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INTERNATIONAL CONFERENCE ON AI, SMART TECHNOLOGIES AND SUSTAINABLE DEVELOPMENT

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ON

AI, SMART TECHNOLOGIES AND SUSTAINABLE DEVELOPMENT

(ICASTSD-2026)

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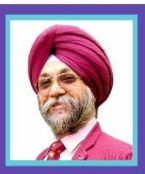

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Key Papers

INDUSTRIAL EFFLUENTS AND AQUATIC LIFE: A CASE STUDY OF SUGAR FACTORY WASTEWATER IN INDIA

Shishir Tripathi

Assistant Professor, Department of Zoology, Shri Lal Bahadur Shashtri Degree College, Gonda, U.P., India

Abstract

India's industrial expansion has driven economic growth while intensifying environmental degradation. Sugar manufacturing stands out as a major source of freshwater pollution, routinely discharging untreated or partially treated effluents into rivers and ponds. These wastewaters contain elevated levels of organic matter, suspended solids, and toxic chemicals that devastate aquatic ecosystems, depleting dissolved oxygen and disrupting food chains. This paper investigates how sugar mill effluents harm aquatic organisms, particularly fish populations, in the Indian context. By analyzing the biochemical composition of sugar industry wastewater and examining documented cases of biodiversity loss, the study builds a comprehensive understanding of the ecological crisis. The findings underscore the urgent need for sustainable waste management practices and stronger environmental enforcement within the sugar sector to protect India's freshwater resources and preserve aquatic biodiversity.

Keywords: Sugar industry, industrial effluents, water pollution, aquatic life, environmental degradation, India, wastewater management.

Introduction

Water sustains all life on Earth, supporting both human societies and countless aquatic organisms through rivers, ponds, lakes, and groundwater systems. Yet rapid industrialization has compromised freshwater quality globally, with India particularly vulnerable to industrial pollution. The sugar sector exemplifies this tension: while agro-based sugar manufacturing contributes substantially to rural economies and employment across major producing states as Uttar Pradesh, Maharashtra, Karnataka, Punjab, and Haryana, it simultaneously generates significant environmental costs.

India ranks among the world's largest sugarcane and sugar producers, yet sugar factories routinely produce vast quantities of liquid waste during sugarcane processing. The prevailing practice of discharging untreated effluents into rivers, irrigation canals, and agricultural fields has created an ecological crisis. Contaminated

waterways now exhibit telltale signs of severe degradation: elevated fish mortality rates, depleted oxygen concentrations, persistent odour problems, and the systematic destruction of aquatic vegetation. These observable impacts underscore the fundamental incompatibility between current industrial practices and ecosystem health.

Nature and Composition of Sugar Factory Effluents

The sugar manufacturing process unfolds across multiple sequential stages as washing, crushing, clarification, evaporation, crystallization, and refining, each generating wastewater laden with both organic and inorganic pollutants. Sugar mill discharges characteristically exhibit elevated Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) concentrations, reflecting the intense organic contamination inherent to the industry.

The pollutant profile of sugar factory effluents is diverse and multifaceted:

- Suspended solids and sedimentary matter
- Oil and grease residues
- Sulphates and phosphate compounds
- Chloride ions
- Organic byproducts from sugarcane processing
- Molasses-derived contaminants
- Industrial cleaning agents and surfactants

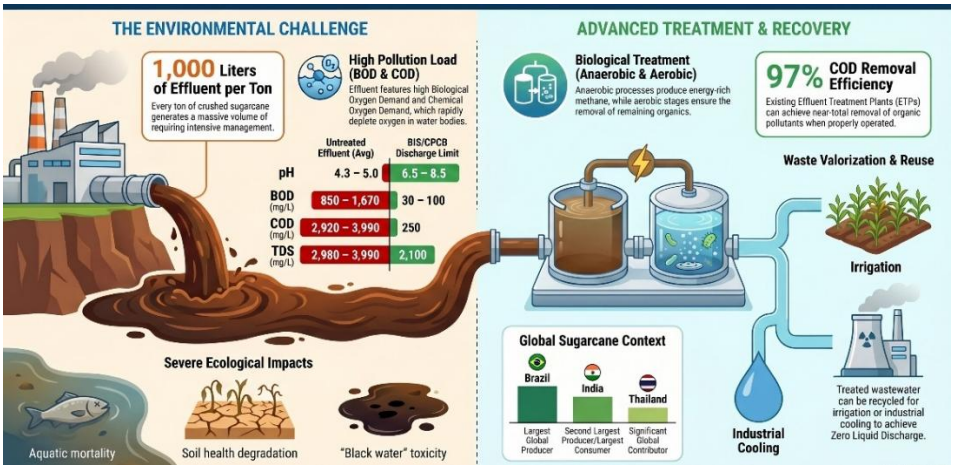

Figure 1: Sugar Industry Wastewater: Balancing Economic Growth and Environmental Safety

Source: Author's Imagination Using Notebook LM

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These contaminants degrade water quality through increased turbidity and chemical toxicity. The characteristic dark coloration of sugar mill discharge particularly impedes light transmission through the water column, thereby suppressing photosynthetic activity in aquatic vegetation and phytoplankton communities.

Equally problematic is the aerobic decomposition of organic matter within discharged effluents. This microbial breakdown process consumes dissolved oxygen at accelerated rates, progressively deoxygenating the aquatic environment. As oxygen availability declines below critical thresholds, aquatic fauna experience physiological stress and eventual mortality, fundamentally destabilizing the ecosystem.

Effects on Aquatic Life

- **Reduction in Dissolved Oxygen**

Aquatic organisms, including fish, prawns, and plankton, depend on dissolved oxygen for survival. Sugar factory effluents contain substantial biodegradable organic matter, which consumes oxygen during decomposition and thereby reduces oxygen availability in rivers and ponds. When dissolved oxygen levels fall below the threshold required for life, fish experience physiological stress and may ultimately die. Studies from areas near sugar mill discharge sites in India have repeatedly reported large-scale fish mortality linked to oxygen depletion.

- **Toxicity to Fish and Aquatic Organisms**

Industrial effluents frequently contain toxic compounds and heavy metals that accumulate within aquatic ecosystems. Although present in trace concentrations, chronic exposure to these contaminants progressively damages vital organ systems in aquatic fauna, particularly the nervous, reproductive, and respiratory systems. The bioaccumulative nature of such pollutants poses a persistent threat to organism health and population viability.

Fish exposed to polluted water may show symptoms such as:

- Abnormal swimming behavior
- Reduced growth rate
- Skin infections
- Damage to gills
- Reproductive failure

Small aquatic organisms like plankton and insect larvae are even more vulnerable. Since plankton forms the base of the aquatic food chain, their destruction affects the entire ecosystem.

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- **Eutrophication and Algal Bloom**

Sugar factory wastewater contains elevated nutrient concentrations, particularly phosphates and nitrates that trigger excessive algal proliferation in receiving water bodies, a phenomenon termed algal bloom. These dense algal masses obstruct light penetration and suppress oxygen production, while their subsequent decomposition intensifies oxygen depletion through microbial respiration. This cascading process, known as eutrophication, progressively transforms aquatic environments into hypoxic "dead zones" where aquatic organisms cannot sustain viable populations.

- **Loss of Biodiversity**

Persistent industrial pollution selectively eliminates sensitive aquatic species while favoring pollution-tolerant organisms, thereby reducing overall biodiversity and destabilizing ecological balance. Pristine rivers naturally sustain diverse communities comprising fish species, aquatic macrophytes, benthic insects, amphibians, and microorganisms in complex interdependence. Conversely, rivers adjacent to industrial discharge zones exhibit marked reductions in species richness and functional diversity, accompanied by progressive ecological degradation and compromised ecosystem integrity.

Indian Case Studies

- **Case Study 1: Sugar Mills in Uttar Pradesh**

Uttar Pradesh hosts one of India's largest concentrations of sugar manufacturing facilities. Rivers and canals in western Uttar Pradesh have experienced significant contamination from sugar mill effluents. Local environmental agencies have documented multiple instances of aquatic mortality in water bodies receiving untreated discharges. Communities dependent on these ecosystems, particularly farmers and fishermen have consistently reported malodorous water conditions and diminished fish populations. The situation intensifies seasonally during the sugarcane crushing period, when effluent discharge volumes surge substantially, exacerbating ecological degradation in already stressed aquatic systems.

- **Case Study 2: Krishna River Basin, Maharashtra**

Maharashtra, a principal sugar-producing region, hosts numerous sugar factories proximate to the Krishna River basin, whose operations discharge wastewater that compromises fluvial ecology. Limnological investigations of adjacent water bodies have documented elevated biochemical oxygen demand (BOD) and chemical oxygen demand (COD) concentrations concurrent with diminished dissolved oxygen levels. Local fishing communities report substantially reduced yields and

progressive water quality deterioration. Aquatic macrophytes in contaminated river reaches exhibit visible pathological symptoms, including necrosis and chromatic abnormalities, indicative of severe ecosystem stress and trophic dysfunction.

- **Case Study 3: Karnataka Sugar Industry Regions**

Karnataka's sugar industries, positioned in proximity to rural communities, have catalyzed contamination of both groundwater and surface water resources. Rural populations reliant on ponds and riverine systems have observed marked alterations in water organoleptic properties, specifically discoloration and malodorous conditionsfollowing industrial effluent discharge. Fish mortality events and suppressed aquatic biological activity correlate temporally with peak production seasons, reflecting acute pollution stress during periods of maximum effluent generation and discharge volume.

Environmental Regulations and Challenges

India has established environmental laws such as the Water (Prevention and Control of Pollution) Act, 1974, and guidelines issued by the Central Pollution Control Board to regulate industrial pollution. Sugar factories are required to install Effluent Treatment Plants (ETPs) before discharging wastewater.

However, several challenges limit effective implementation:

- Inadequate monitoring by authorities
- Poor maintenance of treatment plants
- Illegal discharge during nighttime
- Lack of environmental awareness
- Financial constraints among smaller industries

As a result, pollution continues despite legal provisions.

Suggestions and Recommendations

- Installation of Efficient Treatment Plants
- Recycling and Reuse of Wastewater
- Strict Government Monitoring
- Adoption of Green Technologies
- Community Participation

Conclusion

India's sugar industry constitutes a vital pillar of rural economic development, yet its environmental consequences warrant equally serious consideration. Inadequately treated sugar mill effluents inflict substantial damage on aquatic

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ecosystems through oxygen depletion, elevated toxicity levels, and systematic biodiversity loss. Fish kill events, eutrophic algal proliferation, and ecological disequilibrium now manifest regularly in water bodies adjacent to contaminated discharge zones.

Resolving this challenge requires coordinated action across multiple stakeholder groups: industrial operators, governmental regulatory bodies, environmental advocacy organizations, and civil society. Sustainable industrial development mandates reconciliation of economic expansion with environmental stewardship. Strategic interventionsencompassing advanced wastewater treatment technologies, rigorous regulatory enforcement, and community environmental literacyare essential prerequisites for safeguarding India's aquatic biodiversity and securing ecological integrity for successive generations.

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EXPLORING HR-DRIVEN INNOVATIVE CULTURE AND SUSTAINABILITY PERFORMANCE: A COMPARATIVE REVIEW OF LARGE ORGANIZATIONS AND MSMES

Deepika Kanwar & Dr. Pankaj Gupta

Abstract

Innovation and sustainability are becoming a key issue of concern in organizations in the contemporary competitive business world, as organizations seek to attain growth and performance over a long period of time. HR practices are very important in promoting an innovative organizational culture where employees can be creative, share knowledge, and participate. This paper examines the role of HR-led innovative culture in sustaining the performance of organisations, and it is comparatively conducted in reference to large organisations and Micro, Small and Medium Enterprises (MSMEs). The paper discusses the effect of various HR practices like training employees, helping them to become leaders, managing performance and reward systems on the innovation and long-term organizational results. The research is grounded on the review and analysis of secondary data comprising of research articles, journals, and industry reports on human resource management, innovation, and sustainability. The comparative analysis of the paper puts light on the differences and similarities between the HR practices embraced by large organizations and the MSMEs. Formal HR systems, formal training programs, and clear sustainability strategies are usually implemented in large organizations where the amount of financial resources available is greater, as well as technological resources. Contrarily, the MSMEs tend to utilize the flexible managerial framework, entrepreneurial leadership, and informal human resources practices to promote innovation and adaptability.

Key Words: Human Resource Management, Innovative Organizational Culture, Sustainability performance, HR practices, big organizations, MSMEs, Organizational Innovation, Employee engagement, Sustainable development, Comparative Analysis.

Introduction

The current business world is dynamic and highly competitive, thus it is in this ever-changing environment that organizations have been paying more attention to innovation and sustainability in order to ensure they stay in the growth and competitive position in the long run. Human Resource Management (HRM) is of great importance in development of the organizational culture and promotion of innovations

among employees. Employee training, involvement into decision-making, performance management, reward system, and other HR policies assist in that environment where employees are motivated to come up with new ideas and help in the development of organizations.

A new corporate culture will encourage creativity, knowledge sharing, working together, and constant improvement. The culture does not only enhance performance in organizations but also promotes sustainable development as it encourages better use of organizational resources, ethical behavior and long-term strategic thinking. Companies that appropriately incorporate innovation and sustainability have a greater chance of reacting to evolving market conditions and international issues. The difference between the large organizations and Micro, Small and Medium Enterprises (MSMEs) is very wide in the resources, management structure, and HR practices. Big companies usually possess well-developed HR system, official training and systematized sustainability policy. Conversely, MSMEs tend to be resource-starved and depend more on loose forms of management, informality in human resource policies and entrepreneurial management. These differences notwithstanding, the two forms of organizations appreciate the role of innovation and sustainability to long-term success.

- **HR-Driven Innovative Culture**

HR-based innovative culture means the organizational culture in which human resource policies and practices have been proactive in promoting creativity, experimentation, and the creation of new ideas in employees. In ensuring that such a culture is created, HR departments have an important role to play and some of the strategies that can be used include skill development programs, empowerment of employees, knowledge sharing platforms and reward systems that are based on innovations.

HR practices that facilitate innovation in organizations are more likely to result into increased employee engagement and productivity as well as enhanced ability to solve problems. The promotion of teamwork, open communication, and unceasing learning assists the employees to come up with innovative solutions that can help the organization grow and stay competitive.

- **Sustainability Performance in Organizations**

Sustainability performance is the capability of an organization to attain economic growth and at the same time ensure environmental responsibility and social well being. It encompasses activities like effective use of resources, minimization of environmental footprint, responsible business behavior and social responsibility programs.

HR is critical in ensuring that there is sustainability through the incorporation of sustainability objectives into the organizational training programs, organizational policies, and performance appraisals. With employees working towards the realization of the sustainability goals and actively undertaking the realization initiatives, there are higher chances that organizations would establish long term sustainable strategies and enhance the overall performance.

Objectives of the Study

- To examine the contribution of the HR practices towards the creation of an innovative organizational culture.
- To investigate the correlation between the innovation initiated by HR and the sustainability performance.
- To contrast the HR practices in large organizations and MSMEs as far as the topic of innovation is concerned.
- To examine the effect of size of organizations on sustainability performance.
- To propose policies to enhance HR-based innovation of MSMEs.

Literature Review

Human Resource Management (HRM), innovative culture, and sustainability performance are the topics that have been much debated in the academic literature. It has been highlighted by researchers that proper HR practices assist the organizations to establish an environment that promotes creativity, innovation and long-term sustainability. The HR policies of training and development, employee involvement, performance appraisal and reward systems play a significant role in creating innovative culture in the organizations.

Teresa Amabile (1997) indicated that the organizational support and HR practices have a great influence on motivating employees to be creative and innovative. According to the research conducted by Amabile in terms of creativity in organizations, employees tend to be more innovative and provide their contribution to organizational development when they are supported, recognized, and free to make their own decisions. The HR policies which aim at employee motivation, capability building and teamwork establish a favorable working environment which promotes innovative thinking.

On the same note, **Michael Porter & Mark Kramer (2011)** also noted the notion of shared value and stated that the sustainability initiatives are directly linked with the organizational strategies and human resource participation. According to their research, by including sustainability in the main business strategies, organizations can successfully attain both economic and social benefits. HR departments are critical in

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this process as they will be able to align the behavior of the employees, performance management systems as well as organizational goals to sustainability objectives.

A study by **Agarwal & Sharma (2020)** explored the connection between HR practices and innovation in the Micro, Small and Medium Enterprise (MSMEs). Their results show that training programs, employee empowerment, and participative decision-making have a strong impact on the innovation capabilities development of MSMEs. Because of their smaller size and the flexible nature of their structures, MSMEs usually focus on the close communication between employees and management that may help encourage creativity and accelerate the introduction of innovative ideas.

A number of studies also note the variation between big organizations and MSMEs when it comes to HR practices and innovation management. Formal HR policies, formal training systems and clear innovation strategies are typically used in large organizations. They usually possess focused research and development (R&D) departments, hi-tech resources and official sustainability programs. These formalized systems enable bigger companies to pursue innovation and sustainability programs at a greater level of scale. Conversely, MSMEs tend to have fewer financial and human resources and this influences the degree of formalization in their HR practices. MSMEs tend to rely on informal communication, loose managerial culture, and entrepreneurial leadership in lieu of formal institution in encouraging innovativeness. Albeit, MSMEs might not have the developed HR systems, their flexibility and quicker decision-making procedures can be a benefit in the application of innovative solutions in some cases.

Research Methodology

The paper is an analytical and comparative research study to determine the relationship between HR-led innovative culture and sustainability performance within organizations. The study is mainly premised on the analysis of secondary data, which entails gathering and analyzing secondary data as contained in credible academic and institutional sources. Secondary data is also applicable in a review-based study since it enables the researcher to analyze the past and establish trends and come up with comparative ideas about HR practices, innovation, and sustainability in various forms of organizations.

The research question identified by the methodology is to determine the impact of Human Resource (HR) practices on the culture of innovations and sustainability performance and the difference in the relationship between the large organizations and Micro, Small and Medium Enterprises (MSMEs). Through an

evaluation of already published sources and reports, the study finds out important HR strategies that help in innovation and sustainable development.

Data Sources

The information used in this research has been gathered through different secondary sources so that it is reliable and academically pertinent. These sources include:

- The research papers were published in national and international journals that are related to the management of human resources, organizational behavior, innovation, and sustainability.
- Reports on the industry that offer insight on HR practices, innovation and sustainability initiatives in organizations.
- Government MSME reports, which outline policies, performance indicators and issues of MSMEs in the implementation of innovative and sustainable practices.
- Peer reviewed journals and academic publications in the area of HRM, innovation management and sustainable organizational development.

The sources are very informative and can be used to gain an insight into how HR can facilitate innovation and sustainability within organizations of varying sizes..

