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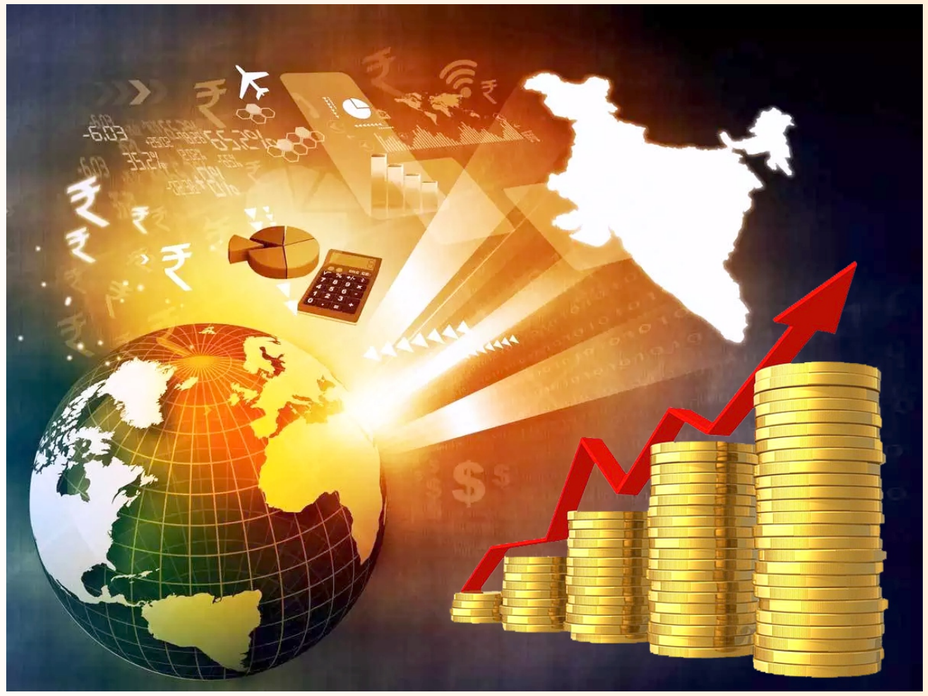
GROWTH AND DEVELOPMENET OF THE INDIAN ECONOMY IN THE 21ST CENTURY : TOWARDS ECONOMY 4.0



GROWTH AND DEVELOPMENT OF THE INDIAN ECONOMY IN THE 21ST CENTURY:TOWARDS ECONOMY 4.0

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Growth and Development of the Indian Economy in the 21st Century: Towards Economy 4.0

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Preface

The Indian economy has undergone remarkable transformation in the 21st century, emerging as one of the fastest-growing economies in the world. With the advancement of globalization, technological innovation, and policy reforms, India has steadily moved from a traditional economy toward a knowledge-driven and digitally enabled economic system. The concept of Economy 4.0 reflects this transition, where digital technologies, automation, artificial intelligence, and data-driven decision-making play a crucial role in shaping economic activities and development.

In recent decades, India has experienced significant growth across various sectors such as manufacturing, services, agriculture, and digital infrastructure. Government initiatives aimed at economic reforms, financial inclusion, digitalization, and industrial development have contributed to strengthening the country's economic foundation. Programs such as Digital India, Make in India, and Startup India highlight India's commitment to building a modern and innovation-driven economy.

The emergence of Economy 4.0, inspired by the principles of Industry 4.0, emphasizes the integration of advanced technologies such as artificial intelligence, big data analytics, the Internet of Things (IoT), and automation into economic systems. This transformation is reshaping production processes, financial systems, governance, and employment patterns, creating new opportunities while also presenting significant challenges.

This work aims to explore the growth and development of the Indian economy in the 21st century and analyze the country's journey toward Economy 4.0. It examines the structural changes in key sectors, the role of technological innovation, policy initiatives, and the impact of digital transformation on sustainable economic growth. Understanding these developments is essential for policymakers, researchers, academicians, and students who seek to comprehend the evolving dynamics of India's economic landscape.

