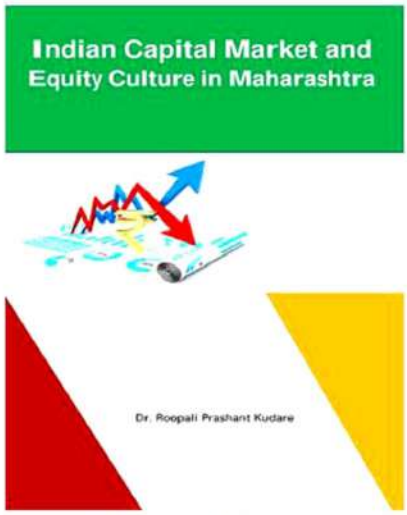

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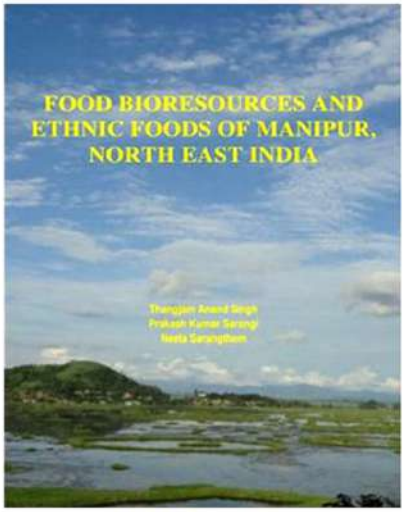

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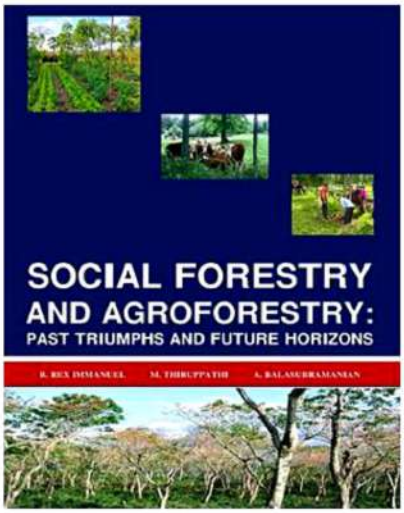

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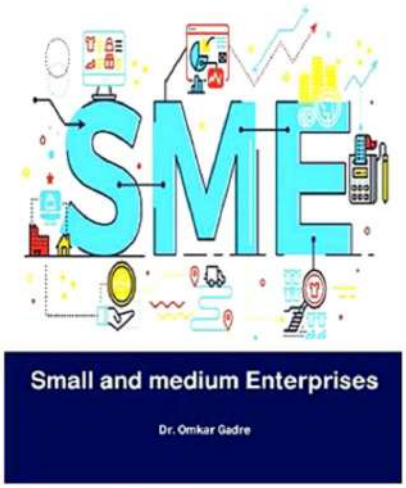

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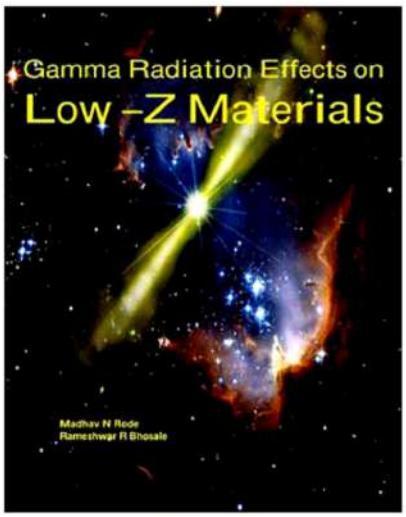

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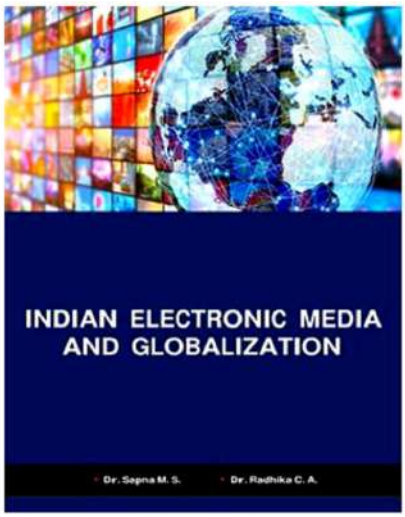

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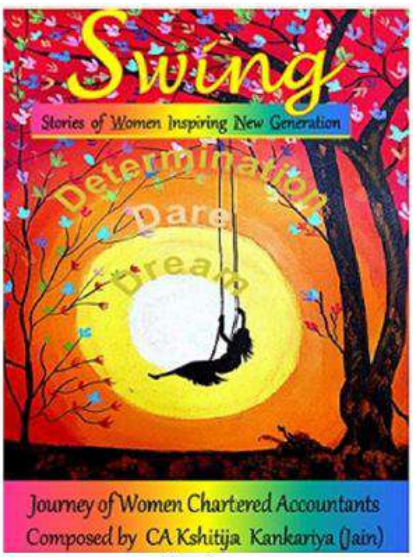