Research Design

The research is based on a comparative analytical research design. This design is aimed to compare the practices of HR-driven innovation and sustainability performance across two types of organizations:

- Large Organizations: In such organizations, the HR departments are usually well organized, the organization has formal policies, there is a special research and development (R&D) unit as well and the entity has sustainability programs.
- MSMEs (Micro, Small and Medium Enterprises): These organizations are frequently resource constrained and they tend to depend more on flexible management system, informal HR systems and entrepreneurial leadership approach to facilitate innovation.

The comparative method assists in determining similarities, differences, strengths and challenges within the HR practices and their influence on HR practices and innovation and sustainability in various organizational scales.

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Variables Studied

The study is concerned with 3 central variables that are subject to the research:

- **HR Practices**: Common HR practices focus on training and development initiatives, employee involvement, leadership assistance, performance appraisal systems, reward and recognition initiatives, and knowledge sharing systems. The practices play a significant role in determining the behavior of employees and promoting innovative thinking.
- **Innovative Culture**: Innovative culture is an organizational climate, which promotes creativity, experimentation, problem-solving and development of new ideas. It entails open communication, teamwork, learning provisions and encouragement of employee initiatives.
- **Sustainability Performance**: Sustainability performance is a concept that describes the capacity of the organization to be economically successful, at the same time being environmentally responsible and socially well. It encompasses the habits including effective use of resources, environmental conservation measures, ethical business conduct and corporate social responsibility actions.

Through these variables analysis, the study will get to learn how HR practices impact the maturity of the innovative culture and how the culture can be used to enhance sustainability performance in large organizations as well as in MSMEs.

Data Analysis

The analysis of data presented in the current research is grounded on comparative analysis of secondary information provided in research papers, reports, and academic journals on the topic of HR practices, innovation, and sustainability. The analysis is devoted to determining patterns and differences in the implementation of the HR strategies to promote the innovative culture and sustainability performance in large organizations and MSMEs. Through assessing the results of the earlier studies, the study reveals the usefulness of the HR practices which include training, employee involvement, and leadership support in enhancing the innovativeness and sustainable organizational performance.

Key Points of Data Analysis

- Major organizations tend to have formal sustainability programs and systematic HR policies because of more financial and technological capacities.
- To promote innovation, it is more on flexible management practices and entrepreneurial leadership that enables MSMEs.

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- The HR factors that have a positive impact on innovative culture in both forms of organizations is employee training and empowerment.
- HR-led innovation organizations are more likely to have a positive sustainability performance and long-term growth.
- The presence of resources and the organization structure play a big role in ensuring innovation and sustainability practices are implemented.

Table 1: Comparative Analysis of HR Practices in Large Organizations and MSMEs

HR Factor	Large Organizations	MSMEs
Training Programs	Structured and frequent	Limited but flexible
Innovation Support	Dedicated R&D departments	Informal innovation
Employee Participation	Formal suggestion systems	Direct communication
Sustainability Initiatives	CSR programs and green policies	Cost-focused sustainability
Leadership Style	Strategic and hierarchical	Entrepreneurial and flexible

Source: Author's compilation

Analytical Interpretation

- Formal HR structures of big organizations will facilitate systematic innovation and sustainability programmes.
- Flexibility and quick decision making are more prominent in MSMEs, which encourages innovation at the cost of less-organized sustainability practices.
- Combining training, leadership support, and employee participation is more effective in terms of HR-driven innovation.

Summary

This paper provides an analysis of how Human Resource (HR) practices can be used to achieve development of an innovative organizational culture and enhance sustainability performance with a comparative viewpoint to large organizations and MSMEs. The study shows that employees training, participation, leadership support, and reward systems are some of the HR strategies that are effective in promoting innovation and sustainable practices. The discussion indicates that big organizations tend to adopt systematic HR policies and formal sustainability programmes because of the available resources and MSMEs tend to use less formal ways of managing organisations and entrepreneurial approaches to leadership as a way of encouraging innovation. Regardless of these variations, the two forms of organizations have the advantage of HR-based innovation in realizing growth and sustainability in the long term. The researchers conclude that the HR practices could be reinforced and the

involvement of employees promoted to improve innovation and sustainability performance in organizations considerably.

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A MULTIDIMENSIONAL STUDY OF HR PRACTICES INFLUENCING EMPLOYEE JOB SATISFACTION IN EDU-TECH FIRMS OF DELHI NCR

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Abstract

The rapid expansion of the Edu-Tech sector in India, particularly in the post-COVID era, has created new challenges and opportunities in human resource management. This study examines the impact of specific HR practices—recruitment and selection, training and development, performance appraisal, and compensation—on employee job satisfaction within Edu-Tech firms located in Delhi NCR. Drawing upon Expectancy Theory, Social Exchange Theory, and the Resource-Based View (RBV), the study investigates how employee-centric HR practices contribute to satisfaction in a fast-paced, digitally intensive work environment. A structured questionnaire was administered to 400 employees across various Edu-Tech companies using a stratified random sampling method. Data were analyzed using descriptive statistics, Pearson correlation, and multiple regression techniques. The results reveal that recruitment fairness and structured training programs are significantly and positively associated with employee satisfaction. KPI clarity also emerged as a strong predictor of satisfaction, while the motivational effect of performance appraisal systems was statistically weak. Compensation practices were moderately rated, indicating room for improvement in reward alignment. The findings support the argument that transparent, developmental, and performance-aligned HR practices are critical to fostering job satisfaction in the Edu-Tech sector. The study contributes to the limited empirical literature on HRM in emerging digital industries and offers practical insights for HR professionals seeking to enhance workforce engagement, retention, and organizational commitment. Recommendations are provided for implementing HR strategies that align employee expectations with organizational goals in the context of India's rapidly evolving education-technology landscape.

Keywords: Human Resource Practices, Job Satisfaction, Edu-Tech, Recruitment, Training, Delhi NCR, Performance Appraisal, Compensation

Introduction

The Indian Edu-Tech industry has changed a lot in the last few years, and the COVID-19 pandemic caused a lot of digital disruption that had never happened before. What started as a way to learn more has now become a common way to teach, changing how learning is planned, given, and used. With the proliferation of online learning platforms such as Byju's, Unacademy, upGrad, and Vedantu, the Edu-Tech industry has emerged as a dynamic and high-growth segment within India's broader digital economy (Bhattacharya & Saini, 2019). Delhi's National Capital Region (NCR) has become a centre for Edu-Tech activity because it is in a good location, has a skilled workforce, has good technology infrastructure, and is close to places where new ideas are born and studied. National programs like Digital India and the National Education Policy (NEP) 2020 have sped up this change even more by pushing for digital literacy, hybrid learning models, and lifelong learning (Eze et al., 2021).

This growth has made it much easier for people to get a good education and has also opened up a lot of different job opportunities. However, it has also made managing human resources (HRM) much more difficult. In contrast to conventional educational institutions, Edu-Tech companies function within a dynamic, technology-centric landscape marked by significant employee turnover, swift scaling requirements, and fierce competition for digital talent (Singh & Sharma, 2015). As these companies deal with hybrid work models, roles that require a lot of skills, and higher employee expectations, problems like retention, burnout, role ambiguity, and disengagement at work have become very important. In this high-pressure environment, job satisfaction has become a key factor in both employee well-being and the performance of the organisation (Spector, 1997). A satisfied workforce not only boosts productivity and innovation, but it also lowers turnover and encourages long-term commitment to the organisation. These are all important for the long-term success of Edu-Tech businesses (Jiang et al., 2012).

Human Resource (HR) practices are essential in influencing employee experiences and fostering a culture of engagement, development, and psychological safety. Important HR tasks like hiring and firing, training and development, performance reviews, pay management, and company culture have a direct effect on how employees feel about fairness, motivation, and satisfaction (Taylor & Collins, 2000; Herzberg, 1959; Ehrhardt et al., 2011). Nonetheless, despite the pivotal role of HR in the operations of Edu-Tech companies, there exists a significant deficiency in academic research that empirically investigates HRM practices within the Indian Edu-Tech landscape, particularly concerning employee job satisfaction. Most studies in India have focused on either conventional educational environments or general

corporate human resource management, neglecting the distinct challenges and opportunities associated with digital education enterprises (Mishra & Bhardwaj, 2020).

This study aims to fill this research gap by examining the impact of particular HR practices on employee job satisfaction in Edu-Tech companies located in Delhi NCR. The study utilises three prominent theoretical models to contextualise the analysis:

- **Expectancy Theory** (Vroom, 1964): This theory asserts that employees are driven when they perceive that their efforts will yield effective performance, which in turn will lead to favourable rewards. In the realm of Edu-Tech, this theory is pertinent for assessing the impact of well-structured training programs, performance evaluations, and reward systems on employees' expectations and job satisfaction (Ehrhardt et al., 2011).
- **Social Exchange Theory** (Blau, 1964): This framework stresses the give-and-take between the employer and the employee. When companies put money into fair hiring practices, professional development, and treating employees with respect, they are more likely to be loyal, work hard, and be happy (Kundu & Gahlawat, 2016).
- **Resource-Based View (RBV)** (Barney, 1991): This theory views employees as strategic assets that confer a competitive edge. From this point of view, HR practices are important for getting, training, and keeping people, which is a key part of success in fields like Edu-Tech that are based on innovation (Jiang et al., 2012).

In many cases, the fast growth of Edu-Tech companies has outpaced the growth of strong HR systems. Companies often put a lot of effort into hiring new people quickly, but not as much into giving them feedback on their work, providing opportunities for learning, or making sure their employees are happy (Bhattacharya & Saini, 2019). Even though they are based on the tech/startup ecosystem, pay structures often don't take into account long-term contributions or match up with individual performance metrics (Gupta & Shaw, 2014). Additionally, communication deficiencies and the lack of ongoing professional development opportunities lead to employee dissatisfaction and disengagement (Brown et al., 2010). The structural and systemic deficiencies in HR necessitate an examination of employee perceptions regarding HR practices and the influence of these perceptions on their satisfaction levels.

This study utilises primary data gathered from 400 employees employed at various Edu-Tech companies in the Delhi NCR region. The study utilises a quantitative research design featuring structured questionnaires and statistical tools,

including descriptive analysis, ANOVA, correlation, and regression modelling, to investigate the relationships between core HR practices and job satisfaction. The regional focus on Delhi NCR adds depth to the context because it is a high-density Edu-Tech cluster with a diverse workforce that works on product development, content creation, instructional design, and customer support (Mishra & Bhardwaj, 2020).

Research Objectives

- To examine how recruitment and selection practices impact employee job satisfaction in Edu-Tech firms.
- To analyze the role of training and development in shaping job satisfaction.
- To assess the influence of performance appraisal systems on employee motivation and satisfaction.
- To evaluate the impact of compensation structures on employee perceptions and engagement.

Research Questions

- How do recruitment processes affect employees' perceptions of fairness and satisfaction?
- What is the relationship between training programs and employee development satisfaction?
- To what extent do performance appraisal mechanisms contribute to or hinder job satisfaction?
- How do compensation and reward systems influence overall job satisfaction in Edu-Tech firms?

By integrating empirical analysis with established theoretical models, this study aims to provide both **practical implications** for HR practitioners and **theoretical contributions** to the body of knowledge on HRM in digitally intensive sectors. The findings are expected to inform policy formulation and help HR leaders in Edu-Tech companies design more employee-centric, transparent, and strategically aligned HR systems that not only attract top talent but also retain and empower it in a sustainable manner.

Literature Review

The role of human resource (HR) practices in shaping employee job satisfaction has been a widely researched area across organizational studies. In high-growth, technology-driven sectors such as Edu-Tech, effective HRM is especially critical due to evolving work models, skill intensity, and the need for continuous

innovation. As the Indian Edu-Tech industry continues to expand post-COVID, understanding how recruitment, training, appraisal, compensation, and organizational culture influence job satisfaction has become increasingly important for sustainable workforce management and employee retention.

- **HR Practices and Job Satisfaction: Conceptual Overview**

Job satisfaction refers to an individual's affective response to various aspects of their job, including rewards, supervision, and work environment (Spector, 1997). Herzberg's Two-Factor Theory (1959) distinguishes between hygiene factors (e.g., salary, policies) and motivators (e.g., recognition, growth) in explaining employee satisfaction. In modern workplaces, these drivers are embedded within HR practices. Scholars have consistently linked well-structured HRM systems to enhanced employee morale, reduced turnover, and increased organizational commitment (Jiang et al., 2012).

According to the Resource-Based View (Barney, 1991), human capital is a strategic asset. Thus, HR practices that attract, develop, and retain talent become core to organizational competitiveness, especially in sectors like Edu-Tech, where intellectual capabilities are central to value creation.

- **Recruitment and Selection**

Recruitment is the first touchpoint in the employee-employer relationship and directly shapes early perceptions of fairness and fit. Transparent and merit-based recruitment processes not only build employer brand equity but also influence job satisfaction by setting realistic expectations (Breaugh, 2008). In technology-intensive organizations, targeted hiring strategies that align employee competencies with job requirements have been shown to predict higher satisfaction and performance (Taylor & Collins, 2000).

A study by Eze et al. (2021) on digital learning platforms in Nigeria found that structured recruitment procedures significantly influenced educators' motivation and retention. Similarly, in Indian startups, Singh and Sharma (2015) emphasized that clarity in job roles and alignment during hiring reduced early attrition and improved satisfaction.

- **Training and Development**

Training is a fundamental process for skill development and career advancement. It not only helps employees get better at their jobs, but it also shows that the company cares about their growth, which is linked to happiness (Ehrhardt et al., 2011). In fast-changing fields like Edu-Tech, where technology changes quickly, ongoing training is important to keep employees interested and skilled.

Tharenou et al. (2007) conducted a meta-analysis that revealed perceived access to learning and development opportunities as a significant predictor of job satisfaction and career commitment. Bhattacharya and Saini (2019) discovered that employees in technology-driven educational companies in India regarded certification-oriented learning initiatives and mentorship as significant contributors to their psychological well-being and motivation.

The Expectancy Theory (Vroom, 1964) posits that employees experience greater satisfaction when they believe that training enhances performance, subsequently yielding significant rewards.

- **Performance Appraisal**

Performance appraisal systems work as ways to give feedback that link hard work with praise, rewards, and promotions. But how satisfied people are with them depends on how fair, open, and relevant they are to the outcomes of their roles (Brown et al., 2010). Badly designed appraisal systems can make employees cynical and unhappy, especially in fields where performance is often subjective, like knowledge-based work.

In the context of India's knowledge economy, Kundu and Gahlawat (2016) reported that participatory appraisal mechanisms, where employees are involved in setting KPIs and reviewing outcomes, positively influenced engagement and job satisfaction. Moreover, performance appraisals aligned with development conversations (rather than punitive assessments) fostered stronger psychological contracts and employee trust (Aguinis, 2009).

- **Compensation and Rewards**

Compensation remains a fundamental hygiene factor in job satisfaction, particularly in competitive labor markets like Edu-Tech. While intrinsic motivators such as learning and purpose are essential, dissatisfaction often stems from perceived inequity in pay or non-alignment between effort and reward (Adams, 1965).

Studies in Indian startups show that employees expect both financial and non-financial rewards to be performance-linked and transparent. According to Gupta and Shaw (2014), pay dispersion that aligns with merit rather than favoritism is associated with higher employee morale and retention

Khan and Rasheed (2015) observed that in educational institutions transitioning to digital models, reward clarity, including incentive schemes and bonuses, played a critical role in boosting satisfaction among instructional designers and content creators. Equity Theory further explains how perceptions of fairness in compensation directly influence affective commitment and job satisfaction.

- **Organizational Culture and Employee Experience**

Organizational culture shapes the social and psychological environment in which employees operate. It affects communication flow, inclusion, recognition, and emotional safety—all of which are essential for satisfaction (Lok & Crawford, 2004). In fast-scaling Edu-Tech startups, culture can often become fragmented or inconsistent, leading to dissatisfaction and disengagement.

Mishra and Bhardwaj (2020) conducted a study on Indian digital firms, revealing that inclusive and feedback-driven cultures were positively associated with job satisfaction and creative output. Workers at tech-focused learning companies liked working together, having freedom, and being in environments that encouraged new ideas.

Social Exchange Theory (Blau, 1964) offers a valuable framework, indicating that employees who recognise mutual investment in their well-being by the organisation are likely to exhibit increased engagement, trust, and satisfaction.

Theoretical Framework

This research utilises three interconnected theoretical frameworks—Expectancy Theory, Social Exchange Theory, and the Resource-Based View (RBV)—to elucidate the impact of particular human resource practices on employee job satisfaction within the Edu-Tech sector.

- **Expectancy Theory**

Vroom (1964) introduced Expectancy Theory, which asserts that individuals are driven to act when they perceive that their efforts will result in desired outcomes, which will subsequently produce significant rewards. The theory is based on three main ideas: expectancy (the link between effort and performance), instrumentality (the link between performance and reward), and valence (the value of the reward). In the realm of Edu-Tech, training programs and well-defined Key Performance Indicators (KPIs) serve as essential mechanisms through which employees comprehend the effort-performance-reward relationship.

For instance, employees are more motivated and happier when they think that the training they get will help them get better at their jobs and move up in their careers, and when their KPIs are well-defined and possible to reach (Ehrhardt et al., 2011). The theory posits that when performance evaluations and rewards are regarded as equitable and consistent with these KPIs, employees are more inclined to remain engaged and dedicated to the organisation. So, Expectancy Theory is a good way to look at how training effectiveness and goal clarity affect job satisfaction in the Edu-Tech world.

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- **Social Exchange Theory**

Blau's (1964) Social Exchange Theory focusses on the importance of reciprocity in relationships within organisations. It implies that employees are inclined to reciprocate positive treatment from their employer with heightened loyalty, commitment, and satisfaction. This theory is especially helpful for figuring out how open hiring practices, fair treatment by bosses, and respect in the workplace can help build a good psychological contract between workers and the company. Employees feel valued and are more likely to put their energy and loyalty into the organisation when it shows trust and fairness, such as by making sure hiring processes are fair, giving employees chances to grow, and keeping lines of communication open (Kundu & Gahlawat, 2016). In the high-demand, high-burnout Edu-Tech sector, where job roles are often fluid and workloads are heavy, trust, fairness, and recognition are important for keeping employees happy. Social Exchange Theory elucidates the emotional and psychological processes through which HR practices affect workplace attitudes.

- **Resource-Based View (RBV)**

Barney (1991) came up with the Resource-Based View (RBV), which sees human capital as a strategic asset that helps businesses stay ahead of their competitors. RBV says that businesses that create and keep valuable, rare, inimitable, and non-substitutable (VRIN) resources, like skilled and happy workers, are more likely to do better than their competitors.

In the Edu-Tech sector, where employee knowledge is very important for innovation, teaching quality, and user engagement, job satisfaction is very important for keeping important employees. HR practices that make employees happier, like pay based on performance, personalised development programs, and welcoming company cultures, can help an organisation build its human capital. Employees who are happy are more likely to stay with the company, help it come up with new ideas, and be brand ambassadors in a job market that is very competitive (Jiang et al., 2012). RBV thus gives a strategic reason to put money into HR systems that put employee experience and satisfaction first.