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BOOKS CHAPTER SERIES 2025

BLOCKCHAIN-DRIVEN EMPLOYEE HEALTH MONITORING SYSTEMS: A CONCEPTUAL APPROACH TO ADVANCE SDG 3 IN INDIAN CORPORATE SETTINGS

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Abstract*: In the evolving landscape of corporate governance, employee health monitoring has emerged as a pivotal component of sustainable human resource practices, particularly in alignment with the United Nations' Sustainable Development Goal 3 (SDG 3) – Good Health and Well-being, as localized within the Indian context. This conceptual paper explores the transformative potential of blockchain technology in designing secure, transparent, and real-time employee health monitoring systems within Indian corporate settings. By leveraging blockchain's core features—decentralization, immutability, and smart contracts—organizations can enable continuous health data tracking, predictive wellness interventions, and automated compliance with occupational health standards. The study proposes a blockchain-integrated framework that connects HR systems with wearable devices, healthcare providers, and wellness programs to ensure data privacy, real-time health analytics, and equitable access to preventive care. This approach addresses critical gaps in traditional health monitoring mechanisms, such as data silos, privacy breaches, and delayed interventions, while reinforcing adherence to national regulations like the Occupational Safety, Health and Working Conditions Code, 2020. The proposed framework offers actionable insights for HR leaders, technologists, and policymakers to foster a proactive, data-driven culture of employee well-being in a digitally empowered and socially responsible corporate ecosystem.*

Keywords*: Blockchain, Employee Health Monitoring, SDG 3, Real-Time Analytics, Data Privacy, Indian Corporate HRM*

INTRODUCTION

In recent years, Indian organizations have increasingly focused on employee welfare by offering a variety of facilities. These include educational support such as schools, libraries, and financial assistance for workers and their children. Medical benefits are provided through insurance schemes and the Employees' State Insurance (ESI) program. Transport facilities are arranged from the workplace to employees' residences, even for shift-based work, along with conveyance allowances. To support employees' physical and mental well-being, organizations also organize recreational activities such as

annual home day events, team outings, and cultural programs like dance and drama. Housing facilities equipped with essential amenities and durable items are also provided. Additionally, many companies run consumer stores that offer food grains and other essential items at affordable prices.

Source:https://www.recruitingbrief.com/thumbs/large/c/5/4/c544cf04d03fd5bd6a785d046f3e787e007a4fb2.jpg

Employee welfare is directly linked to Sustainable Development Goal 3 (SDG 3), which focuses on ensuring healthy lives and promoting well-being for all. By prioritizing employee health and safety in the workplace, businesses can significantly contribute to achieving SDG 3. This includes implementing safety measures, offering training programs, and fostering a culture of health. Furthermore, prioritizing employee well-being can lead to a more productive and satisfied workforce, ultimately contributing to the overall economic and social development goals outlined in other SDGs.

Technology has significantly transformed the design, delivery, and monitoring of welfare systems. Among emerging technologies, blockchain plays a pivotal role due to its capabilities in ensuring transparency, security, and accountability. Blockchain enables the creation of tamper-proof digital records, making it ideal for tracking welfare disbursements, verifying beneficiary identity, and preventing fraud. Through smart contracts, welfare benefits such as healthcare access, insurance claims, and financial aid can be automatically triggered based on predefined conditions, minimizing human intervention and delays.

In employee welfare systems, blockchain facilitates:

- Secure storage of employee health and benefits data
- Efficient claim processing and real-time updates
- Decentralized access that empowers both employers and employees
- Improved compliance tracking and auditability

By reducing administrative burdens and enhancing trust, blockchain supports the development of inclusive, transparent, and efficient welfare systems. This directly contributes to achieving Sustainable Development Goal 3 (Good Health and Well-being), particularly in large organizations where managing employee benefits equitably is crucial.

STATEMENT OF THE PROBLEM

Despite the increasing focus on employee welfare in Indian corporates, existing systems often suffer from inefficiencies, a lack of transparency, and delayed benefit distribution. These limitations reduce the impact of welfare programs and hinder alignment with SDG 3 – Good Health and Well-being**.** Traditional, centralized systems are prone to data errors and compliance issues. Although blockchain technology offers promising features like transparency, security, and automation, there is a lack of a well-defined framework to integrate it into employee welfare systems in Indian HR practices. This study aims

to bridge that gap by developing a conceptual model that leverages blockchain to enhance welfare delivery and support sustainable development goals.