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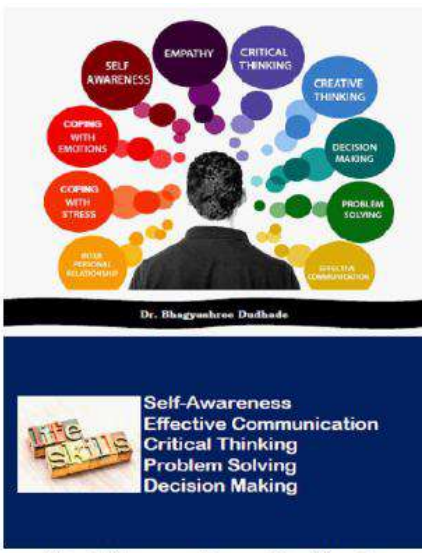

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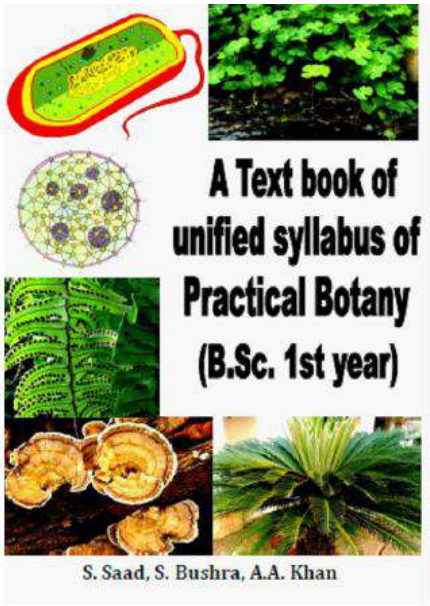

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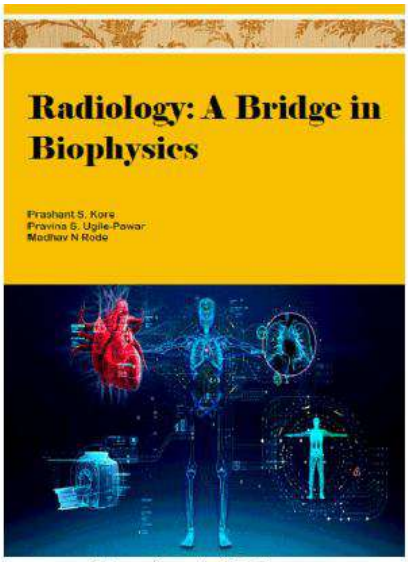

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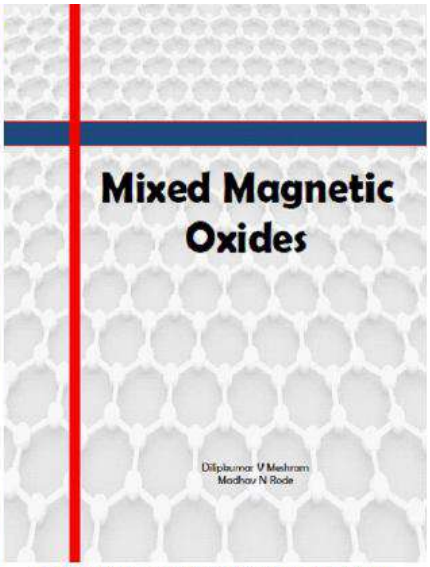

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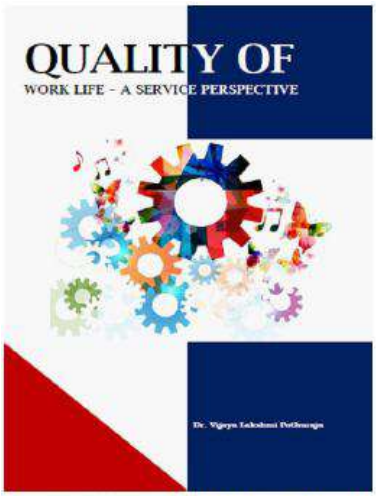

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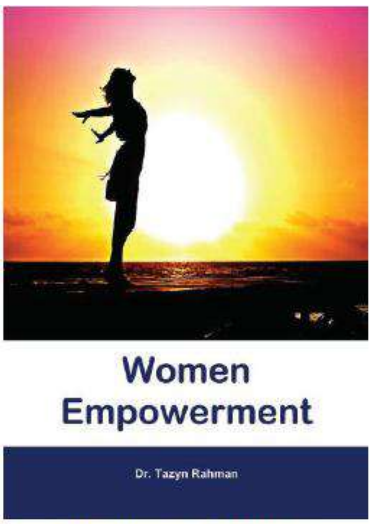