These three theories work together to give us a full picture of how HR practices affect job satisfaction in India's Edu-Tech sector. Expectancy Theory concentrates on motivational mechanisms, Social Exchange Theory highlights relational equity, and Resource-Based View (RBV) contextualises satisfaction within strategic resource management. The combination of these points of view allows for a more detailed look at how well HRM works and gives Edu-Tech companies looking to

improve employee well-being and organisational performance both operational and strategic insights.

Research Methodology

This study employs a quantitative, descriptive research design to analyse the impact of HR practices on employee job satisfaction within Edu-Tech firms situated in Delhi NCR. The objective is to evaluate the proposed correlations between fundamental HR dimensions—recruitment, training, performance appraisal, compensation, and organisational culture—and job satisfaction.

- **Sampling and Respondents**

The study targeted full-time employees working across various Edu-Tech organizations in Delhi NCR. A stratified random sampling technique was used to ensure representation across departments such as technology, instructional design, and learner support. A total of 400 valid responses were collected via an online survey platform over a 2-month period. Participation was voluntary, and confidentiality was assured.

- **Research Instrument**

A structured questionnaire was employed, comprising:

  - Demographic details (age, gender, tenure, role)
  - HR practice constructs (5-point Likert scale)
  - Job satisfaction items adapted from Spector's Job Satisfaction Survey (1985)

Measurement items for recruitment, training, appraisal, compensation, and culture were adapted from validated prior studies (e.g., Breaugh, 2008; Ehrhardt et al., 2011; Gupta & Shaw, 2014). A pilot test with 30 respondents confirmed item clarity.

- **Reliability and Validity**

The reliability of each scale was confirmed using Cronbach's alpha, with all constructs exceeding the 0.70 threshold (ranging from 0.78 to 0.88). Content and construct validity were established through expert review and exploratory factor analysis.

- **Data Analysis Techniques**

Data were analyzed using SPSS 29. Descriptive statistics summarized the demographic profile and overall response patterns. Pearson correlation measured the strength of relationships, while multiple linear regression tested the hypotheses regarding the impact of HR practices on job satisfaction. The regression model

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included all five HR variables as predictors and job satisfaction as the dependent variable. Significance was assessed at $p < 0.05$.

Data Analysis & Results

- **Descriptive Statistics**

Descriptive statistics were computed to provide an overview of the respondent profile and central tendencies for the key HR variables assessed in the study. The final dataset comprised **400 valid responses** from employees working in various Edu-Tech companies located in Delhi NCR.

Demographic Profile of Respondents

- **Gender:** 53.5% of the respondents were male, 46.5% female
- **Age Distribution:** The majority (62%) were between **25–34 years**, followed by 23% aged **35–44**, and 15% aged **below 25** or **above 45**.
- **Tenure:** 34% had **less than 2 years** of experience in their current organization, 41% had between **2–5 years**, and 25% had **more than 5 years**.
- **Firm Type:** 68% of the respondents worked in **medium-sized Edu-Tech firms** (100–500 employees), while 20% were from **startups (fewer than 100 employees)** and 12% from **large organizations (500+ employees)**.

Mean Scores of Key HR Variables

All HR-related constructs were measured on a **5-point Likert scale** (1 = Strongly Disagree, 5 = Strongly Agree). The **mean scores** for each variable are summarized below:

HR Practice	Mean Score (N = 400)	Std. Deviation
Recruitment and Selection	3.84	0.71
Training and Development	3.69	0.77
Performance Appraisal	3.48	0.82
Compensation and Rewards	3.42	0.89
Organizational Culture and Support	3.93	0.68
Job Satisfaction	3.87	0.75

The results indicate **moderately high levels of agreement** across all HR practices, with **organizational culture** and **recruitment processes** receiving the highest average ratings. In contrast, **compensation** and **performance appraisal systems** were rated comparatively lower, suggesting potential areas for HR policy refinement.

- **Hypothesis Testing**

H1: There is a significant impact of recruitment practices and employee job satisfaction.

To test Hypothesis 1, a linear regression analysis was conducted with employee job satisfaction as the independent variable and recruitment practices as the dependent variable. The model revealed a strong and statistically significant relationship between the two variables.

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.898[a]	.808	.800	1.09248
a. Predictors: (Constant), employee job satisfaction.				

The Model Summary indicates a high R-value of 0.898, suggesting a strong positive correlation between recruitment practices and job satisfaction. The R^2 value of 0.808 implies that approximately 80.8% of the variance in recruitment practices can be explained by employee job satisfaction levels, which reflects a substantial effect size and model fit.

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	264.169	2	132.085	110.670	.000[b]
	Residual	473.821	397	1.194		
	Total	737.990	399			
a. Dependent Variable: recruitment practices						
b. Predictors: (Constant), employee job satisfaction						

The ANOVA table supports the model's statistical significance with an F-statistic of 110.670 and a p-value < 0.001, indicating that the regression model significantly predicts recruitment practices based on employee satisfaction.

In the Coefficients table, the unstandardized coefficient (B = 0.596) suggests that for every one-unit increase in employee job satisfaction, the perceived effectiveness of recruitment practices increases by 0.596 units. The relationship is statistically significant, as shown by the t-value of 10.552 and a p-value of 0.000.

Based on these results, Hypothesis 1 is supported. The findings demonstrate that employees who report higher job satisfaction are more likely to perceive recruitment practices as effective, fair, and transparent. This underscores the importance of aligning hiring strategies with employee expectations and satisfaction drivers in the Edu-Tech sector.

H2: There is a significant positive correlation between training and development practices and employee job satisfaction

To test Hypothesis 2, a Pearson correlation analysis was conducted to examine the relationship between employees' perceptions of training and development practices and their overall job satisfaction. The results indicate a strong positive correlation, with a correlation coefficient (r) of 0.719, which is statistically significant at the 0.01 level ($p < 0.001$).

Correlations			
		Training and Development Practices	**Employee Job Satisfaction**
training and development practices	Pearson Correlation	1	.719**
	Sig. (2-tailed)		.000
	N	400	400
employee job satisfaction	Pearson Correlation	.719**	1
	Sig. (2-tailed)	.000	
	N	400	400
**. Correlation is significant at the 0.01 level (2-tailed).			

This finding indicates that when employees view training and development opportunities as effective, pertinent, and conducive to their professional advancement, their job satisfaction correspondingly elevates. The strength of the correlation ($r = 0.719$) suggests a strong link, which means that changes in the quality and frequency of training practices are closely linked to changes in how satisfied employees are with their jobs.

Hypothesis 2 is supported because the relationship is important and strong. This shows how important it is for Edu-Tech companies to invest in structured learning programs, upskilling programs, and frameworks for ongoing development. In a digital industry that changes quickly, where roles and knowledge needs are always changing, HR interventions like these are very important for making employees happy and getting them to stay with the company.

Discussion

The results of this study offer robust empirical evidence for the assertion that particular human resource practices—especially recruitment, training, and performance appraisal systems—exert a considerable influence on employee job satisfaction within India's Edu-Tech sector. These findings underscore the strategic significance of HRM in improving organisational outcomes via employee-centric policies and further substantiate established theoretical frameworks, including Expectancy Theory, Social Exchange Theory, and the Resource-Based View.

The regression findings pertaining to Hypothesis 1 indicated a robust positive correlation between job satisfaction and recruitment practices, with around 81% of the variance in perceived recruitment quality accounted for by employee satisfaction levels. This is in line with Breaugh's (2008) claim that open, honest, and fair hiring processes build trust from the start and have a lasting effect on the relationship between employees and employers. It also supports the work of Singh and Sharma (2015), who found that being clear about job expectations from the start makes people much happier in Indian startups. The present study applies these insights to the Edu-Tech sector, where swift expansion and significant turnover necessitate precise alignment between recruitment strategies and employee expectations.

Further, the strength of this relationship can be interpreted through the lens of **Social Exchange Theory** (Blau, 1964), which suggests that perceived fairness and respect in organizational processes encourage positive reciprocation from employees in the form of satisfaction, commitment, and loyalty. The results affirm that fair recruitment is not merely an entry mechanism but a foundational HR intervention that shapes the long-term employment experience.

The **second hypothesis** was supported by a statistically significant and strong positive correlation (r = 0.719) between training and development and job satisfaction. This supports previous research by Tharenou, Saks, and Moore (2007), which emphasized that professional development is one of the most critical predictors of satisfaction, particularly in knowledge-driven industries. In the context of Edu-Tech firms, where technological fluency and pedagogical agility are essential, effective training programs are not only a developmental necessity but also a psychological signal of employer investment in employee growth. This aligns well with **Expectancy Theory** (Vroom, 1964), where employees perceive value when their effort (e.g., participation in training) is likely to result in improved performance and tangible rewards.

Interestingly, while KPI clarity (examined in the context of performance metrics) emerged as a strong predictor of satisfaction, the **motivational value of performance appraisal systems was found to be statistically weak**, as indicated by insignificant regression coefficients. This suggests that although roles and expectations are well communicated, appraisal mechanisms may not be effectively reinforcing or rewarding performance. This discrepancy mirrors findings from Brown et al. (2010), who argued that unless performance feedback is specific, timely, and perceived as just, appraisal systems often fail to motivate employees. In Edu-Tech settings—where subjective evaluations, fast-changing goals, and limited one-on-one

feedback are common—traditional appraisal formats may not resonate with employees seeking clarity and fairness.

From a practical standpoint, these findings imply that HR departments in Edu-Tech firms must critically examine their appraisal practices. Rather than relying solely on annual reviews or top-down evaluations, there is a need to integrate **continuous feedback loops**, peer assessments, and employee self-reflections to make performance management more participatory and development-focused.

The study's results align significantly with the Resource-Based View (RBV) (Barney, 1991), which regards satisfied and effectively managed employees as strategic assets. The significant impact of recruitment and training on employee satisfaction indicates that companies that prioritise these aspects are more capable of retaining talent, minimising burnout, and preserving institutional knowledge—elements that are crucial in the Edu-Tech sector, characterised by brief learning product cycles and fierce competition.

When you compare these results to HRM research in the tech and start-up sectors, you can see both similarities and differences based on the situation. Edu-Tech companies have to deal with a lot of turnovers, pressure to perform, and demands for quick innovation, just like tech startups (Gupta & Shaw, 2014). But the extra layer of teaching responsibility and student outcomes makes job satisfaction in this field even more complicated. The study's focus on Delhi NCR, which is a hub for Edu-Tech development, makes it even more important because it gives us a better understanding of HRM dynamics in areas with a lot of industry growth.

This study shows that hiring fairness, relevant training, and clear performance are not separate HR functions, but rather interconnected ways to make employees happy. To stay competitive, sustainable, and ethical, Edu-Tech companies need to change their HR strategies from transactional checklists to holistic experience design. To create a happy, motivated, and committed workforce, it's important to build trust during the hiring process, offer opportunities for growth during employment, and make sure that evaluations are fair.

Conclusion

This study examined the influence of fundamental HR practices—recruitment, training and development, performance appraisal, and compensation—on employee job satisfaction within India's Edu-Tech sector, specifically targeting firms in the Delhi NCR region. The results showed that both hiring practices and chances for training and development are strongly linked to job satisfaction. Clarity in KPIs also turned out to be an important factor in shaping employee expectations and engagement. On the other hand, the motivational effect of performance appraisal systems was found to be

statistically weak, which suggests that there may be a mismatch between how evaluations are done and how employees think they are fair or useful.

The results strongly support the theoretical propositions of **Expectancy Theory**, **Social Exchange Theory**, and the **Resource-Based View**, reinforcing the idea that strategic, transparent, and employee-centered HR practices lead to higher satisfaction and retention—key metrics for long-term organizational sustainability.

As Edu-Tech companies scale rapidly in response to rising digital learning demand, the need for structured, consistent, and agile HR frameworks becomes even more critical. This study contributes to the limited empirical literature on HRM in the Edu-Tech sector and offers practical insights for HR professionals aiming to build engaged, capable, and committed teams in a highly competitive environment.

Limitations and Future Research

While this study offers valuable insights, it is subject to several limitations. First, the research is geographically restricted to **Edu-Tech firms operating in Delhi NCR**, which may limit the generalizability of findings to other regions of India, particularly Tier-II and Tier-III cities where HR challenges and employee expectations may differ significantly. Future studies could expand the geographic scope to include a more diverse organizational and cultural context.

Second, the study employs a **quantitative cross-sectional design** using self-reported measures, which may introduce response bias and restrict the depth of understanding regarding employee experiences. Integrating **qualitative methods** such as interviews or focus groups could uncover deeper nuances and contextual insights related to HRM effectiveness and job satisfaction.

Third, the focus was limited to four key HR practices. Future research may explore additional dimensions such as leadership style, work-life balance, remote work culture, and employee voice. Moreover, **longitudinal studies** would be useful to observe how changes in HR policies over time influence satisfaction and retention outcomes.

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Abstracts

AI-DRIVEN APPROACHES IN THEORETICAL AND APPLIED PHYSICS: A COMPREHENSIVE STUDY

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Artificial Intelligence (AI) has emerged as a transformative force in modern physics, enabling new paradigms for understanding complex systems and accelerating scientific discovery. By integrating machine learning (ML), deep learning, and physics-informed approaches, AI enhances both theoretical and applied physics domains. This paper presents a comprehensive analysis of AI-driven methodologies, including their role in quantum mechanics, high-energy physics, cosmology, materials science, and computational modeling. It also examines physics-informed neural networks (PINNs), symbolic regression, and neural differential equations as key tools for scientific discovery. Furthermore, challenges such as interpretability, generalization, and data limitations are critically discussed. The study concludes with future directions, emphasizing hybrid AI-physics models and autonomous scientific systems.

ENVIRONMENTAL SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT IN THE MODERN ERA

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Environmental sustainability has become a major global priority in the modern era due to the increasing environmental challenges caused by rapid industrialization, urbanization, population growth, and excessive exploitation of natural resources. It emphasizes maintaining harmony between economic growth, social development, and environmental protection. Sustainable practices include the conservation of energy and water, promotion of renewable energy sources, waste reduction and recycling, afforestation, pollution control, and adoption of environmentally friendly technologies.This article examines the meaning, importance, principles, and objectives of environmental sustainability while analyzing the major environmental challenges faced globally and in India. Furthermore, the study emphasizes that environmental sustainability is not merely an environmental concern but also an

economic and social necessity for ensuring long-term human survival and prosperity. Sustainable development requires collective responsibility, effective governance, technological innovation, environmental awareness, and active public participation. The article concludes that protecting the environment and promoting sustainable lifestyles are essential for achieving ecological balance and securing a healthy, safe, and prosperous future for generations to come.

CONTENT MARKETING, CONSUMER ENGAGEMENT, AND SMART EMERGING TECHNOLOGIES: AN EXPLORATORY FACTOR ANALYSIS AMONG NETFLIX USERS

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The rapid growth of Over-the-Top (OTT) platforms has transformed the global entertainment industry through the integration of smart and emerging technologies such as artificial intelligence, machine learning, recommendation systems, and data-driven personalization. Among OTT platforms, Netflix has emerged as a leading digital streaming service by effectively combining content marketing strategies with technology-enabled user engagement practices. The present study examines the influence of content marketing and smart emerging technologies on consumer engagement among Netflix users. The study follows an exploratory research design and collects primary data from 220 active Netflix users through a structured questionnaire. Variables related to content relevance, personalization, recommendation systems, entertainment value, and content trustworthiness were examined to understand their role in influencing user engagement. Reliability analysis, Kaiser-Meyer-Olkin (KMO) test, Bartlett's Test of Sphericity, and Exploratory Factor Analysis (EFA) were used for statistical analysis. The findings reveal excellent internal consistency with a Cronbach's Alpha value of 0.942 and strong sampling adequacy with a KMO value of 0.929. Exploratory Factor Analysis identified three major factors namely Technology-Enabled User Engagement, Content Trustworthiness, and Smart Content Relevance and Personalization, collectively explaining 64.896% of the total variance. The study concludes that AI-driven personalization, intelligent recommendation systems, and technology-supported content marketing significantly enhance consumer engagement and emotional attachment among Netflix users. The research contributes to the growing literature on smart entertainment technologies

and provides practical insights for OTT platforms to strengthen sustainable digital engagement strategies.

CASE-BASED CONCEPTUAL STUDY ON CIRCULAR ECONOMY STRATEGIES FOR GLOBAL COMPETITIVENESS IN SMES, STARTUPS, AND MULTINATIONALS

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The growing climate crisis, depletion of natural resources, increasing waste, and global pressure for sustainable development have transformed the way businesses operate across industries. Traditional linear business models based on take-make-dispose practices are increasingly viewed as unsustainable in the long term. In response, the circular economy has emerged as a transformative framework that promotes resource efficiency, waste minimization, regeneration, reuse, recycling, and sustainable production systems. This research examines how businesses of different scales, Small and Medium Enterprises (SMEs), multinational corporations (MNCs), and startups can adopt and scale circular strategies for achieving global sustainability impact. The chapter follows a descriptive research approach and draws upon recent literature from Springer, Scopus-indexed journals, Web of Science publications, and sustainability reports. It explores the strategic dimensions of circular economy implementation, barriers to scaling, innovation ecosystems, digital transformation, policy support, stakeholder collaboration, and global competitiveness. The discussion highlights how SMEs contribute through localized innovation and resource optimization, how multinational corporations leverage global supply chains and technological capabilities, and how startups act as catalysts for disruptive, sustainable innovation. The research further discusses practical frameworks for scaling circular strategies internationally while maintaining economic viability, social responsibility, and environmental stewardship. By integrating sustainability into organizational strategy, businesses can create long-term value, improve resilience, enhance competitiveness, and contribute significantly to the Sustainable Development Goals (SDGs). The chapter concludes with policy recommendations, managerial implications, and future research directions for strengthening circular business ecosystems globally.

SHIFTING TRENDS IN SENIOR CITIZEN INVESTMENT PATTERNS: A COMPARATIVE STUDY OF PRE-2010 AND POST-2020 ERA

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The increasing life expectancy and growing elderly population in India have significantly influenced the investment landscape for senior citizens. Individuals above the age of 60 are increasingly becoming active participants in financial planning and investment decisions due to their need for financial security, regular income, and wealth preservation after retirement. Traditionally, senior citizens preferred safe investment avenues such as fixed deposits because of assured returns and low risk. Historically, fixed deposit interest rates in India reached as high as 13.5%, making them one of the most attractive savings instruments. However, declining interest rates over the years have compelled senior citizens to explore alternative investment opportunities that balance safety, liquidity, and returns. India currently has more than 150 million senior citizens, and this number is projected to rise substantially in the coming decades due to demographic transition and improved healthcare facilities. The growing elderly population highlights the importance of understanding their changing investment behaviour and financial preferences. This paper examines the evolving investment patterns among senior citizens and analyses the factors influencing their investment decisions, including risk tolerance, income requirements, inflation, healthcare expenses, and government policies. The study also discusses the various investment options presently available to senior citizens in India, such as Senior Citizens Savings Scheme (SCSS), fixed deposits, Post Office Monthly Income Scheme (POMIS), Pradhan Mantri Vaya Vandana Yojana (PMVVY), National Savings Certificates (NSC), mutual funds, annuity plans, tax-free bonds, and pension schemes. The paper aims to provide insights into how senior citizens are adapting their investment choices in response to changing economic conditions and financial market dynamics.