OBJECTIVES OF THE STUDY

1. To analyse limitations of conventional employee health monitoring systems in Indian corporates.
2. To examine blockchain's role in enabling real-time, secure, and predictive health monitoring.
3. To propose a conceptual framework for blockchain-driven health monitoring aligned with SDG 3.

SCOPE AND SIGNIFICANCE OF THE RESEARCH

This study focuses on the application of blockchain technology in employee welfare systems within the Indian corporate sector, specifically in relation to achieving Sustainable Development Goal 3 (Good Health and Well-being). The research is conceptual in nature and aims to develop a framework that integrates blockchain features such as transparency, decentralization, and automation into HR welfare practices. It primarily targets HR processes related to health benefits, insurance, reimbursements, leave management, and wellness programs. The scope is limited to corporate organizations operating in India, with a particular focus on how technology can enhance welfare service delivery, compliance, and employee well-being. This research holds significance in the current era, where organizations are striving to adopt technology-driven and sustainable HR practices. By exploring blockchain as a tool for enhancing welfare systems, the study contributes to:

- Innovative HR solutions that ensure accountability, reduce delays, and minimize fraud in welfare distribution.
- Strategic alignment with national and global sustainability goals, particularly SDG 3.
- Guidance for corporate policymakers, HR professionals, and technologists on how to build transparent, secure, and employee-friendly welfare ecosystems.
- Academic and practical value by filling a gap in the literature on the integration of blockchain in employee-centric policies in India.

This research not only supports improved employee well-being but also promotes ethical and sustainable corporate governance in the Indian context.

LITERATURE REVIEW

Catherine Mulligan (2024) conducted a comprehensive systematic literature review exploring how blockchain technologies can support policymakers in achieving Environmental, Social, and Governance (ESG) objectives and broader environmental sustainability goals. The study utilized the PRISMA SLR framework and reviewed 10,188 technical and policy-related articles from high-quality sources like Scopus and IEEE, ensuring extensive coverage. The authors noted that no conflicts of interest influenced the findings of the research.

Gupta, R., & Singh, A. (2024). Study conducted with a survey of 300 IT professionals revealed 72% feared data misuse from wearables. Blockchain was recommended for consent-driven, encrypted health data sharing. The study emphasized employee trust as critical for wellness program adoption.

Findings support decentralized ledgers to comply with the DPDP Act, 2023. This underscores the need for blockchain in real-time health monitoring systems.

Rao, P., Kumar, S., & Nair, V. (2023). This research paper has experimented in three firms and reduced health claim processing time by 60% using blockchain. Smart contracts automate approvals based on wearable vitals and medical records. Interoperability between HR, insurers, and hospitals improved significantly. Challenges included integration costs and employee training requirements. The study validates blockchain's efficiency in continuous health monitoring.

Mishra, S. (2023). A study analysed blockchain under the OSH Code, 2020, and DPDP Act compliance. Permissioned blockchains ensure data localization and auditability. Employee ownership of health data keys enhances ethical governance. And also, the study recommended regulatory sandboxes for corporate blockchain pilots. Establishes the legal feasibility of decentralized health monitoring in India.

Anshu Singh (2023) focused on identifying and synthesizing existing literature on the application of Blockchain Technology (BCT) for Sustainable Development (SD). An initial pool of 1,277 studies was gathered from databases such as Scopus and Web of Science, which, after applying inclusion and exclusion criteria, was narrowed down to 157 primary studies. The research employed bibliometric analysis and VOSviewer software to examine BCT characteristics and their impact on recent sustainability literature. Key research themes were aligned with United Nations Sustainable Development Goals (UNSDGs), and a mind map was developed based on thematic classification to guide future research questions.