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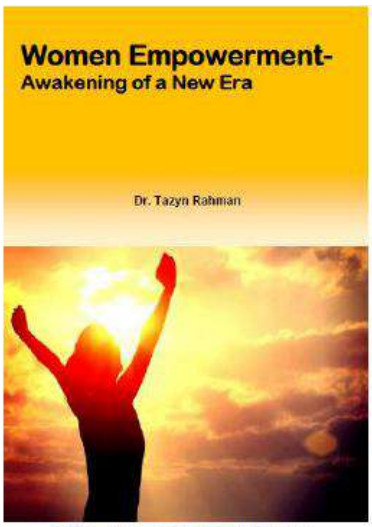

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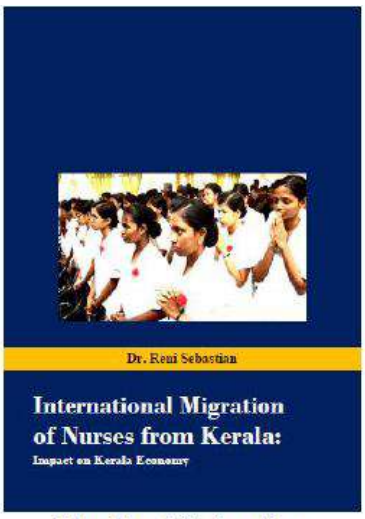

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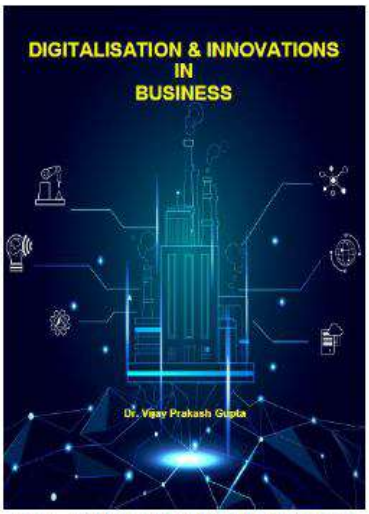

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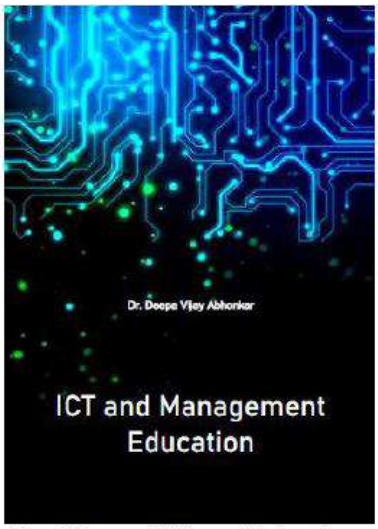

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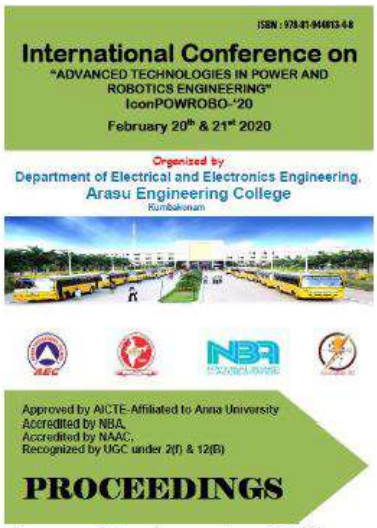

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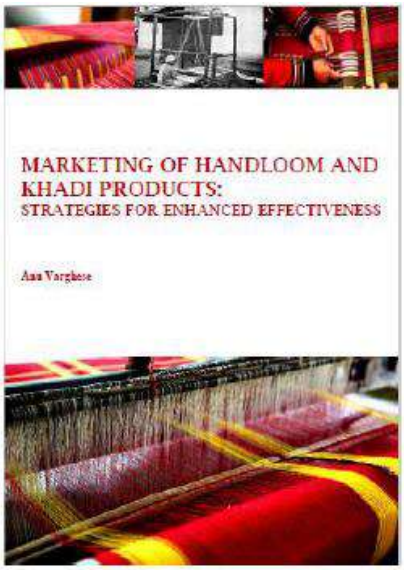

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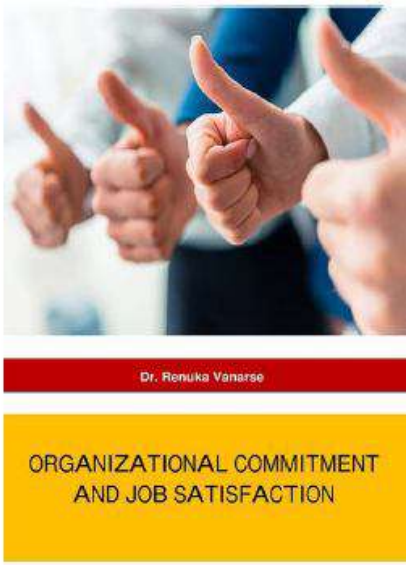

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