INTERSECTION OF CUSTOMARY LAW AND DIGITAL FEMINISM INMATRILINEAL GARO COMMUNITY

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Matrilineal inheritance systems are frequently assumed to secure gender equality because lineage and ancestral property devolve through women. However, this assumption often obscures internal power hierarchies and male-dominated decision-making structures within such communities. Focusing on the Garo community of Meghalaya, North East, India, this paper critically examines how digital feminist discourse—particularly among students within Higher Education Institutions (HEIs)—challenges and reshapes customary property norms in matrilineal societies. Universities and colleges have increasingly become sites of critical engagement where students, researchers, and academic networks interrogate customary practices through scholarship, debate, and digital advocacy. Social media platforms have simultaneously emerged as spaces for public debate, youth-led activism, and reinterpretation of customary norms that question symbolic matriliny and demand substantive gender equality. At the same time, online resistance reveals tensions between gender reform and the preservation of indigenous identity, often reflecting generational divides within the community. The paper ultimately contends that the interaction between customary law, student-led discourse, and digital activism highlights a critical tension: how to reconcile respect for cultural identity with evolving understandings of gender equality. This intersection of customary law, higher education engagement, and digital activism illustrates the dynamic relationship between culture, identity, student participation, and constitutional principles in plural legal systems.

INTEGRATION OF FINTECH IN PROMOTING FINANCIAL INCLUSION IN RURAL INDIA - OPPORTUNITIES, CHALLENGES AND POLICY IMPLICATIONS

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Financial inclusion plays a key role in achieving inclusive economic growth, especially in developing countries like India, where rural communities have traditionally had restricted access to formal banking services. The adoption of financial technology (FinTech) has greatly changed India's financial environment by facilitating digital payments, biometric verification systems, and mobile banking services. Government-driven programs like the Pradhan Mantri Jan Dhan Yojana (PMJDY), Aadhaar Enabled Payment System (AePS), and Unified Payments Interface (UPI) have improved financial inclusion in rural areas of India (Ministry of Finance, 2024; Reserve Bank of India [RBI], 2024-25). This study focuses on secondary data from 2017- 2025 in order to assess the influence of Fin Tech advancement affect financial inclusion and saving habits among rural population. Statistical tools used to measure Financial Inclusion Index (FI – Index), progress in PMJDY accounts and level of financial awareness are measured.

ARTIFICIAL INTELLIGENCE AND SUSTAINABLE CONSUMER BEHAVIOUR: DRIVERS, MECHANISMS, AND IMPLICATIONS FOR GREEN MARKETING

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The convergence of artificial intelligence (AI) and sustainability has introduced a transformative paradigm in the study of consumer behaviour. It has been observed that AI-driven tools, recommendation systems, predictive analytics, and digital nudges subtly influence environmentally and socially conscious purchasing decisions. This review synthesizes interdisciplinary scholarly evidence to examine how it is done. Drawing on empirical studies, industry data, and illustrative case examples, the paper

explores the mechanisms through which AI augments sustainable consumption, identifies barriers to adoption, and provides strategic guidance for businesses and policymakers. The analysis demonstrates that AI, when ethically deployed, can serve as a powerful catalyst for green consumer transitions across sectors ranging from retail and energy to fashion and food systems.

GROWTH AND STRUCTURE OF BILATERAL TRADE OF INDIA WITH SOUTH AFRICA

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The present study is based on secondary data compiled from UN COMTRADE and World Integrated Trade Solution (WITS) databases, covering the period from 2000-01 to 2023-24. India's trade with South Africa is examined by calculating growth and the structure of India's exports and imports with South Africa. The percentage shares of exports and imports have been calculated to analyse the structure and composition of trade. The CAGR of India's exports to South Africa and the world was 12.73% and 9.97%, respectively. In contrast, the CAGR of India's imports from South Africa and the world was recorded at 8.72% and 10.89% respectively. In terms of structural composition, the percentage share of India's imports from South Africa in India's total imports from the world decreased from 2.63% in 2000-01 to 1.78% in 2023-24. While the percentage share of India's exports to South Africa in India's total exports to the world increased from 0.72% in 2000-01 to 1.78% in 2023-24, indicating a growing export trend towards South Africa during the study period. Additionally, India's exports to and imports from South Africa as a share of India's GDP stood at 0.31% and 0.21% respectively, indicating the significant contribution of this bilateral trade relationship to the national economy. The top three exported commodities of India to South Africa were Apparel and clothing accessories, cotton and cereals during the year 2000-01, which shifted to Mineral fuels and oils, vehicles and pharmaceuticals during the year 2023-24.

IMPACT OF URBANIZATION ON NESTING BEHAVIOUR OF HOUSE SPARROW IN RAJASTHAN, INDIA

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The rapid expansion of urban areas has significantly altered natural habitats, affecting the survival and behavioural patterns of many bird species. Among these, the House Sparrow (Passer domesticus), once a common urban bird, has experienced noticeable population decline in several Indian cities. The present study investigates the impact of urbanization on the nesting behaviour of House Sparrow in selected urban and semi-urban regions of Rajasthan, India. The research focuses on nest site selection, nesting materials, breeding preferences, and environmental factors influencing nesting success in urban landscapes. Field observations were conducted across residential colonies, commercial zones, and semi-urban settlements to assess the availability and utilization of nesting sites. Data were collected through direct observation, photographic documentation, and interaction with local residents. The study revealed that increasing urban infrastructure, reduction in traditional buildings, loss of vegetation, electromagnetic radiation, noise pollution, and limited food availability have adversely influenced sparrow nesting behaviour. House Sparrows were found to prefer older buildings, ventilators, roof cavities, and areas with nearby vegetation for nesting. In highly urbanized zones, a decline in suitable nesting spaces resulted in reduced nesting frequency and breeding success. The findings indicate that urbanization has a substantial impact on the ecological adaptability and nesting patterns of House Sparrow in Rajasthan. However, the species also demonstrates behavioural adaptation by utilizing artificial nesting structures and modified urban habitats. The study emphasizes the urgent need for urban biodiversity conservation strategies, including the installation of nest boxes, preservation of green spaces, and promotion of bird-friendly urban planning. Such measures can contribute to the conservation of House Sparrow populations and enhance ecological sustainability in rapidly developing urban environments.

IMPACT OF DIGITAL TRANSFORMATION AND SMART TECHNOLOGIES ON ORGANIZATIONAL CULTURE AND EMPLOYEE MOTIVATION

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The rapid advancement of digital transformation and smart technologies has significantly reshaped organizational structures, work processes, and employee experiences across industries. Technologies such as Artificial Intelligence (AI), automation, cloud computing, big data analytics, and smart communication systems are increasingly influencing organizational culture and employee behavior. This study examines the impact of digital transformation and smart technologies on organizational culture and employee motivation within contemporary organizations. The research aims to explore how technology-driven workplace environments affect employee engagement, adaptability, collaboration, and motivational levels while supporting sustainable organizational development. The study adopts a conceptual and empirical approach by analyzing the relationship between digital transformation practices, organizational culture dimensions, and employee motivation factors. It highlights the role of innovative and adaptive organizational cultures in facilitating employee acceptance of technological changes and enhancing workplace productivity. Furthermore, the study investigates how smart technologies contribute to improved communication, flexible work systems, skill development, and employee empowerment, thereby positively influencing motivation and organizational performance. The findings suggest that organizations with supportive, technology-oriented cultures are more likely to achieve higher levels of employee motivation, job satisfaction, and sustainable growth. However, challenges such as resistance to change, technological stress, and skill gaps may negatively affect employee morale if not managed effectively. The study emphasizes the importance of leadership support, continuous learning, and inclusive organizational practices in ensuring successful digital transformation. The research contributes to the growing literature on AI, smart technologies, and sustainable development by providing insights into the human and cultural dimensions of digital transformation in modern organizations.

EVALUATION OF OCCLUSION OF DENTINAL TUBULES USING NOVEL NANO-SIZED CALCIUM SILICATE AND DIODE LASER: A SCANNING ELECTRON MICROSCOPIC STUDY

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Background / purpose: This *in-vitro* study aims to compare the degree and efficacy of dentinal tubule occlusion achieved by a novel nano-sized calcium silicate material, a 980-nm diode laser, and their combination, using scanning electron microscopy (SEM) as the primary evaluation method. Introduction: Dentinal hypersensitivity (DH) is a common clinical problem often attributed to open dentinal tubules. Effective long-term management requires agents that can deeply and durably occlude these tubules, ideally with resistance to acid challenges. Nano-sized calcium silicate materials show promise by inducing biomimetic, hydroxyapatite-like intratubular crystal growth. Diode laser therapy is another established modality for occluding tubules via surface melting or dentin modification. The combined effect of these two modalities remains relatively unexplored. Materials and Methods: One hundred twenty caries-free human premolars will be prepared with standardized cervical cavities and their smear layers removed with 17% EDTA to simulate hypersensitivity. Specimens will be randomly allocated to four groups (n=30):

ROLE OF GREEN ANALYTICAL TECHNIQUES IN POLLUTION MONITORING AND CONTROL

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Environmental pollution has become a major worldwide issue, necessitating precise, effective, and long-lasting monitoring techniques for mitigation and control. Conventional analytical techniques used in pollution assessment frequently generate secondary waste, require a lot of dangerous chemicals, and use a lot of energy, all of which increase the environmental burden. In this regard, green analytical methods have become more well-known as economical, efficient, and environmentally safe substitutes for pollution monitoring and control. The use of green analytical methods for evaluating and controlling environmental contaminants in soil, water, and air matrices is examined in this research. It emphasises the use of environmentally friendly techniques that reduce environmental impact while maintaining analytical

accuracy and sensitivity, such as miniaturised analytical systems, solvent-free and low-solvent extraction methods, biosensors, spectroscopic techniques, microfluidics, and real-time monitoring technologies. The study examines the integration of green analytical chemistry principles in environmental monitoring frameworks to reduce chemical waste, energy consumption, and occupational hazards. Through a review of recent developments and practical applications, the paper emphasizes how these sustainable analytical approaches contribute to early pollutant detection, informed decision-making, regulatory compliance, and long-term environmental protection. The findings underscore that the adoption of green analytical techniques not only strengthens pollution monitoring systems but also aligns scientific practices with the broader goals of sustainability and environmental stewardship.

FATE AND TRANSPORT OF PATHOGENS IN WASTEWATER TREATMENT SYSTEMS

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The fate of pathogens in wastewater treatment systems is complex influenced by a number of factors. Existing on-site wastewater treatment plants (WWTPs) have the potential to contribute to the spread of infectious diseases caused by waterborne pathogens. Wastewater treatment is related with the sustainable development goal 6 (SDG6) related with clean water and sanitation. The various microalgae and bacterial communities have been used to treat wastewater from various sources. On-site wastewater treatment systems (OWTS) play a critical role in treating household wastewater for various residents. This system causes the spread of pathogenic bacteria in the water. OWTS uses materials such as sand, gravel, or other materials to filter out contaminants. Transport of pathogens in wastewater treatment systems is a significant public health problem, especially in regions where OWTS serve as primary WWTPs. These systems have the potential to facilitate the spread of infectious diseases caused by waterborne pathogens. Pathogens can enter wastewater systems from a variety of sources, including human waste, decontaminated wastewater, illegal activities, and surface water runoff following major biological incidents. Developing and optimizing pathogen removal efficiency requires a better mechanistic understanding of the hydrological, geochemical, and biological processes that control water quality in WWTPs. This includes understanding the source of the pathogen and its common pathogenicity indicators, as well as the

underlying mechanisms for its removal using OWTS. Smart Technologies like AI and IoT can play an important role in understanding the fate and transport of pathogens.

DIGITAL WASTE AND ECOLOGICAL CRISIS IN *THE EVERY* BY DAVE EGGERS

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Although smart technologies and artificial intelligence in the current digital world have typically been considered forms of progress and sustainable growth, an increasing reliance on them is developing a culture of dependency, excessive consumption thereby degrading ecosystems. While digital culture has gained growing influence, literary studies still lack sufficient study of its ecological effects from an Ecocritical perspective. A thematic exploration of digital waste and ecological depletion is presented in novel *The Every* by Dave Eggers's. Through the interdisciplinary approach of Ecocriticism, this paper presents the selected novel as a harsh criticism of digital modernity and its environmental impact. It examines the representation of data culture, electronic dependency, and the uncontrolled growth of digital systems, all of which distinguish humans from the natural world while simultaneously representing the ongoing cycle of surveillance, consumption, and waste created by technological growth. It concludes that although smart technologies supposedly provide a better quality of life and maintain sustainability, they also intensify ecological imbalance, psychological displacement, and the loss of genuine human connection within technologically saturated environments. By emphasising the ecological implications of digital culture, the research draws attention to the adverse environmental impacts of energy-intensive digital infrastructures, e-waste, and consumerist technological practices. Consequently, this connects these concerns with United Nations Sustainable Development Goals (SDGs) related to Responsible Consumption and Production (SDG 12) and Climate Action (SDG 13) through their mutual commitment to sustainable resource management, waste reduction, and environmental consciousness in the face of rapid technological advancement.

SMART SUPPLY CHAINS AND LOGISTICS OPTIMIZATION THROUGH BUSINESS ANALYTICS

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The study titled “Smart Supply Chains and Logistics Optimization through Business Analytics” explores the role of business analytics in improving logistics efficiency, operational performance, and decision-making within modern port and supply chain ecosystems. The study addresses growing challenges in logistics management such as uneven cargo distribution, fluctuating demand patterns, forecasting uncertainty, and inefficient resource utilization in Indian port operations. The primary objective of the research was to analyze cargo throughput trends, regional logistics performance, customer cargo behavior, and revenue relationships using analytical and predictive techniques. The study adopted an analytical and descriptive research design based entirely on secondary quantitative data collected from government reports, port authority publications, annual reports, and logistics databases related to selected Indian ports. Business analytics tools including Microsoft Excel, Power BI, and statistical techniques such as descriptive statistics, Chi-square test, Z-test, regression analysis, and time series forecasting were used to evaluate operational trends and logistics performance. The findings revealed stable monthly cargo throughput with consistent operational performance and a strong upward growth trend in annual cargo movement. The study also identified a significant relationship between customer type and cargo type, while regression analysis confirmed that cargo throughput has a strong positive impact on revenue generation. Forecasting results further indicated increasing future cargo demand, highlighting the need for infrastructure expansion, operational optimization, and analytics-driven planning. The study emphasizes that integrating business analytics, forecasting systems, and predictive modeling can significantly support smart logistics management, sustainable supply chain growth, and strategic decision-making in modern port ecosystems.

AN ANALYSIS OF LAST-MINUTE TAX PLANNING BEHAVIOUR IN SALARIED INDIVIDUALS

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Tax planning is one of the core elements of individual finance management because individuals who have their income subjected to direct tax tend to plan tax. However, even though there is an array of tax planning instruments as well as an increase in financial literacy, the majority of salaried individuals tend to plan taxes at the end of a financial year. Consequently, late tax planning tends to lead to impulsive decision-making as well as ineffective financial and resource planning and management. The current research investigates the factors which contribute to late tax planning behaviors. This research combines both descriptive and analytical methods, using information straight from people and from published sources. The team surveyed salaried employees in education, banking, IT, healthcare, and private companies with a structured questionnaire. They also pulled data from journals, government reports, RBI publications, and financial studies. The study looks at how things like financial literacy, procrastination, employer influence, awareness of tax-saving rules, income level, and investment habits shape the way people approach tax planning. Most people with salaried jobs wait until January or March to think about their taxes. They usually put it off because they don't know much about tax planning, are busy or forget, and rely on their employers to remind them. When they finally get around to it, they're more focused on quick tax savings than actually building wealth for the future. Old-school choices like life insurance and Public Provident Fund are still popular, but you see younger folks starting to invest in things like Equity Linked Savings Schemes and National Pension System. The paper wraps up by saying that when people understand finances better and actually plan ahead, they're way less likely to scramble for tax-saving options at the last minute. Everyone needs to get involved—employers, policymakers, and financial institutions should work together to push salaried folks to start planning their taxes early and with good information.

IMPACT OF ONLINE REVIEWS ON CONSUMER PURCHASE INTENTION

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There has been a great increase in the use of the internet as a tool for conducting transactions, thus leading to changes in the consumer behavior of buying products. Online reviews have become one of the major information sources, which determine the consumer's attitudes and behavior when making purchases. In this research work, an analysis of the impact of online reviews on consumer purchase intention will be conducted using a qualitative research approach. The research is grounded in thematic analysis of secondary sources of literature, views of consumers, and already available empirical studies on e-word-of-mouth (e-WOM), digital trust, and consumer decision-making behavior. The research results show that consumers utilize the Internet reviews extensively for alleviating their uncertainties and risks associated with online buying activities. The positive reviews increase trust, credibility, and confidence of consumers regarding the quality of goods and brands, while negative ones substantially diminish purchase intent. Moreover, the research indicates the significance of social proofing in the era of the internet, as consumers are observed to look into the reviews and opinions of their peers before reaching an informed purchasing decision. Also, younger consumers and regular online shoppers are identified to be more responsive to review-based marketing than traditional consumers. Thus, this piece of work would benefit greatly from contributing to the body of knowledge on digital consumers and providing insights for marketers and brand managers. As a result, the study indicates that the use of online reviews has become an essential part of contemporary marketing communications and engagement. Thus, companies need to ensure openness and allow customers to give feedback and manage online review processes to increase their purchasing intentions and build consumer trust.

BLOCKCHAIN AND IOT-ENABLED SMART SOLID WASTE MANAGEMENT FRAMEWORK FOR URBAN APARTMENTS IN GUWAHATI

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A precise Solid Waste Management (SWM) strategy is essential for smart cities. The Internet of Things (IoT) has transformed traditional systems by enabling real-time monitoring of municipal solid waste. In Guwahati, where 15–20% of the

metropolitan population resides in apartments, unplanned urban growth and limited technical expertise have intensified waste challenges. To address this, we propose a graphical design for optimized waste collection, supported by computerized algorithms to determine container placement and optimal collection routes. IoT sensors prevent bin overflow and ensure timely disposal, while blockchain technology secures data integrity, enhances transparency in waste tracking, and enables tamper-proof records of collection and disposal activities. Together, IoT and blockchain provide a reliable, efficient, and accountable framework for smart waste management in urban environments.