Vilma Mattila (2022) investigated how blockchain technology could contribute to achieving the UN SDGs. The study sourced data from reputable academic platforms like Web of Science, DOAJ, and Scopus, utilizing both digital and physical documents. It highlighted that although blockchain holds significant promise for advancing sustainable development, current innovations predominantly target financial applications disconnected from real-world economic value. The author raised concerns about the emphasis on speculative gains and financial intermediation, noting that this trend, coupled with regulatory gaps and rapid innovation, could potentially lead to financial instability and speculative bubbles.

RELEVANT THEORIES IN HRM AND WELFARE

Maslow's Hierarchy of Needs: This theory emphasizes that employees have a hierarchy of needs—physiological, safety, social, esteem, and self-actualization. Blockchain-based welfare systems can address safety and security needs through transparent health benefits, timely insurance, and job security, and also support esteem and self-actualization by ensuring fair treatment and employee recognition.

Social Exchange Theory: Suggests that the relationship between employer and employee is based on reciprocal exchanges—if employees receive benefits and fair treatment, they are likely to respond with loyalty and performance. A transparent and equitable welfare system powered by blockchain fosters trust, making employees feel valued, which enhances commitment and reduces turnover.

Herzberg's Two-Factor Theory: Divides workplace factors into hygiene factors (e.g., salary, policies) and motivators (e.g., recognition, responsibility). Blockchain ensures hygiene factors like benefits and policies are clearly communicated and fairly executed, while motivators like transparent rewards can also be tracked.

Equity Theory Relevance: Employees compare their inputs and outcomes with others to determine fairness. Blockchain ensures fair access and distribution of welfare benefits, reducing perceptions of bias or inequality.

Contingency Theory of HRM: States that HR practices must align with the organizational environment and strategy. Adoption of blockchain in welfare is a strategic fit for tech-forward organizations aiming for sustainability and digital transformation.

PRINCIPLES OF BLOCKCHAIN TECHNOLOGY

Transparency- In a blockchain network, data can be accessed and verified instantly by all authorized users. This principle ensures that every transaction record added to the system is visible, traceable, and open to verification, which fosters trust and accountability, particularly crucial in welfare systems to ensure fair benefit distribution.

Immutability- Blockchain ensures that once data is recorded, it remains unchangeable and secure from deletion. This ensures the integrity and reliability of data, which is essential in employee welfare systems where manipulation or errors in health records, insurance claims, or reimbursements can lead to severe consequences.

Decentralization-Blockchain operates on a distributed ledger system, where control is not held by a single authority but shared across a network of nodes. This reduces dependency on intermediaries, minimizes single points of failure, and enhances the efficiency and resilience of welfare delivery mechanisms.

These principles collectively make blockchain an ideal solution for designing secure, efficient, and trustworthy employee welfare systems, especially in alignment with SDG 3 – Good Health and Well-being.

Alignment of Blockchain Capabilities with Welfare Goals

Blockchain technology offers features that naturally align with the objectives of employee welfare systems, particularly in promoting health, well-being, equity, and accountability. Below is a breakdown of how blockchain's core capabilities support welfare goals:

Blockchain Capability	Welfare Goal Alignment
Transparency	Ensures clarity in benefit distribution and reduces information asymmetry; helps employees track entitlements like insurance, medical claims, and leave benefits.
Immutability	Prevents manipulation of welfare records, ensuring the integrity of health data, policy documents, and service history.
Decentralization	Reduces bureaucratic delays by removing intermediaries; promotes inclusive access to welfare services regardless of location or hierarchy.

Blockchain Capability	Welfare Goal Alignment
Smart Contracts	Automates benefit disbursement (e.g., health insurance payouts, wellness reimbursements) based on predefined rules, improving efficiency and fairness.
Security and Data Privacy	Safeguards sensitive employee information, especially in health-related data, promoting trust in the system.
Auditability	Enables real-time monitoring and tracking of welfare activities, supporting compliance and ethical HR practices.

By integrating blockchain, welfare systems become more efficient, secure, and responsive, which supports the broader objective of Sustainable Development Goal 3 – Good Health and Well-being.