ECOLOGIES AND CONTEMPORARY ENVIRONMENT SUSTAINABILITY NARRATIVE CHALLENGES: AFFECT TO HUMAN IN FUTURE

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The problem of ecology in these times is becoming more acute every day. An environmental problem is a change in the natural environment that leads to disruption of the functioning and structure of nature. Global problems are generated by the contradictions of social development, affecting the surrounding world by a sharply increased scale of human activity. Also associated with the uneven scientific, technical and socio-economic development of countries and regions. From the point of view of modern scientists, humanity lives in a world where everything is already collapsing. Dealing with current environmental problems is an ongoing process thatrequires the collective effort of individuals, communities and governments. By working together and implementing sustainable methods and technologies, we can create a better future for ourselves and for future generations. The protection of environment is needed for sustainable development. The Industrial pollution, degradation of forests, depletion of ozonelayer, the green house gases results in global warming and climate which will have an adverse impact on environment and human health. There is a need for conservation of Biodiversity, protection of wetlands and prevention of environmental pollution, promotion of ecological balance enables sustainable development. There are several provisions provided in Indian Constitution for Protection of environment. There are certain legislations enacted viz. Environment Protection Act, Wildlife PreservationAct, Biodiversity Conservation Act, water and Air pollution prevention Acts etc The Judiciary playing a vital role in protection of Environment.

INDUSTRY 4.0 AND SMART MANUFACTURING: TRANSFORMING PRODUCTION SYSTEMS THROUGH DIGITAL INTEGRATION, AUTOMATION AND DATA-DRIVEN DECISION-MAKING

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Industry 4.0 has emerged as a transformative phase in industrial development, reshaping traditional manufacturing systems into intelligent, connected and data-driven production environments. Smart manufacturing, as a key outcome of Industry 4.0, integrates advanced technologies such as the Internet of Things, artificial intelligence, cyber-physical systems, cloud computing, robotics, big data analytics and digital twins to improve operational efficiency, flexibility, product quality and decision-making. The present paper aims to examine the role of Industry 4.0 technologies in enabling smart manufacturing and enhancing industrial competitiveness in the modern business environment. The study highlights how digital connectivity and real-time data exchange support predictive maintenance, process optimization, supply chain visibility, energy efficiency and mass customization. It also discusses the strategic importance of automation and intelligent systems in reducing production errors, improving resource utilization and strengthening responsiveness to changing market demands. However, the adoption of smart manufacturing is not free from challenges. High implementation cost, lack of skilled workforce, cybersecurity risks, data privacy issues, resistance to technological change and integration problems with legacy systems remain major barriers, especially for small and medium enterprises. This paper further explores the need for organizational readiness, digital infrastructure, workforce reskilling and supportive policy frameworks for successful Industry 4.0 adoption. The research suggests that industries must move beyond technology adoption and focus on building a digitally adaptive manufacturing culture. Smart manufacturing can create sustainable value only when technological innovation is aligned with human capability, business strategy and operational goals. The paper concludes that Industry 4.0 has the potential to redefine manufacturing competitiveness by promoting intelligent, agile, sustainable and customer-centric production systems.

THE HUMAN EDGE: CULTIVATING IRREPLACEABLE HUMAN CAPITAL IN AN ERA OF ARTIFICIAL INTELLIGENCE

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As artificial intelligence (AI) increasingly masters cognitive tasks such as data analysis, pattern recognition, and language generation, the primary competitive advantage for commerce professionals is shifting from technical proficiency to the full development of their humanity. This research posits that in a highly automated world, the qualities that emerge from lived human experiencesuch as empathy, ethical judgment, and wisdombecome the most valuable and strategic assets in the professional landscape.

PROFESSOR OF PRACTICE IN TRANSFORMING TEACHER EDUCATION UNDER NEP 2020

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The introduction of the concept of Professor of Practice (PoP) in higher education marks a significant reform in the Indian education system under the framework of the National Education Policy 2020. The initiative aims to bridge the gap between theoretical knowledge and practical expertise by engaging experienced professionals from various fields in academic institutions. In the context of teacher education, the role of Professor of Practice has emerged as an important strategy for strengthening practice-oriented learning, professional competency, and experiential pedagogy. This paper examines the significance of Professor of Practice in transforming teacher education programmes in India. It highlights the emergence of the concept under the regulations of the University Grants Commission and discusses its relevance in enhancing the quality of teacher preparation. The study explores the scope of PoP in promoting school-college collaboration, strengthening internships and practicum experiences, integrating skill-based pedagogy, and providing professional mentoring to pre-service teachers. The paper further analyzes the potential challenges associated with implementation, including lack of clear operational guidelines, resistance from traditional academic structures, funding concerns, and issues related to quality assurance. The study also emphasizes the future prospects of PoP in developing competency-based teacher education and improving classroom readiness among future teachers. The paper is conceptual in nature and is based on

descriptive and analytical methods, policy document analysis, and review of related literature. The study concludes that the effective implementation of Professor of Practice can play a transformative role in achieving the objectives of NEP 2020 and strengthening teacher education in India.

DIGITAL PAYMENT SYSTEMS IN INDIA: THE TRANSFORMATIVE ROLE OF THE NATIONAL PAYMENTS CORPORATION OF INDIA (NPCI) IN SHAPING A CASHLESS ECONOMY

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India's digital payments landscape has changed dramatically since NPCI launched back in 2008. This paper digs deep into how digital payment systems have evolved, what's driving their adoption, and how they've shaped the country's economy and society. There's a special spotlight on NPCI's main products—UPI, IMPS, RuPay cards, BHIM, FASTag, and NACH. To get a clear picture, this research looked at NPCI's annual reports, RBI bulletins, and World Bank financial inclusion data from 2016 to 2024. The story didn't finish there, though—385 people from cities, towns, and villages answered a detailed questionnaire, giving insight straight from the ground. We conducted a mix of statistical tests—descriptive stats, regression models, chi-square tests, and structural equation modeling—to check six different hypotheses. Here's what stood out: people adopt UPI more when they see it as useful ($\beta = 0.612$, $p < 0.001$), when internet infrastructure works well ($\beta = 0.489$, $p < 0.01$), and when government policies endorse these systems ($\beta = 0.531$, $p < 0.001$). Interoperability pushed by NPCI proved to be the primary reason, cutting transaction hassles by about 43% from 2019 to 2023. Moreover, wider use of digital payments strongly improved financial inclusion in districts that need it most, leading to a 27.6% drop in the unbanked population. According to these results, we suggest policies to ensure consistent expansion, strengthen cybersecurity, and extend digital access to the network's periphery.

AI IN EDUCATION FOR SUSTAINABLE DEVELOPMENT: TOWARDS A FUTURE-READY LEARNING PARADIGM

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The rapid integration of Artificial Intelligence into educational systems is redefining the boundaries of teaching, learning, and institutional governance. Far beyond automating administrative tasks or personalizing content delivery, AI holds the potential to fundamentally restructure how educational opportunity is distributed — making it a matter of direct relevance to the global Sustainable Development Goals, particularly SDG 4 (Quality Education) and its interconnections with SDGs 8, 10, and 13. This paper examines AI's transformative role in education through three critical lenses: pedagogical innovation, equitable access, and sustainable institutional design. Grounded in Connectivism and the Technology Acceptance Model, it argues that AI-driven adaptive learning environments can meaningfully address long-standing disparities in educational outcomes, especially across socioeconomically diverse and geographically underserved populations. Beyond access, the paper foregrounds an equally urgent imperative: developing AI literacy as a foundational graduate competency. As economies evolve, the ability to critically engage with AI systems becomes as essential as traditional disciplinary knowledge. This demands a deliberate reimagining of curriculum frameworks, faculty roles, and assessment practices — moving institutions from passive technology adoption toward active, human-centred AI integration. Crucially, the paper resists a purely optimistic reading. Algorithmic bias, erosion of critical thinking, data sovereignty concerns, and widening digital divides remain serious risks that demand governance structures built into AI deployment — not added as afterthoughts. The paper proposes the **SEED Model** (Sustainable, Equitable, Ethical, Data-informed) as a guiding framework for institutions navigating this complexity responsibly. Situated within the context of India's NEP 2020 and the India AI Mission, this paper contributes to an emerging conversation on how nations can harness AI not merely for educational efficiency, but as a lever for long-term, inclusive, and sustainable human development.

ARTIFICIAL INTELLIGENCE-DRIVEN SUSTAINABLE SYSTEMS AND APPLICATIONS: TRANSFORMING MODERN ORGANIZATIONS THROUGH INTELLIGENT AND GREEN TECHNOLOGIES

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Artificial Intelligence (AI) has emerged as a transformative force in promoting sustainability across industries by improving operational efficiency, reducing environmental impact, and supporting intelligent decision-making systems. The integration of AI with sustainable systems has created innovative applications in energy management, smart cities, healthcare, agriculture, hospitality, transportation, and human resource management. This research paper examines the role of AI-driven sustainable systems and their practical applications in achieving economic, environmental, and social sustainability. The study adopts a conceptual and analytical approach based on recent literature, industrial practices, and technological developments. The findings reveal that AI enhances resource optimization, predictive analytics, waste reduction, energy efficiency, and sustainable organizational performance. However, challenges such as ethical concerns, data privacy, implementation costs, and skill gaps continue to affect large-scale adoption. The paper concludes that AI-driven sustainability systems can significantly contribute to global sustainable development goals when implemented responsibly and strategically.

GREEN VISIONARIES: EXPLORING GEN Z BUSINESSMEN'S PERCEPTIONS ON SUSTAINABLE BUSINESS PRACTICES IN THE SAURASHTRA REGION

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The Increasing Emphasis on sustainability has transformed the contemporary business environment, compelling enterprises to integrate environmentally and socially responsible practices into their operations. In this context, the present study titled "Green visionaries: exploring Gen Z Businessmen's perceptions on sustainable business practices in the saurashtra region" Investigates the awareness, attitudes and perceptions generation Z businessmen toward sustainable business practices. The research aims to examine the extent to which Gen Z businessmen understand and adopt sustainability oriented strategies in areas such as environmental protection, ethical business conduct, resource efficiency, waste management, social

responsibility and long term business growth. The findings of the study are expected to reveal that Gen Z businessmen possess a comparatively progressive and positive outlook toward sustainable Business practices due to their higher exposure to digital information and global sustainability movements.

LIGHTWEIGHT DETECTION OF NETWORK ATTACKS IN SMART CITY IOT INFRASTRUCTURE

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The Internet of Things (IoT) devices are being rapidly adopted in smart cities to improve urban sustainability through resource efficient management, energy optimization and environment monitoring. Although they are heterogeneous and resource-constrained, lack of security in IoT networks makes them highly susceptible to cyber-attacks which can disrupt critical infrastructure and undermine sustainability objectives. IDS systems are generally computationally intensive, therefore not ideally suited to operate at the edge of iot networks. In this study we introduce an AI based light weight intrusion detection system utilizing feature selection and ensemble ML model designed for edge computing. Low-energy requirements, minimal memory usage and real-time detection capabilities are all important factors for the framework to maintain high accuracy. Benchmark IoT datasets such as NSL-KDD, UNSW-NB15 and CIC-IoT were used to evaluate the model. Results obtained via experimentation show superior performance in detecting objects with detection accuracy exceeding 98.5% on multiple datasets, reduced false positive rate, and significantly lower computational overhead compared to conventional deep learning approaches. The proposed system advances the smart city's sustainability through ensuring essential ioT applications in smart grid, intelligent transportation, precision agriculture and environmental monitoring with energy saving as a significant criterion for green computing. Ethical considerations, scalability and integration with explainable AI (xai) and federated learning for improved privacy and trustworthiness are also addressed in this study.

A COMPREHENSIVE REVIEW ON POLYMER AND PLASTIC DECOMPOSITION: MECHANISM, ENVIRONMENTAL IMPACT AND SUSTAINABLE APPROACHES

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Plastic waste is very harmful burdens on the environment. Chemical recycling do not decrease quality repeated regeneration, but it is requiresharsh reaction conditions, this is environmentally unfriendly. Underthe mild conditions recycling is possible for enzymatic catalyst, but it faces inherent limitations like poor stability,high cost, and narrow substrate applicability. Biomimetic catalysis may provide a new avenue by combining high enzyme-like activity with the stability of inorganic materials. Biomimetic catalysis has demonstrated great potential in biomass conversion and has recently shown promising progress in plastic degradation. plastic degradation from biomimetic perspectives: the imitation of active centers and substrate-binding clefts. Similarity between biomass and plastics, relevant work is discussion to draw inspiration. The conclusion is highlighting the challenges and opportunities in achieving sustainable plastic recycling via a biomimetic approach. recycling technologies are, chemical depolymerization a route to virgin quality ofrecycled plastics, especially when valorizing complex, waste streams poorly clean by mechanicalmethods.

IMPACT OF VARIED FORMS OF SOCIAL COMMUNICATION ON INDIAN YOUTH

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Indian youth now frequently practice code-switching when communicating, particularly in online, professional, and academic settings where numerous languages are used at once. This paper explores how the practice of shifting between English and regional languages, particularly Hindi, affects levels of social engagement among young people in India. The study focuses on how code-switching affects social interaction, confidence, self-expression, group acceptance, and discussion

participation in various circumstances. Additionally, it looks at whether this language practice is merely a means of communication or if it also functions as a sign of identity, social standing, and cultural affiliation. The study examines communication patterns among urban and semi-urban Indian youth using secondary sources, including research articles, communication studies, and reports on youth language practices. According to the study, code-switching frequently reveals the social prestige associated with fluency in English while also fostering a sense of familiarity and inclusion in conversations. The study adds to current conversations about youth identity, bilingual communication, and how social interaction is evolving in multilingual Indian society.

IOT-DRIVEN SMART FARMING FOR SUSTAINABLE AGRICULTURE: A SYSTEMATIC REVIEW OF TECHNOLOGIES, CHALLENGES, AND SOCIO-ECONOMIC IMPLICATIONS

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Sustainability concerns and the pressure to use agricultural resources more efficiently have pushed modern farming toward IoT-enabled smart systems. Conventional cultivation, which still depends largely on manual inspection and uniform field treatment, often results in wasted water, mistimed irrigation, and slow reaction to environmental change. Wireless sensor networks, artificial intelligence, and cloud or edge computing have together reshaped this picture by enabling continuous field monitoring and data-driven agricultural decisions. The present review examines the IoT-driven smart farming literature across four interconnected dimensions: smart farming architectures, AI-assisted agricultural models, wireless communication frameworks, and the socio-economic sustainability of these systems. A PRISMA-inspired selection procedure was applied to articles drawn from IEEE Xplore, ScienceDirect, Springer, MDPI, and other indexed databases. The review synthesises recent advances in smart farming architectures, communication standards, precision irrigation, AI-enabled applications, and edge-assisted monitoring. Although IoT-based agriculture offers clear gains in environmental observation, irrigation control, and resource efficiency, several persistent issues continue to limit large-scale adoption — notably infrastructure dependency, weak rural connectivity, high deployment cost, energy constraints, computational demands, and limited fit with rural realities. The analysis surfaces important research gaps in scalability, long-term field deployment,

socio-economic integration, and end-user usability. The reviewed evidence indicates that the next generation of smart farming research should target low-cost, scalable, and energy-aware architectures that can be realistically sustained inside everyday agricultural settings. The paper thus maps the progress, barriers, and likely trajectory of IoT-driven smart farming and its contribution to sustainable agriculture.

LIMNOLOGICAL PERSPECTIVES AND WATER RESOURCE MANAGEMENT OF INLAND AQUATIC ECOSYSTEMS IN RAJASTHAN, INDIA

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Rajasthan, the largest state of India, is characterized by arid to semi-arid climatic conditions, scarce freshwater resources, and diverse inland aquatic ecosystems including lakes, reservoirs, ponds, wetlands, and seasonal water bodies. Despite its desert-dominated landscape, these aquatic systems play a vital role in maintaining ecological balance, supporting biodiversity, groundwater recharge, agriculture, fisheries, tourism, and rural livelihoods. Limnology, the scientific study of inland water bodies, has emerged as an important interdisciplinary field for understanding the physical, chemical, and biological characteristics of freshwater ecosystems and their responses to environmental stress. Over the past few decades, limnological research has gained considerable momentum globally as well as in India, particularly in relation to eutrophication, water pollution, plankton diversity, nutrient dynamics, ecological productivity, and climate-induced changes in aquatic environments. In Rajasthan, limnological investigations are especially significant due to extreme temperature variations, high evaporation rates, salinity fluctuations, irregular rainfall, and increasing anthropogenic pressures such as urbanization, industrialization, agricultural runoff, and tourism activities. Several important water bodies of the state, including Sambhar Lake, Pushkar Lake, Fateh Sagar Lake, Pichola Lake, Ana Sagar Lake, and numerous rural ponds of Western Rajasthan, have been studied for physicochemical properties, biological diversity, trophic status, and pollution load. The present review critically examines the available limnological studies conducted in Rajasthan with special emphasis on ecological status, water quality assessment, biodiversity, and water resource management. It highlights the

major environmental challenges affecting freshwater ecosystems, including eutrophication, heavy metal contamination, habitat degradation, and declining water availability. The review further emphasizes the need for integrated limnological monitoring, conservation planning, traditional water harvesting practices, and sustainable management approaches to protect Rajasthan's fragile aquatic ecosystems. The chapter provides valuable insights for researchers, environmental planners, policymakers, and water resource managers working toward sustainable freshwater ecosystem conservation in arid and semi-arid regions.

A REVIEW: SAFER DOCUMENT EXCHANGE PROTECTING DOCUMENTS USING OTP, AUTHENTICATION, AND QR CODES

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Sensitive document communication must be done securely in the digital age. Conventional approaches frequently fail to provide enough protection against tampering and unwanted access. By combining One-Time Passwords (OTPs) with authentication methods and Quick Response (QR) codes, this article suggests an improved document protection solution. By using OTPs as a dynamic authentication factor, the suggested solution makes sure that every access request is verified with a distinct, time-sensitive code. The technique enables quick and easy authentication when combined with QR codes, which act as a secure connection between the user and the document. An OTP is generated when users use a mobile device to scan the QR code. Only those who are authorised can see or download the content because access to the document is allowed upon entering the OTP. This two-pronged strategy greatly reduces the chances of data breaches, phishing scams, and illegal access. Additionally, user experience is given top priority in the system's design, which strikes a compromise between strong security features and usability. While OTPs offer an extra degree of protection, QR code integration streamlines the authentication procedure. This study shows how well OTPs and QR codebased authentication work together to improve document security through thorough analysis and application. The

suggested system provides a scalable solution that may be applied to a variety of industries where document secrecy is essential, such as government, healthcare, and finance. Organisations can strengthen their digital document exchange procedures against new security threats by implementing this integrated approach. Index Terms—Data protection, information integrity, digital verification, OTP authentication.

IOT-ENABLED SMART PRODUCTION AND MANUFACTURING IN INDUSTRY 4.0

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The emergence of Industry 4.0 has transformed traditional manufacturing systems into intelligent, interconnected, and automated production environments through the integration of the Internet of Things (IoT), Cyber-Physical Systems (CPS), cloud computing, artificial intelligence, and data-driven industrial automation technologies. IoT-enabled smart production and manufacturing systems provide significant advantages including real-time monitoring, predictive maintenance, enhanced operational efficiency, improved decision-making, and flexible manufacturing capabilities. Despite the growing interest in Industry 4.0 technologies, the majority of advanced industrial implementations remain concentrated within large-scale enterprises, while many manufacturing organizations still face challenges in understanding and adopting these technologies effectively. Furthermore, there remains a limited understanding of how IoT and Industry 4.0 technologies are currently implemented within modern manufacturing and production industries. Therefore, this study aims to investigate the adoption patterns of IoT-enabled Industry 4.0 technologies in manufacturing and production enterprises. In this paper, we explore whether production organizations can be categorized based on Industry 4.0 adoption trends and analyze how these patterns contribute to defining specific configurations of IoT-enabled industrial technologies within smart manufacturing environments. The proposed study provides valuable insights into the requirements, challenges, and technological factors necessary for the successful implementation of IoT-enabled smart production and manufacturing systems in Industry 4.0 environments. Additionally, we present an analytical study of manufacturing and production enterprises operating within the machinery and appliances sector to evaluate the current state of Industry 4.0 adoption and IoT integration in industrial production systems.

ARTIFICIAL INTELLIGENCE IN EDUCATION FOR SUSTAINABLE DEVELOPMENT

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As the importance of sustainable development grow increasingly urgent, educational systems worldwide face mounting pressure to equip learners with the knowledge, skills, and techniques necessary to navigate complex socio-environmental challenges. This paper examines the transformative potential of artificial intelligence (AI) in advancing education for sustainable development (ESD), with particular reference to the United Nations' Sustainable Development Goals (SDGs) as a guiding framework. Through a systematic review of emerging literature and documented implementations, this study investigates how AI-driven tools, including adaptive learning platforms, intelligent tutoring systems, and natural language processing applications are reshaping the delivery, personalization, and scalability of sustainability-oriented curriculum. Evidence suggests that AI integration correlates with measurable improvements in learner engagement, conceptual retention, and the capacity to apply sustainability principles to real-world challenges. However, the paper critically acknowledges that these benefits are unevenly distributed. Structural inequalities, including digital infrastructure deficits, linguistic barriers, and socioeconomic disparities, significantly constrain access, particularly among learner populations in low and middle-income countries. The paper further underscores the indispensable role of educators as critical mediators in AI-augmented learning environments, arguing that effective ESD demands a complementary relationship between technological capability and human pedagogical judgment. Policy recommendations emphasize the need for inclusive design standards, transparent data governance, and better access frameworks to ensure that AI serves as a vehicle rather than a stratifying force in global education systems. This research contributes to the growing concern on responsible AI adoption in education, asserting that the alignment of AI development with sustainable development principles is not merely desirable but essential for achieving equitable and lasting educational outcomes.

SUSTAINABLE LIVELIHOOD RESOURCES

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The sustainable livelihoods approach is a perspective which promotes the importance of developing deep understanding about the way the poor and vulnerable lives their lives and the importance of policies and institutions in the choices they make regarding their livelihood. It helps formulate development activities that are people-centered; responsive and participatory; multilevel; conducted in partnership with the public and private sectors; and presents dynamic and sustainable qualities. With this approach towards development, the concept of 'sustainable rural livelihoods (SRL)' is increasingly central to the debate about rural development, poverty reduction and environmental management. Chambers and Conway (1992) have defined SRLas "A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base." Later in the year 2000, Ellis included the term 'institutions' and stated that "A livelihood comprises the assets, the activities and the access to these mediated by policies and institutions that together determine the living gained by the individual or household." In development economics and the widely-used Sustainable Livelihoods Framework, these resources are typically categorized into five key types of capital: 1. Natural Capital the natural resource stocks from which resource flows and services useful for livelihoods are derived. Examples: Land, soil, water, forests, air quality, and biodiversity.2. Social Capital the social resources upon which people draw in pursuit of their livelihood objectives. Examples: Networks, membership in formalized groups, relationships of trust, and access to wider institutions of society .3. Human Capital the skills, knowledge, ability to work, and good health that together enable people to pursue different livelihood strategies. Examples: Formal education, vocational training, physical health, and practical labor capacity.4. Physical Capital The basic infrastructure and producer goods needed to support livelihoods. Examples: Affordable transport, secure shelter, water supply and sanitation, access to information (communications), and tools/equipment.5. Financial Capital the financial resources that are available to people and provide them with different livelihood options. Examples: Savings, available credit/debt, regular remittances, pensions, and wages. Why are they important?-If we discuss about these importance then it is very importance for us because When vulnerable communities have access to a healthy balance of these assets, they are more resilient to external threats (like droughts or

job losses) and can sustainably lift themselves out of poverty. Organizations like the Food and Agriculture Organization (FAO) use these resource categories to design policies that promote both environmental conservation and economic.

ALGORITHMIC SOCIETY: ARTIFICIAL INTELLIGENCE, DIGITAL INFRASTRUCTURES, AND THE RECONFIGURATION OF SOCIAL STRATIFICATION IN INDIA

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The accelerating emergence of an algorithmic society — wherein Artificial Intelligence (AI) and digital infrastructures increasingly mediate social life — is fundamentally reconfiguring social stratification in contemporary India. This paper examines how AI-driven technological systems interact with India's existing social hierarchies, institutional frameworks, and digital ecosystems, critically analyzing both the transformative opportunities and the deep structural challenges this evolution presents. As AI penetrates key sectors including healthcare, education, governance, and social communication, it simultaneously reshapes employment structures, redistributes social power, and raises pressing ethical concerns around human autonomy and systemic accountability.While intelligent systems hold significant potential for enhancing institutional efficiency and broadening participatory decision-making, they also risk entrenching pre-existing inequalities rooted in India's socio-economic and caste-based stratification, compounded further by algorithmic bias and digital exclusion. This study, therefore, foregrounds the urgent need for responsible AI governance frameworks that priorities equitable access, transparency, and the protection of marginalized communities within India's rapidly digitalizing social landscape.Furthermore, this work investigates how AI-enabled digital infrastructures can be harnessed to promote social inclusivity and address structural challenges such as the urban-rural digital divide, cyber security vulnerabilities, and public health disparities. The societal perception of AI — encompassing public trust in automation, human-machine collaboration, and community-level acceptance — is treated as a critical sociological variable that shapes the trajectory of AI integration within India's evolving social structures. By interrogating the socio-cultural, legal, and ethical dimensions of AI adoption through a sociological lens, this paper endeavors to offer a comprehensive understanding of AI's role in reconfiguring social stratification in Digital India, and proposes pathways toward an equitable, inclusive, and human-centered algorithmic society.

GST DOCTRINE: ELUCIDATION OF GST 2.0 IN INDIA

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The Genesis of Taxing Structure and its fierce compliance could lead to the activities being moved towards a surge in better economic conditions of citizens across the globe. To fund the state's program designed in sync with the long-term objectives, vision and mission of the people through government, a well-structured taxation mechanism arose worldwide. The current paper describes the Genesis of Taxation in detail for knowing modern fringe, that is all about precision and intent about welfare programs being initiated. A subtle assessment of GST Doctrine attempts to clarify the unprecedented methods, techniques and claims regarding financial and economical achievements by the assessor. For the elicitation of a profound GST notification, reforms were introduced by the higher financial Authorities in India. Nationally, various industrial, manufacturing, trading, Service sectors and households are purportedly in compliance with the laws enacted, primarily due to the unification, simplicity and congruence of the banking and financial system in this regard. Information from books, Government websites, Banking guidelines and social media is processed to guard this academic work with an aim to appraise and interpret the GST Doctrine in economies since its inception. To envision & evoke the ideas, and opportunities in the whole body of Taxing, concerted efforts are made to undertake Indian financial services and the banking system in this study.

CONCEPTUALIZING THE IMPACT OF INFLUENCER MARKETING ON CONSUMER BEHAVIOUR

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Now a days, youth are spending their time on scrolling reels. This increase in the use of social media platforms shifted brands to use such platforms for advertisement which were TV advertisement earlier. This paper attempts to conceptualize the impact of influencer marketing on consumer behaviour. Consumer behavior starts with attention and leads to ultimate purchase. Social media influencers now a days are like TV stars. They are famous amongs a certain set of social media users, that too of a certain place. They influence the followers and others (those who

see them in the feed) in many ways. This papers tries to examine each of the factors which affect the consumer behavior. Influencers identity, trust, relevance to the recommendation and socio cultural context of the viewers are also discussed in the paper. For the same, paper evaluates the existing research the the findings. Papers of last 20 years are analysed and the concept is drawn using these papers. Finally, the paper summarizes the impact of impact of influencer marketing on consumer behaviour.

CONSUMER BUYING BEHAVIOUR IN THE INDIAN FMCG SECTOR: A CRITICALREVIEW OF LITERATURE ON ADVERTISING, BRAND EQUITY, BRAND LOYALTY, ANDBRAND AFFINITY

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A critical review of literature on consumer buying behaviour in the Indian Fast Moving Consumer Goods (FMCG) sector is presented in this paper. The review mainly focuses on work done in the fields of advertising, brand equity, brand loyalty, and brand affinity. Peer-reviewed journal articles, doctoral dissertations, government reports, and industry publications have been studies for the purpose of identifying gaps in the research done in the area. The review is organised in sections so as to trace the evolution of each concept and understand its evolution over time. The review indicates that although substantial work has been done nationally and internationally on advertising, brand equity, brand loyalty, but less work has been done on brand affinity as a separate construct, especially in Indian and more so in rural area. Also, while majority of the researches study two-dimensional pairing between advertising, brand equity, brand loyalty, and brand affinity; triangular relationship between advertising, brand affinity, and consumer behaviour has received very little explicit research attention. The paper identifies gaps appearing from literature review and argues for such specific research in Tier-2 cities, which hold the key to the future growth of Indian market space.

DISTRICT-LEVEL SALARY TRENDS AND REGIONAL ECONOMIC CONVERGENCE: EVIDENCE FROM GUJARAT

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This study investigates district-level salary trends and tests for regional economic convergence across Gujarat's 33 districts over a fifteen-year panel (2008–2023). Using a harmonised dataset drawn from the Annual Survey of Industries (ASI), Periodic Labour Force Survey (PLFS), Employee Provident Fund Organisation (EPFO) administrative records, and state government payroll data, we construct a comprehensive District Salary Index (DSI) that encompasses both formal and informal employment across agriculture, manufacturing, construction, and services. The analysis employs three complementary methodological frameworks: (i) absolute and conditional β-convergence regressions in a panel fixed-effects specification with time-varying controls; (ii) σ-convergence analysis tracking cross-sectional wage dispersion over time; and (iii) non-parametric distributional dynamics via stochastic kernel estimation to characterise the full transition of the district wage distribution. Empirical results confirm conditional β-convergence at a speed of 3.4% per annum (half-life approximately 20 years), driven primarily by catch-up in the lagging eastern tribal belt districts of Dahod, Narmada, Chhota Udaipur, and Dang. Stochastic kernel estimates reveal bimodal persistence in the wage distribution, reflecting a polarisation between a high-wage industrial cluster (Ahmedabad, Surat, Vadodara, Bharuch) and a mid-to-low wage rural periphery. Infrastructure endowment, manufacturing employment density, and proximity to Special Economic Zones (SEZs) are identified as robust determinants of both wage levels and convergence speed. Robustness checks using synthetic panel methods and Bonferroni-corrected multiple inference confirm the baseline findings. The paper concludes with evidence-based recommendations for spatially targeted industrial policy, skills development, and infrastructure investment to accelerate inclusive convergence.

ASSESSING THE ROLE OF INDUSTRIALIZATIONIN GUJARAT'S INCOME DISTRIBUTION: A SECTORAL SALARY DYNAMICS APPROACH

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This paper investigates the distributional consequences of industrialization on income inequality across Gujarat's 33 districts over the period 2006–2023. Departing from the conventional aggregate-level analysis, we adopt a granular sectoral salary dynamics framework that disaggregates wages across eight industrial sectors — agriculture, chemicals and petrochemicals, textiles and apparel, engineering and metals, diamond processing, pharmaceuticals, construction, and information technology and financial services — and tracks their evolution under varying intensities of industrial deepening. The study constructs a novel District Industrialization Intensity Index (DIII) from six administrative and survey-based components and integrates it with a harmonised sectoral wage panel drawn from the Annual Survey of Industries (ASI), Periodic Labour Force Survey (PLFS), EPFO administrative records, and the sixth and seventh Economic Censuses. Four analytical frameworks are employed: (i) Kuznets inverted-U testing via semi-parametric panel estimation to assess whether Gujarat follows the classic industrialization-inequality trajectory; (ii) Oaxaca-Blinder decomposition of formal-informal wage gaps to identify the contribution of industrialization to endowment versus return effects; (iii) a Generalised Method of Moments (GMM) dynamic panel model to estimate the wage-growth effect of industrialization while controlling for persistence and endogeneity; and (iv) inter-sectoral wage linkage analysis using Input-Output multipliers to quantify wage spillovers from manufacturing to services and agriculture. Results reveal an inverted-U pattern consistent with Kuznets at the district level, with inequality peaking at a DIII value of approximately 0.54 — corresponding to the industrialization intensity of mid-tier districts such as Rajkot, Anand, and Mehsana. The Oaxaca-Blinder decomposition shows that industrialization explains 34% of the formal-informal wage gap, primarily through returns effects rather than endowment differences. The GMM estimates indicate a significant positive effect of industrialization on wage growth (coefficient 0.063, $p < 0.01$) in the short run, but this effect attenuates and becomes statistically insignificant beyond an industrialization intensity threshold of 0.71, indicating diminishing marginal wage

returns. Input-Output multiplier analysis reveals that one rupee of manufacturing wage income generates approximately INR 1.84 of total economy-wide wage income through forward and backward linkages. Policy implications emphasise the distributional primacy of the formal employment quality over the quantity of industrial employment, the need for sector-specific minimum wage reforms, and the strategic role of agro-processing and pharmaceutical industries as high-multiplier, low-inequality pathways to inclusive industrialization.

A REVIEW PAPER ON CROP DISEASE DETECTION FOR SMART AGRICULTURE USING AI AND ML

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It is imperative that any plant disease be detected at an early age since any disease that might affect the plant may lead to loss of yields and, consequently, the loss of crops. Early detection not only prevents any losses but also saves the farmers time in carrying out unnecessary activities such as labour and other forms of activities. One of the techniques employed in modern intelligent agriculture includes the use of artificial intelligence in the detection of plant disease using photographs. It is done by taking a photograph of the plant using either a digital camera or a phone. Upon analysing the photograph, the computer makes the determination of whether the plant is diseased or not. This method can be used to detect any plant disease ranging from tomatoes, potatoes, and cotton to many other kinds of crops. Not only does it detect the disease, but it also gives advice on how to treat the plant in case of any disease using organic techniques, fertilisers, cultivation practices and also prediction of any disease likely to occur in the future due to climatic factors like temperature and humidity. Apart from all the above facilities, the system also provides facilities to predict future outbreaks of diseases based on environmental conditions such as humidity and temperature. Apart from this, the system also provides facilities such as disease diagnosis through cameras in real time and also an interface in the languages spoken by the farmers, such as Marathi and Hindi.

INNOVATIVE NANO TECHNOLOGICAL PLATFORMS FOR TRANSDERMAL ANTI-PSORIATIC DRUG DELIVERY

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Psoriasis is a long-term inflammatory skin condition linked to poor skin barrier function and excessive keratinocyte proliferation. Conventional treatments often show systemic adverse effects, low bioavailability, and poor skin penetration. Transdermal medication delivery systems based on nanotechnology have become viable alternatives to manage psoriasis. Drug penetration, stability, controlled release, and targeted treatment to psoriatic lesions are boosted by nanocarriers like liposomes, ethosomes, transfersomes, solid lipid nanoparticles, nanostructured lipid carriers, and polymeric nanoparticles. These advances enhance patient compliance, decrease toxicity, and increase therapeutic efficacy. The latest advancements, therapeutic advantages, difficulties, and potential applications of novel nano technological platforms in transdermal anti-psoriatic drug administration are presented in this chapter.

ADAPTIVE NEURO-PEDAGOGICAL MODELS FOR AI-SUPPORTED ENGLISH LANGUAGE LEARNING: NEUROADAPTIVE ELT

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The emergence of Artificial Intelligence (AI) has significantly transformed educational methodologies across the globe, particularly in the field of English Language Teaching (ELT). Traditional approaches to language learning often adopt uniform instructional methods that fail to address the cognitive diversity, emotional variations, and neurological learning patterns of individual learners. In response to these limitations, the concept of NeuroAdaptive ELT has emerged as an innovative interdisciplinary framework integrating neuro-pedagogy, cognitive science, and AI-supported adaptive learning technologies. This study explores how AI-driven systems can analyze learners' cognitive responses, emotional engagement, memory retention,

attention span, and linguistic behaviors to create personalized English learning environments. The research adopts a mixed-method approach involving experimental learning sessions, AI-assisted language assessment tools, learner analytics, and qualitative feedback from participants. Findings indicate that neuro-adaptive AI systems enhance vocabulary acquisition, pronunciation accuracy, communicative competence, learner engagement, and emotional confidence. The study concludes that NeuroAdaptive ELT has the potential to redefine future English education by creating intelligent, emotionally responsive, and cognitively adaptive learning ecosystems capable of supporting individualized language acquisition.

BANKING IN THE ERA OF ARTIFICIAL INTELLIGENCE: EMERGING TECHNOLOGIES TRANSFORMING MODERN FINANCE

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Banking Industry is facing a rapid digital transformation due to emerging technologies. Artificial Intelligence has revolutionized traditional banking system into Digital banking practices which has increased productivity, reduced cost and improved customer satisfaction. This study aims to explore the evolving landscape of Banking 5.0 with a focus on the integration of Artificial Intelligence (AI) and other emerging technologies in the banking sector. Thestudy also aims is to understand the key characteristics of Banking 5.0 including its emphasis on sustainability, AI, and seamless person-robot collaboration. Further, the study examines the major applications of AI in banking such as fraud detection, cyber security, credit scoring, customer service automation, risk management, and predictive analytics. It also highlights emerging technologies supporting AI in banking such as machine learning, big data analytics, block chain technology, cloud computing, and natural language processing IoT, which enhance operational efficiency and decision-making in the Banking industry. However key challenges associated with AI adoption in banking such as data security concerns, algorithmic bias, regulatory compliance issues, low digital literacy, lack of transparency, and high implementation costs are also explored. The study is primarily based on secondary data collected from recent literatures, reports and other publications. The findings suggest that while Artificial Intelligence can significantly improves operational efficiency and customer experience in Banking 5.0 but their successful adoption still requires addressing ethical, technological, and regulatory issues. The study contributes to in depth understanding of how AI based Banking 5.0 can transformthe future of banking industry in a more secure, innovative, transparent and inclusive manner.