MAPPING BLOCKCHAIN-BASED WELFARE SYSTEMS TO SDG 3 INDICATORS

Sustainable Development Goal 3 aims to ensure healthy lives and promote well-being for all at all ages. Blockchain technology, when applied to employee welfare systems, can directly or indirectly contribute to several key SDG 3 indicators:

SDG 3 Indicator	How Blockchain-Based Welfare Systems Contribute
3.8 – Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services	Blockchain enables transparent and automated health benefit management (e.g., insurance, claims, and wellness programs), ensuring fair access and reducing delays.
3.c – Substantially increase health financing and the recruitment, development, training, and retention of the health workforce	Secure data sharing can streamline partnerships between employers, healthcare providers, and insurance companies to optimize welfare schemes and training access.
3.d – Strengthen the capacity for early warning, risk reduction and management of health risks	Real-time data and smart contracts can help employers manage wellness monitoring and early health interventions (e.g., health screenings, vaccination tracking).

SDG 3 Indicator	How Blockchain-Based Welfare Systems Contribute
3.4 – Reduce premature mortality from non-communicable diseases and promote mental health and well-being	Blockchain can support better mental health programs through secure access to counseling services, wellness reimbursements, and tracking participation in physical and mental health initiatives.

BLOCKCHAIN IN HR AND EMPLOYEE WELFARE

Blockchain technology is transforming traditional Human Resource Management (HRM) by offering secure, transparent, and decentralized solutions that address key challenges in employee data management, welfare administration, and trust-building. The following are the key applications in HR and Welfare:

Employee Records Management - Blockchain allows for the secure and tamper-proof storage of employee data such as qualifications, certifications, work history, and performance reviews. This improves background verification and reduces administrative overhead.

Payroll and Benefits Administration- Through smart contracts, payroll processing and welfare disbursements (e.g., health insurance claims, reimbursements, bonuses) can be automated, reducing errors, delays, and the risk of fraud.

Health and Well-being Programs- Welfare initiatives such as wellness benefits, mental health support, and medical reimbursements can be securely managed and tracked on blockchain platforms, ensuring transparency and compliance with regulatory standards.

Transparency and Trust- Blockchain fosters a high-trust environment by giving employees visibility into welfare entitlements, transactions, and HR policies, ensuring fairness and building stronger employer-employee relationships.

Data Privacy and Security- Employee health and welfare data is sensitive. Blockchain provides encrypted, decentralized data storage, enhancing data protection and compliance with privacy laws like India's Digital Personal Data Protection Act.

SMART CONTRACTS FOR WELFARE BENEFITS

Self-executing digital agreements known as smart contracts are stored on the blockchain and activate processes once set conditions are satisfied. In the context of employee welfare, smart contracts offer a highly efficient, transparent, and tamper-proof method for administering benefits. In employee welfare systems, they streamline processes such as insurance claims**,** medical reimbursements, and leave management by automating approval workflows and disbursements. For example, once a medical claim is uploaded and verified, the smart contract can instantly trigger reimbursement without manual intervention. Similarly, leave requests can be processed automatically by matching eligibility criteria, leave balance, and

company policy, reducing HR workload and delays. Insurance benefits can also be linked to real-time health data or policy requirements, enabling faster, tamper-proof settlements. These applications ensure greater transparency, efficiency, and fairness, contributing to improved employee satisfaction and aligning welfare practices with the goals of SDG 3 – Good Health and Well-being**.**

Health Data Privacy and Decentralized Medical Records

Protecting employees' confidential health information is a necessary one in this recent developing digital world. Blockchain technology ensures health data privacy by offering decentralized and encrypted storage solutions that prevent unauthorized access or tampering. Unlike traditional centralized databases, decentralized medical records stored on blockchain networks are distributed across multiple nodes, making them more secure and resilient to breaches. Employees can control who accesses their health data through permissioned systems, ensuring compliance with privacy regulations such as India's Digital Personal Data Protection Act. This decentralized approach also enables seamless sharing of verified medical records with healthcare providers and insurers, reducing paperwork and improving the efficiency of welfare services like insurance claims, wellness programs, and occupational health management. Overall, blockchain enhances both security and autonomy in managing employee health data.

Real-world examples of blockchain applications in health data privacy and welfare benefits, both in India and globally.