IMPACT OF OMNICHANNEL CONSISTENCY AND OMNICHANNEL COLLABORATION ON CONSUMER BUYING BEHAVIOUR FOR SMART DEVICES

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In the context of smart devices, this study investigates the effects of omnichannel collaboration and omnichannel consistency on consumer purchasing behavior. As smartphones, wearables, and Internet of Things (IoT)-enabled goods become more widely used, consumers are depending more and more on both online and physical channels when making purchases. In order to influence purchasing decisions, it is now essential to ensure a smooth and integrated omnichannel experience. A structured questionnaire was used to gather data from 130 respondents as part of a quantitative research method. The measurement model was validated using Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA). Despite a weak model fit, the results demonstrated adequate validity and reliability. Omnichannel collaboration significantly improves consumer purchasing behavior, but omnichannel consistency has no discernible effect, according to regression analysis. The results show that consumers in the smart device market value channel coordination and integration more than just channel consistency. In technology-driven marketplaces, the study offers retailers and marketers useful data to improve customer experience and omnichannel strategies.

DESIGN OF MICROSTRIP ANTENNA

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This project presents the comprehensive design, simulation, and performance evaluation of a microstrip patch antenna operating at 2.4 GHz, a frequency band that plays a crucial role in modern wireless communication systems including Wi-Fi (IEEE 802.11b/g/n), Bluetooth, ZigBee, and several IoT-based technologies. Due to the increasing demand for compact, low-cost, and high-efficiency antennas, microstrip patch antennas have become one of the most preferred choices. Their low profile, planar configuration, and ease of fabrication make them ideal for integration into portable and embedded wireless devices. In this work, a rectangular microstrip patch antenna is designed on a dielectric substrate such as FR-4 or Rogers RT/Duroid, selected based on requirements for dielectric constant, loss tangent, and fabrication feasibility. The initial dimensions of the patch are calculated using standard antenna

design equations derived from the transmission line model, ensuring the antenna resonates near the target frequency of 2.4 GHz. A microstrip line feed or coaxial probe feed is incorporated to achieve proper impedance matching at 50 Ω. After constructing the initial geometry, parametric optimization is carried out in Ansys HFSS, leveraging its full-wave 3D electromagnetic solver to fine-tune the antenna dimensions and achieve improved performance. Key performance metrics such as S11 (return loss), VSWR, impedance bandwidth, radiation pattern, surface current distribution, gain, and radiation efficiency are evaluated through HFSS simulations. The optimized antenna demonstrates a strong resonance at 2.4 GHz with return loss better than −10 dB, VSWR close to 1, and stable radiation characteristics suitable for both indoor and outdoor wireless communication scenarios. The radiation pattern exhibits broadside characteristics, while current distribution analysis confirms efficient radiation from the patch surface. Overall, the project highlights the effectiveness of HFSS as a design and optimization tool for high- frequency antennas and demonstrates the potential of microstrip patch antennas as reliable, low-profile solutions for 2.4 GHz wireless applications. The results validate that the proposed antenna offers a balance of compact size, efficient operation, and ease of fabrication, making it suitable for integration into a wide range of communication devices.

FINANCIAL INCLUSION AND ECONOMIC EMPOWERMENT IN RURAL AREAS: EVIDENCE FROM BIHAR, INDIA SELF-HELP GROUPS

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The literature widely recognizes the significance of financial inclusion for economic development. Even Nevertheless, a sizable portion of the rural populace continues to live outside of the official financial system. The relationship between financial inclusion and rural economic well-being is examined in this study. The study is based on a primary survey of 426 rural women from three districts in rural Bihar, India, who participate in Self-Help Groups (SHGs). Through increased access to and utilization of credit facilities, physical banking services (PBS) are positively correlated with household economic well-being, according to the study, which uses structural equation modeling (SEM). In rural areas, PBS is likewise favorably correlated with both access to and use of insurance services; however, there is no positive correlation between insurance services and economic well-being. One significant route for policy is the National Rural Livelihood Mission (NRLM). PBS access is enhanced by NRLM, which also mediates the relationship between PBS, credit utilization, and rural

economic well-being. The study emphasizes the importance of policies that concentrate on the efficient execution of NRLM programs, enhanced insurance scheme awareness and delivery, and focused initiatives to remove supply-side and demand-side obstacles to financial access in order to increase economic well-being.

EVIDENCE FROM UPI ADOPTION ON DIGITAL PAYMENTS, FINANCIAL INCLUSION, AND RURAL DEVELOPMENT IN INDIA

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In emerging economies, digital payment technology have drastically changed financial institutions. The Unified Payments Interface's (UPI) quick growth in India has changed the country's payment infrastructure and increased access to financial services. UPI, which was introduced by the National Payments Corporation of India and is overseen by the Reserve Bank of India, has made it possible for smooth, real-time transactions between bank accounts using mobile devices. The adoption of digital payments, financial inclusion, and rural development in India between 2016 and 2024 are all examined in this study. The study uses panel regression models and diagnostic tests to assess the effect of UPI transaction growth on rural income and financial access indicators using secondary data from official financial databases and national payment statistics. The findings show that improvements in financial accessibility and rural economic outcomes are strongly correlated with the growth of digital payments. The results emphasize how digital payment infrastructure supports equitable economic growth and fortifies financial ecosystems in underdeveloped nations.

ADVANCE COMPUTER DIGITAL TECHNOLOGIES

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Advanced computers and digital technologies are changing the world. They are changing industries, economies and daily life. This is happening because of things like intelligence, cloud computing, big data analysis, Internet of Things and cyber security. This research paper looks at how advanced digital technologies have changed and how they affect society. The study shows how intelligent computing

systems make things more efficient, automated and connected. They also help with decision-making in areas like healthcare, education, finance, manufacturing and smart cities. Advanced computing and digital technologies make things better. They automate tasks. They improve communication. They help with decision-making. The research paper also talks about trends. These trends include edge computing and quantum computing. They are changing the world. However there are still challenges. These challenges are about data privacy and cyber security threats. The research stresses the need for innovation that's sustainable. It also stresses the need for literacy and rules. These are needed to ensure growth that's secure and fair for all. By looking at what's happening and what is coming next this paper gives insights into the role of computing and digital technologies. They drive innovation. They aid growth. They help society move forward.

ROLE OF ARTIFICIAL INTELLIGENCE IN TRANSFORMING PRIVATE BANKING SYSTEMS FOR SUSTAINABLE DEVELOPMENT

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Artificial Intelligence (AI) has emerged as one of the most influential technologies transforming the global banking industry. The increasing adoption of AI-powered technologies in private banking systems has significantly improved operational efficiency, customer experience, fraud detection, cybersecurity, and sustainable banking practices. The present study examines the role of Artificial Intelligence in transforming private banking systems for sustainable development. Primary data were collected from 100 respondents using a structured questionnaire based on AI-based service efficiency, AI-driven customer experience, AI-enabled risk management, and AI support for sustainable banking practices. Statistical tools such as descriptive statistics, reliability analysis, correlation analysis, and multiple regression analysis were applied through SPSS. The findings indicate that all AI-related variables positively and significantly influence the transformation of private banking systems. Among all variables, AI-driven customer experience emerged as the most influential factor. The study concludes that AI plays a significant role in enhancing sustainable banking operations, improving customer satisfaction,

strengthening risk management systems, and promoting long-term growth and competitiveness in private banking institutions.

UNDERSTANDING YEAR WISE DEVIATION AND TREND OF MONTHLY VALUE OF METEOROLOGICAL PARAMETERS FOR SOME CITIES IN INDIA FOR THE MONTH OF APRIL IN COMPARISON WITH NORMAL BY AIML

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This paper is based on research study with meteorological parameters related with monthly day summary data from historical years since 1969 till 2026 . The month of study was the month April. The data collection platform was 'Data supply platform IMD Pune'. The stations under study were some important cities in India . The historical meteorological day summary monthly data for some important meteorological parameters for each city were collected similarly since 1969 till 2026 along with corresponding historical record of monthly normal values for those meteorological parameters for those cities for analysis. The study was to understand the deviation of monthly value of these parameters from the monthly normal value of the same parameters since 1969 till 2026 and also to understand the predicted trend of the deviation of the same parameters for recent future years. For better understanding of the pattern change or deviation from past as well as understanding of future trend of the deviation of those meteorological parameters through all over India , data for cities from all parts of India among which Srinagar and Shimla from north, Jaipur and Mumbai from west, Bhubaneswar and Kolkata (Alipore) from East , Chennai and Bengaluru from south and Delhi as city from central part of India were chosen whose historical monthly data were collected for the analysis with python programming language on google collaborator platform. The meteorological day summary data , for these cities and monthly deviation from normal for the parameters MMAX, mean maximum temperature in ^{0}c, HMAX, highest maximum temperature in ^{0}c, MMIN, mean minimum temperature in ^{0}c , LMIN, lowest minimum temperature in ^{0}c, TMRF, total rainfall in the month in mm, RD, number of rainy days in the month having rainfall more than 2.4 mm ,MWS, mean wind speed in kmph,P2, number of days with precipitation 0.3 mm or more and also for HA,TH,FG,DS,SQ , respectively number of days with hail, thunder, fog, dust storm data in month ,were collected for those cities for this analysis with concerned month APRIL under study.

SPECTROSCOPIC STUDY OF AL DOPED ZINC OXIDE (AZNO) THIN FILMS FOR OPTOELECTRONIC DEVICES

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Recently, large band gap semiconductor (ZnO) is among the largest studied material because of a wide range of applications in photodetectors, light emitting diode, blue and ultraviolet laser diodes, transparent conductive oxides (TCOs), transparent field effect transistors, gas sensors, solar cell and dilute magnetic semiconductors (DMSs). This paper reports 1 at% Al doped ZnO (AZNO) thin films prepared by sol-gel spin coating method at 1000rpm to 6000rpm spin coating speeds. The sol was prepared from zinc acetate dehydrate, 2-methoxyethanol and mono-ethanolamine as precursor, solvent and stabilizer respectively. Aluminium chloride hexahydrate was used for doping of Al. The effect of spin coating speed on absorbance, transmission, Raman shift and fluorescence spectra of Aldoped ZnO thin films is studied in this paper. The absorbance of thin films decreases corresponding to increase in spinning speed. The transmittance of all thin films in the range 400nm to 700nm is greater than 90%. Raman and fluorescence spectra of thin films show that the intensity of both spectra decreases with increase in the spin coating speed.

REVOLUTIONIZING NOBLE GAS SAMPLING: METHOD DEVELOPMENT AND PERFORMANCE ANALYSIS

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Radioactive xenon isotopes are members of the fission product noble gases (FPNG) family and help in the identification of production mechanisms and their extent in any nuclear installation. Therefore, it is necessary to assess the FPNG concentration in the air during the operation of any nuclear power plant. Presently, the available methodology of assessment of FPNG at almost all Nuclear Power plants worldwide (mostly light water-based) is through a computer-based gamma-ray

spectrometry system. This method provides FPNG qualitative and quantitative identification through peak search within the acquired spectra of the collected air samples. For this purpose, the radioactive air sample from the active air of the plant is collected by the direct grab sampling method, which has inherent disadvantages as the sample size should be large enough to collect a sample representative of the entire stream. Usually, the collected samples are then analyzed in a high-purity germanium detector (HPGe) as a part of the gamma-ray spectrometer. This paper presents details about an alternative novel method for collecting and analyzing FPNG. This method is developed to overcome the disadvantages of the traditional method. The sampling here is based on cryogenic adsorption of noble gases on activated charcoal, enabling pre-concentration and improved detection sensitivity. Hence, compared to the traditional grab sampling technique, this method enhances the radioactive air collection capacity, ultimately reducing the minimum detectable activity and improving the sensitivity of environmental monitoring.

HOW AI RECOMMENDATIONS AFFECT CONSUMER BUYING PATTERNS AND BEHAVIOUR

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AI recommendations are no longer a small back-end feature in online shopping. They affect what consumers notice first, how much they search, which products they compare, and how confident they feel before buying. This research treats AI-based product recommendations as marketing tools and as forces that shape behaviour in digital markets. It looks at perceived relevance, transparency, personalization depth, and intrusiveness, then connects these design features with algorithmic trust, perceived autonomy, and privacy concern. Buying behaviour is not treated as one final purchase click. The outcomes include click intention, purchase intention, repeat buying, basket value, product variety, and perceived decision quality. The proposed design uses a structured consumer survey and a scenario-based experiment with different levels of personalization and explanation. That design helps test whether consumers accept AI suggestions because they find them useful or reject them because the system feels invasive or controlling. The main argument is that recommendation systems can reduce search effort and support better decisions, but only when consumers still feel that the final choice is theirs. For marketers, recommendation performance should not stop at sales uplift or click-through rate. Trust, privacy comfort, and freedom of choice affect whether consumers keep using the platform. The paper offers a research model for studying AI recommendations in

marketing and behavioural economics, especially in online shopping settings where personalization has become a normal part of buying.

CONSUMER TRUSTAI-DRIVEN DIGITALCOMMERCE PLATFORMS: A COMPARATIVE STUDY OF URBAN AND RURAL CONSUMERS IN JAMMU AND KASHMIR

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In recent years, Artificial Intelligence (AI) has played an important role in transforming digital commerce platforms through automation and personalized customer services. Many online commerce companies now use AI-based tools such as recommendation systems, virtual assistants and predictive analytics to improve customer experience and operational efficiency. Despite these technological developments, concerns regarding data privacy, cyber security, transparency and ethical use of consumer information continue to affect consumer trust toward online commerce platforms. The study focuses on consumer trust toward AI-driven digital commerce platforms with special reference to ethical and sustainable online business practices in urban and rural areas of Jammu and Kashmir. A descriptive and analytical research designwas adopted for conducting the study using both primary and secondary sources of data.Primary data was collected through a structured questionnaire from 120 respondents belonging to both urban and rural areas of Jammu and Kashmir. Secondary information was gathered from journals, books, research articles, reports and relevant online sources related to artificial intelligence and digital commerce. Urban consumers demonstrated grater familiarity with online commerce applications such as Amazon, Flipkart, Myntra, Meesho and Nykaa because of better internet accessibility and digital awareness. In contrast, rural consumers showed comparatively lower confidence in online transactions due to concerns related to payment security, privacy and limited technological knowledge. On the other hand, rural consumers demonstrate lower awareness regarding online commerce systems and express concerns related to online payment security, misuse of personal information and lack of technological knowledge. Poor internet connectivity and inadequate digital infrastructure continue to remain major barriers affecting the adoption of digital commerce platforms in rural areas. The study

indicates that transparent business operations, secure payment systems, genuine customer reviews and responsible AI practices play an important role in strengthening consumer trust and customer satisfaction. The findings also suggest that sustainable online business practices contribute toward improving long-term customer relationships and the credibility of digital commerce platforms.

ROLE OF GREEN MARKETING IN SUSTAINABLE DEVELOPMENT

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Green marketing plays a significant rolein promoting sustainable development by encouraging businesses and consumers to adopt environmentally responsible practices .It refers to the marketing of products and services that are eco friendly, recyclable, energy efficient and less harmful to the environment .In recent years increasing environmental awareness and concerns about climate change, pollution and resource depletion have made green marketing an important business strategy.The role of green marketing in sustainable development is to balance economic growth environmental protection and social welfare. Companies use sustainable production methods, reduce waste, conserve natural resources and promote green products to meet consumer demands while protecting the environment. Green marketing also helps in creating awareness among consumers about the importance of environmentally, friendly consumption and responsible lifestyle choices. The role of green marketing in sustainable development is to balance economic growth, environmental protection and social welfare. Companies use sustainable reduce waste conserve natural resources and promote green products to meet consumer demandswhile protecting the environment. Green marketing also helps in creating awareness among consumers about the importance of environmentally friendly consumption and responsible lifestyle choices. Moreover, green marketing provides competitive advantages to organisations by improving brand image, customer trust and long term profitability. Government and environmental organizations also support green initiatives through policies, regulation and awareness campaigns. However challenges such as high costs, lack of consumer awareness and false environmental claims can affect itseffectiveness. Over all, green marketing is an essential tool for achieving sustainable development. It encourages responsible production and consumption, Protects natural resources and supports a healthier future for for present and future generations. This paper attempts to provide an insight for understanding different dimensions of green marketing. Green

marketing supports the three pillars of sustaible development: economic growth, social well being and environmental protection. It encourages innovation improves corporate social responsibility and contributes to long term environmental sustainability. however such as high costs lack of consumer awareness and false environmental claims may affect its effectiveness.

WASTE, WORK AND JUSTICE: HARITHA KARMA SENA AND COMMUNITY-BASED WASTE GOVERNANCE IN KERALA

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Haritha Karma Sena has emerged as one of Kerala's most visible community-based waste management initiatives, linking decentralised sanitation governance with women's work, local environmental responsibility and public health improvement. This chapter examines Haritha Karma Sena through a secondary literature-based conceptual framework that connects three interrelated dimensions: waste, work and justice. It argues that Haritha Karma Sena should not be understood merely as a door-to-door waste collection mechanism, but as a socio-environmental intervention operating at the intersection of women's livelihood, community health and environmental justice. Based on published studies, journal articles and available secondary sources, the chapter analyses how Haritha Karma Sena contributes to household-level waste segregation, public awareness, women's employment, decentralised governance and cleaner local environments. At the same time, it critically highlights persistent challenges, including inadequate infrastructure, low social recognition of waste workers, occupational vulnerability, inconsistent public participation and the risk of reducing women's empowerment to low-paid sanitation labour. The chapter proposes a waste–work–justice framework in which Haritha Karma Sena's transformative potential depends on the integration of dignified labour conditions, environmental sustainability, community participation and gender-sensitive local governance. It concludes that Haritha Karma Sena offers an important model for community-led waste governance, but its justice-oriented potential can be realised only when women waste workers are treated not merely as service providers, but as environmental agents, public health contributors and local governance actors.

PHENOLIC BIOACTIVE AS PROMISING NATURAL THERAPEUTICS FOR OBESITY CONTROL

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Obesity has emerged as a major global health concern and is now considered to have reached epidemic or pandemic levels worldwide. Although growing research highlights the potential role of phenolic compounds in the management of obesity, their exact mechanisms and overall effectiveness are still not fully clarified. Various in vitro and in vivo investigations have indicated that phenolic compounds may contribute to obesity control through multiple mechanisms, including reduction of food consumption, suppression of lipogenesis, enhancement of lipolysis, stimulation of fatty acid β-oxidation, inhibition of adipocyte formation and proliferation, reduction of inflammatory responses, and mitigation of oxidative stress. This review summarizes recent findings regarding the anti-obesity potential of phenolic compounds derived from plants, nutraceuticals, and functional foods, based on experimental, animal, and clinical studies. Particular emphasis has been placed on widely consumed plant-based products such as cocoa, cinnamon, olive oil, and beverages including red wine, green, white and black tea, as well as Hibiscus sabdariffa L. tea, among others.

ASSESSING THE EFFECT OF GST ON HEALTHCARE COSTS: A STUDY OF HOSPITALS AND DIAGNOSTICS SERVICES

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Goods and services tax is one of the remarkable policy changes in India that has tapped on almost all sectors, ranging from healthcare. The impact of GST particularly on hospitals and the costs incurred on diagnostic services forms the core of this research. The study will seek to establish modifications in cost structures, service cost, and accessibility of the patients after the implementation of GST. The analytical approach of the current study is qualitative and quantitative to painting an integrative picture. It consists of interviews with managers of the analyzed hospitals as well as the providers of diagnostic services accompanied by quantitative analysis

before and after the introduction of GST. To generalize the results, fifty hospitals and forty diagnostic centers have been selected after considering a mix of both urban and semi-urban centers. The study employs Statistical Package for the Social Sciences (SPSS) in quantitative data analysis and the qualitative data analysis involves thematic coding. Closely examined are fluctuations in the cost of core services, tax on citizens' expenditure, and shifts in the patient influx. The initial study results indicate that the cost increase of diagnostic ambulatory care services has been slightly rising, especially in urban areas, and the effects on hospitals have been variable depending on the type of service. The paper establishes that GST has integrated taxation although the direct and indirect impacts of this reform on the costs of health care require policy action from the government to foster equitable provision of health care services.

SUSTAINABLE AGRICULTURE AND SOCIAL JUSTICE: BRIDGING THE EQUITY GAP

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Sustainable agriculture aims to meet current and future societal needs while protecting environmental resources. However, the transition must also confront deeply entrenched social inequities in India around labor rights, land access, and economic distribution. This paper analyzes these three dimensions of social equity, examining conditions faced by small, marginalized farmers and landless wage laborers. Challenges like low wages, informal work, child labor, gender inequality in land ownership, market consolidation, and low crop prices are outlined. Potential policy solutions such as tenancy reforms, cooperatives, and strengthened local food systems are discussed. Ensuring dignified livelihoods, inclusive resource rights, and balanced value distribution is imperative for just, resilient food systems. But uprooting structural inequality requires centering marginalized voices in agroecology efforts. The paper provides background on key equity issues to inform such discourse on sustainable agriculture in India.

ग्रीन बैंकिंग में आर्टिफिशियल इंटेलिजेंस उपकरणों के उपयोग

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ग्रीन बैंकिंग वित्तीय क्षेत्र में पर्यावरण की दृष्टि से प्राचीन परम्पराओं को बनाये रखने, पर्यावरण के अनुकूल योगदान देने, डिजिटल लेनदेन को प्रोत्साहित करने और उचित, आवश्यक व आसान ऋण प्रक्रिया को बढ़ावा देने पर जोर देती है। आर्टिफिशियल इंटेलिजेंस उपकरणों के उत्पन्न होने के साथ–साथ बैंक अपनी हरित निति को सुदृढ़ करने के लिए तेजी से उन्नत होने वाली ऐसी अनेक तकनीकों को अपना रहे हैं और जलवायु के संवेदनशील उपयोगों के लिए जोखिम प्रबंधन करने व स्थायी वित्तीय निर्णय लेने की प्रक्रिया को बढ़ावा दे रहे हैं। इस लघु शोध–पत्र में ग्रीन बैंकिंग में आर्टिफिशियल इंटेलिजेंस उपकरणों की भूमिका को दर्शाते हुए इनके अनुप्रयोगों, लाभों, चुनौतियों और भविष्य की संभावनाओं की व्याख्या करने का प्रयास किया गया है। ग्रीन बैंकिंग पर्यावरण की दृष्टि से प्राचीन बैंकिंग विचारधाराओं के आधार पर कार्य करता है जिसका उद्देश्य बैंकिंग के कार्य परिसंचालन में पर्यावरण के अनुकूल संस्थाओं के योगदान को बढ़ावा देते हुए वित्तीय संस्थानों के पारिस्थितिकी तंत्र पर निर्भरता को कम करना है। ये उपकरण बैंकिंग संचालन में वित्तीय स्थिरता के सिद्धांतों को एकीकृत करके, बैंकों के कागज रहित लेनदेन, ऊर्जा दक्षता, नवीकरणीय ऊर्जा, प्रदूषण नियंत्रण और सतत विकास का साथ देने वाली परियोजनाओं को ऋण देने के लिए प्रोत्साहित करते हैं। ग्रीन बैंकिंग न केवल परिचालन लागत को कम करती है बल्कि कॉर्पोरेट उत्तरदायित्यों को भी पारदर्शी, सरल एवं अधिक विश्वश्नीय बनाता है।

बाल संरक्षण में किशोर न्यायालय की भूमिका

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किशोर संरक्षण और बाल अधिकारों की सुरक्षा में न्यायालयों की भूमिका अत्यंत महत्वपूर्ण है। न्यायालय केवल बालकों के मामलों की सुनवाई नहीं करते, बल्कि उनके पुनर्वास और पुनःस्थापना की प्रक्रिया में भी सक्रिय भागीदारी निभाते हैं। किशोर न्याय बोर्ड और बाल कल्याण समितियाँ, जो किशोर न्याय (बालकों की देखरेख और संरक्षण) अधिनियम, 2015 के तहत गठित की गई हैं, बालकों के प्रति संवेदनशील और पुनर्वासात्मक दृष्टिकोण अपनाती हैं । इन संस्थानों का उद्देश्य बालकों की विशेष आवश्यकताओं का ध्यान रखना और उनके अधिकारों की रक्षा करना है। किशोर न्याय बोर्ड और बाल कल्याण समितियाँ बालकों को एक संरक्षित और सुरक्षित

वातावरण में रहने का अवसर प्रदान करती हैं। इन संस्थानों के माध्यम से बालकों को सुरक्षा, शिक्षा, मानसिक स्वास्थ्य सेवाएं, और चिकित्सा सुविधाएं प्रदान की जाती हैं। यह सुनिश्चित किया जाता है कि बालकों को उनकी आवश्यकताओं के अनुसार मार्गदर्शन और समर्थन मिले ताकि वे अपराध की दुनिया से बाहर निकलकर एक स्वस्थ और सम्मानजनक जीवन जी सकें। **किशोर न्यायालय में बच्चों के अधिकारों का संरक्षण–** किशोर न्यायालय बच्चों के अधिकारों के संरक्षण में एक विशेष भूमिका निभाता है। किशोर न्याय (बालकों की देखरेख और संरक्षण) अधिनियम, 2015 के तहत बच्चों के अधिकारों की रक्षा के लिए कई महत्वपूर्ण प्रावधान किए गए हैं। इस अधिनियम का उद्देश्य यह सुनिश्चित करना है कि बच्चों को एक सुरक्षित और प्रेरणादायक वातावरण मिले, जो उनके पुनर्वास और सुधार में सहायक हो । यह कानून बच्चों को समाज में स्थापित करने के लिए उनके शिक्षा, स्वास्थ्य और मानसिक विकास से संबंधित सेवाओं को उपलब्ध कराने का प्रावधान करता है, ताकि वे एक सकारात्मक भविष्य की ओर बढ़ सकें। किशोर न्यायालय यह भी सुनिश्चित करता है कि बच्चों के अधिकारों का कोई भी उल्लंघन न हो और उनकी पहचान और गोपनीयता पूरी तरह से सुरक्षित रहे। अधिनियम में बच्चों की पहचान और उनकी गोपनीयता की सुरक्षा पर विशेष जोर दिया गया है, जिससे यह सुनिश्चित हो सके कि किशोर अपराधी के रूप में उनका कलंकित न हो और समाज में उन्हें पुनः स्थापित होने में किसी प्रकार की रुकावट न आए। इस प्रक्रिया के तहत बच्चों के आत्म–सम्मान को बढ़ाने और उन्हें एक सम्मानजनक जीवन प्रदान करने के उद्देश्य से विशेष व्यवस्था की जाती है। किशोर न्यायालय इस बात का ध्यान रखता है कि बच्चों के साथ ऐसा व्यवहार किया जाए जिससे उनमें आत्म–विश्वास बढ़े और वे अपनी गलतियों को सुधारते हुए एक सकारात्मक जीवन जीने की ओर प्रेरित हों । इसके अतिरिक्त, किशोर न्यायालय बच्चों को अपराध के दुष्प्रभावों से बचाने के लिए काम करता है। वह बच्चों को एक ऐसे माहौल में रखता है, जो उनकी शिक्षा, मानसिक स्वास्थ्य और सुधार में मददगार हो। इन सुधार गृहों और पुनर्वास केंद्रों में बच्चों के लिए विभिन्न कार्यक्रम चलाए जाते हैं, जिनमें शिक्षा, मानसिक स्वास्थ्य परामर्श, और कौशल विकास से संबंधित गतिविधियाँ शामिल होती हैं। यह सुनिश्चित किया जाता है कि बच्चों को ऐसा सुरक्षित माहौल मिले, जहाँ वे अपने अतीत के अपराधों से उबर सकें और समाज में पुनःस्थापित होने के लिए तैयार हो सकें। किशोर न्यायालय का उद्देश्य बच्चों को समाज में स्वीकृति दिलाना और उनके जीवन को एक नई दिशा देना है। यह न्यायालय यह मानता है कि हर बच्चे में सुधार की संभावना होती है और उन्हें सही मार्गदर्शन और सहारा प्रदान करने की आवश्यकता होती है। इस न्यायालय के माध्यम से बच्चों को न केवल कानूनी सुरक्षा मिलती है बल्कि उन्हें एक ऐसा मार्ग भी मिलता है जिससे वे अपने अतीत की गलतियों को सुधार सकें और समाज में सम्मानजनक स्थान प्राप्त कर सकें।

झुंझुनूं जिले में भूमिगत जल के सतत प्रबंधन में सूक्ष्म सिंचाई की उपादेयता

शुभलता यादव

शोधकर्ता (सहायक आचार्य), पंडित दीनदयाल उपाध्याय शेखावाटी विश्वविद्यालय, सीकर

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कृषि एक पारंपरिक एवं प्रमुख व्यवसाय है, जो सभ्यता के विकास का मूल आधार भी है। राजस्थान प्रांत के विभिन्न भागों में विद्यमान भौतिक बाधाओं के बावजूद कृषि प्रमुख मानवीय गतिविधि है एवं अर्थव्यवस्था की धुरी है। अध्ययन क्षेत्र झुंझुनूं जिला राजस्थान के उत्तरी–पूर्वी भाग में स्थित अर्द्धशुष्क जलवायु दशाओं वाला प्रदेश है, जहाँ सामान्य वर्षा 486.7 मिमी है। अध्ययन क्षेत्र की भू–दृश्यावली कृषि प्रधान है। अर्द्धशुष्क जलवायु वाले क्षेत्रों में कृषि मुख्य रूप से भूमिगत जल पर निर्भर होती है। यह जिला अपनी समस्त जल संबंधी आवश्यकताओं की पूर्ति के लिए भूमिगत जल पर ही निर्भर है एवं सतही जल स्रोतों की दृष्टि से अभावग्रस्त प्रदेश है। तेजी से बढ़ती आबादी, कृषि विकास व विस्तार, तीव्र नगरीकरण, खनन, औद्योगिकीकरण एवं अन्य मानवीय गतिविधियों में भूमिगत जल के अत्यधिक दोहन के कारण जिले में भूमिगत जल स्तर तेजी से गिरता जा रहा है। कम वर्षा एवं भूमिगत जल के अत्यधिक दोहन के कारण पुनर्भरण दर कम है। भूमिगत जल की निकासी दर लगभग 200 प्रतिशत से भी अधिक होने से समस्त जिला अति दोहित श्रेणी में शामिल है। अध्ययन क्षेत्र में अनियमित और अल्प वर्षा के कारण सिंचाई ही कृषि का मुख्य आधार है। भूमिगत जल का सर्वाधिक दोहन सिंचाई में हो रहा है। अतः स्पष्ट है कि कृषि के स्थायित्व एवं भूमिगत जल संसाधन के सतत प्रबंधन हेतु सिंचाई की ऐसी तकनीकी अपनाई जाए, जो जल बचत और कृषि उत्पादन को बढ़ाने में सहायक हो। कृषि में सिंचाई की आधुनिक तकनीकी को अपनाने एवं उनके विस्तार को बढ़ावा दिया जाना आवश्यक है। वर्तमान में सूक्ष्म सिंचाई भूमिगत जल के सतत प्रबंधन के लिए प्रभावी तकनीकी के रूप में उभरी है, जिनमें फव्वारा सिंचाई और बूँद–बूँद सिंचाई सबसे प्रमुख हैं। सूक्ष्म सिंचाई से न केवल सिंचाई दक्षता बढ़ती है, अपितु जल की 30 से 60 प्रतिशत तक बचत होती है। सूक्ष्म सिंचाई के विस्तार में संस्थागत, तकनीकी, आर्थिक, मनोवैज्ञानिक इत्यादि कारक बाधक हैं, जिन्हें समय रहते दूर कर भूमिगत जल का सतत प्रबंधन किया जा सकता है। यह अध्ययन द्वितीयक आँकड़ों पर आधारित भौगोलिक अध्ययन है, जिसमें झुंझुनूं जिले में भूमिगत जल की उपलब्धता, भूमिगत जल स्तर, दोहन एवं भूमिगत जल के सतत प्रबंधन में सूक्ष्म सिंचाई की उपादेयता का अध्ययन किया गया है।

सतत ग्रामीण विकास के लिए कृत्रिम बुद्धिमत्ताः चुनौतियाँ और संभावनाएँ

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प्रस्तुत शोध पत्र का उद्देश्य ग्रामीण विकास के विभिन्न आयामों (जैसे कृषि, स्वास्थ्य, शिक्षा और वित्तीय समावेशन) में कृत्रिम बुद्धिमत्ता (AI) की वर्तमान भूमिका और भविष्य की संभावनाओं का मूल्यांकन करना है। शोध में यह विश्लेषण किया गया है कि कैसे AI–आधारित तकनीकें ग्रामीण जीवन स्तर को सुधारने और क्षेत्रीय असमानता को कम करने में मदद कर रही हैं। वर्तमान डिजिटल युग में, कृत्रिम बुद्धिमत्ता (Artificial Intelligence & AI) एक ऐसी तकनीक के रूप में उभरी है जो पारंपरिक ग्रामीण प्रणालियों को आधुनिक, कुशल और टिकाऊ बना सकती है। यह शोधपत्र ग्रामीण विकास के विभिन्न आयामों में AI की संभावनाओं और इसके कार्यान्वयन में आने वाली मुख्य चुनौतियों का विश्लेषण करता है। शोध के निष्कर्ष दर्शाते हैं कि जहाँ एक ओर AI आधारित प्रमाण कृषि, ड्रोन तकनीक, प्रारंभिक रोग निदान और स्थानीय भाषाओं में व्यक्तिगत शिक्षण ग्रामीण जीवन स्तर को सुधारने की असीम संभावनाएँ प्रदान करते हैं; वहीं दूसरी ओर, ग्रामीण क्षेत्रों में बुनियादी ढांचे का अभाव, इंटरनेट और बिजली की अनिश्चितता, डिजिटल निरक्षरता, डेटा की कमी और उच्च प्रारंभिक लागत इसके कार्यान्वयन में मुख्य चुनौतियाँ बनी हुई हैं। निष्कर्ष के तौर पर, ग्रामीण सशक्तिकरण के लिए एक समावेशी नीतिगत ढांचे का सुझाव दिया गया है।

सोशल मीडिया उपयोग की अवधि और कॉलेज छात्रों में चिंता एवं अवसाद के स्तर के बीच संबंध

डॉ मिथिलेश कुमार
अतिथि सहायक प्राध्यापक, स्नातकोत्तर संस्कृत विभाग पटना, विश्वविद्यालय, पटना

सोशल मीडिया के तीव्र विस्तार ने कॉलेज छात्रों के दैनिक जीवन को गहराई से प्रभावित किया है, जिससे उनके संचार के तरीके, शैक्षणिक सहभागिता और मानसिक स्वास्थ्य में महत्वपूर्ण परिवर्तन आए हैं। यह अध्ययन कॉलेज छात्रों में सोशल मीडिया उपयोग की अवधि और चिंता (Anxiety) तथा अवसाद (Depression) के स्तरों के बीच संबंध की जाँच करता है। इस शोध का मुख्य उद्देश्य यह विश्लेषण करना है कि क्या सोशल नेटवर्किंग प्लेटफॉर्म पर अधिक समय बिताना मानसिक तनाव में वृद्धि से जुड़ा है। यह अध्ययन मात्रात्मक शोध पद्धति पर आधारित है, जिसमें विभिन्न शैक्षणिक पृष्ठभूमि वाले कॉलेज छात्रों से संरचित प्रश्नावली के माध्यम से डेटा एकत्र किया गया। सोशल मीडिया उपयोग की अवधि को प्रतिदिन औसत घंटों में मापा गया, जबकि चिंता और अवसाद के स्तरों का आकलन मानकीकृत मनोवैज्ञानिक मापनी (स्केल) के माध्यम से किया गया। अध्ययन के निष्कर्षों से यह स्पष्ट हुआ कि लंबे समय तक सोशल मीडिया के उपयोग और चिंता एवं अवसाद के बढ़े हुए स्तरों के बीच एक महत्वपूर्ण सकारात्मक संबंध है। जिन छात्रों ने प्रतिदिन अधिक समय सोशल मीडिया पर बिताने की रिपोर्ट की, उनमें बेचैनी, उदासी, नींद में बाधा तथा

एकाग्रता में कमी जैसे लक्षण अधिक पाए गए। ऑनलाइन तुलना, 'फियर ऑफ मिसिंग आउट' (FOMO), साइबर बुलिंग और निरंतर डिजिटल संपर्क जैसे कारकों को मानसिक स्वास्थ्य समस्याओं के प्रमुख कारणों के रूप में पहचाना गया। इसके विपरीत, शैक्षणिक सहयोग और सामाजिक समर्थन के लिए सोशल मीडिया के संतुलित एवं उद्देश्यपूर्ण उपयोग से अपेक्षाकृत कम नकारात्मक मनोवैज्ञानिक प्रभाव देखे गए। यह अध्ययन दर्शाता है कि यद्यपि सोशल मीडिया सूचना साझा करने और सामाजिक संपर्क का एक महत्वपूर्ण माध्यम है, लेकिन इसका अत्यधिक उपयोग कॉलेज छात्रों के मानसिक कल्याण पर प्रतिकूल प्रभाव डाल सकता है। शोध में शैक्षणिक संस्थानों के भीतर जागरूकता कार्यक्रमों, डिजिटल साक्षरता पहलों और मानसिक स्वास्थ्य हस्तक्षेपों की आवश्यकता पर बल दिया गया है। संतुलित सोशल मीडिया आदतों को प्रोत्साहित करना और ऑफ़लाइन सामाजिक गतिविधियों को बढ़ावा देना चिंता और अवसाद के स्तरों को कम करने में सहायक हो सकता है। यह अध्ययन डिजिटल व्यवहार और मानसिक स्वास्थ्य पर बढ़ते साहित्य में महत्वपूर्ण योगदान देता है और शिक्षकों, नीति–निर्माताओं तथा मानसिक स्वास्थ्य पेशेवरों के लिए उपयोगी अंतर्दृष्टि प्रदान करता है।

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