Estonia's eHealth System (Global Company)

Estonia has implemented a blockchain-based eHealth system that stores patient medical records. The system provides secure, decentralized access to health data while ensuring patient privacy and control. This system allows healthcare providers to access a patient's medical history only when authorized, helping maintain confidentiality and security. Blockchain ensures that records are immutable, providing an auditable trail of any changes made to medical data.

Guardtime (Global Company)

Guardtime is a company that uses blockchain technology to secure health data. It has partnered with healthcare providers and insurance companies to provide secure, tamper-proof medical records. The technology is used to prevent fraudulent claims and ensure data privacy, ensuring that patient records cannot be altered once recorded on the blockchain. Guardtime's system is in use globally in different sectors, including healthcare, where privacy and trust are paramount.

Manthan (Indian company)

Manthan is a blockchain-based healthcare platform in India that focuses on secure medical data management. The platform leverages blockchain to store and manage patient health records, ensuring that the records are immutable and secure. Manthan aims to improve the quality of healthcare while making health data sharing efficient across different healthcare providers without compromising privacy or security. The technology allows patients to control their health data and decide who can access it.

Apollo Hospitals (Indian company)

Apollo Hospitals is one of India's largest healthcare providers and has initiated a blockchain-based initiative to ensure secure access to medical records. They are testing the integration of blockchain technology to allow patients to maintain their medical records in a decentralized and immutable format. This system will not only enhance patient privacy but also improve interoperability between hospitals, clinics, and insurance companies, thus streamlining the claim process and minimizing fraud.

IMPLICATIONS FOR INDIAN CORPORATE HR PRACTICES: ENHANCING TRANSPARENCY AND TRUST

Blockchain technology presents transformative opportunities for Human Resource (HR) practices in India, particularly by increasing transparency and fostering trust in various HR functions. The following are key implications for Indian organizations:

Improved Management of Employee Welfare and Benefits: Blockchain can facilitate clear tracking and verification of employee benefits such as medical reimbursements, insurance claims, and leave records. By storing all transactions in a secure and immutable ledger, blockchain ensures that HR departments, employees, and third-party providers have access to consistent, transparent data in real time. This significantly reduces issues related to delays or errors in benefit management and enhances employee trust.

Fair and Transparent Performance Evaluation: With blockchain, organizations can establish a transparent system for performance reviews. Storing feedback, evaluations, and progression data on a blockchain ensures that these records remain unaltered and can be accessed by authorized personnel only.

Verified Recruitment and Background Checks: Blockchain technology can streamline the recruitment process by storing authenticated employee credentials such as education, certifications, and previous job experience. Employers can easily verify candidates' information in real-time, reducing the risk of false claims and ensuring more reliable hiring decisions. This improves the overall reliability of the recruitment process.

Employee Control over Personal Data: Blockchain's decentralized nature allows employees to have greater control over their data. It can securely store and protect sensitive information, such as medical or personal details, while enabling employees to determine who can access their data. This empowerment of employees strengthens their trust in the organization's ability to manage their private information responsibly.

Automated and Transparent Payroll Systems: Blockchain-powered smart contracts can automate the payroll process, ensuring timely and accurate payments to employees. By setting predefined rules within the contract (e.g., salary, bonuses, deductions), blockchain eliminates discrepancies and ensures that payroll is transparent and immutable. Employees can independently track their payments, fostering trust in the accuracy and fairness of compensation.

CONCLUSION

This study explores the transformative potential of blockchain technology in enhancing employee welfare systems within Indian corporate HR practices, especially in alignment with Sustainable Development Goal 3 (SDG 3) – Good Health and Well-being. By leveraging blockchain's core principles

of transparency, immutability, and decentralization, organizations can ensure more reliable, secure, and efficient management of welfare programs such as insurance claims, medical reimbursements, leave tracking, and data privacy. The implementation of smart contracts can streamline benefit disbursements and reduce delays, while decentralized medical records uphold employee privacy and empower them with control over personal health data. Moreover, blockchain fosters a high level of trust between employees and HR systems by eliminating manual errors, bureaucratic bottlenecks, and data manipulation risks. Overall, blockchain-based welfare systems have the potential to not only enhance operational efficiency but also improve employee well-being, making them a forward-looking solution for socially responsible corporate governance in India.

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