

# Analysis of Digital Transformation in Logistics and Supply Chain Management in India and Nepal an Innovation at Madhesh University

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## Abstract

This editorial illustrates the impactful research and innovation at Madhesh University through collaboration grounded in a published Indian patent (application no. 202641017633) on “Analysis of Digital Transformation in Supply Chain Logistics Management,” verified in 2026 at [iprsearch.ipindia.gov.in](https://iprsearch.ipindia.gov.in). These engagements signify more than institutional partnerships; they represent Madhesh University’s integration into the global academic community. Through conferences, collaborative research, and scholarly exchanges, the university builds networks that facilitate innovation, strengthen research capacity, and promote international visibility. Here, we share Madhesh University’s achievements on “Analysis of Digital Transformation in Logistics and Supply Chain Management” in India and Nepal. This patent is named under [Dr. Anjay Kumar Mishra](#), [Dr. Tara Prasad Gautam](#), [Dr. Shila Mishra](#), [Dr. Binod Lingden](#), and [Prof. Dr. Mahananda Chalise](#), highlighting their collaborative contribution to advancing digital transformation in supply chain logistics across both nations. In general, digital transformation is a factor that contributes to the modernization of supply chains in a sustainable manner and to economic progress in both countries.

**Keywords:** digital infrastructure development, cloud-based logistics platforms, IoT tracking devices, blockchain documentation, automated warehouse systems, smart operational management

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## Cite

Mishra, A. K. (2026). Analysis of digital transformation in logistics and supply chain management in India and Nepal an innovation at Madhesh University. *Madhesh Journal of Interdisciplinary Research (MJIR)*, 1(1), 1–8.



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## Introduction

The university’s growing research profile has gained national and international recognition. According to the AD Scientific Index based on [Total H-Index](#), [Madhesh University](#) is ranked 6<sup>th</sup> in Nepal, 2,779<sup>th</sup> in Asia, and 6,193<sup>rd</sup> globally. Such recognition is particularly noteworthy for an institution established only a few years ago through collaboration only.

Among its notable international engagements, Madhesh University collaborated in the International Conference on Exploring Generative

AI in Multidisciplinary Innovations and Contemporary Landscape (ICEGMICL-2025) organized by Dr. SNS Rajalakshmi College of Arts and Science, India, in association with the Artificial Intelligence Medical and Engineering Researchers Society (AIMER). The university has also been invited for official collaboration in the 9th International Research Conference on Sustainable Features: Leveraging Innovation in Business Practices and Social Enterprises (9<sup>th</sup> IRCCIMR-2026), organized by Chetna's Institute of Management and Research (CIMR), Mumbai, in partnership with leading institutions from Indonesia, the United Kingdom, the United States, and Mexico. Furthermore, Madhesh University has actively participated in the OCEM 2<sup>nd</sup> International Conference (2026), the RajShree Janak University National Conference, and several other academic forums.

Another significant milestone in the university's innovation journey is its contribution to intellectual property development. Researchers associated with Madhesh University were published an Indian patent titled "Analysis of Digital Transformation in Logistics and Supply Chain Management in India and Nepal" (application no. 202641017633). The patent was developed by a team of distinguished co-inventors: Dr. Anjay Kumar Mishra, Dr. Tara Prasad Gautam, Dr. Shila Mishra, Dr. Binod Lingden, and Prof. Dr. Mahananda Chalise. This achievement demonstrates the university's growing capacity to transform research ideas into practical innovations with real-world applications, further strengthening its reputation as a research-oriented institution.

### **Scientific Involvement Evidence From Publication**

The publications of Anjay Kumar Mishra and associates constitute robust scientific involvement evidence for the study on following:

### ***Foundational Evidence of Manual Inefficiencies***

Early work by KC and Mishra (2019) documents reliance on manual recordkeeping and low-bidding trends in Nepal's road divisions, establishing the baseline inefficiency of fragmented coordination that digital transformation must address. Similarly, Wagle and Mishra (2022) identify contract award trends leading to inefficiencies, validating the research objective to reduce logistics costs through automated contract management.

### ***Evidence for Coordination and Real-Time Tracking***

Pradhanang et al. (2024) analyze disruptions from poor stakeholder coordination in road projects, providing empirical support for using cloud platforms to enhance coordination among diverse supply chain stakeholders. Yadav et al. (2024) empirically study worker safety, directly supporting the claim that IoT enables real-time tracking of shipments and personnel—a critical requirement for operational transparency.

### ***Evidence for Data Analytics and Decision-Making***

Wagle and Mishra (2021) reveal a strong correlation (0.61–0.67) between bidder numbers and bid ratios, substantiating the claim that data analytics improves strategic decision-making by optimizing procurement and reducing costs. Celestin and Mishra (2025a) further demonstrate that AI-driven financial analytics enhances forecast accuracy and risk management, confirming how data analytics bridges financial data with supply chain efficiency.

### ***Evidence for AI Architecture and Framework Design***

Ananda et al. (2025) propose an AI architecture framework for educational transformation, directly substantiating the team's capability to design the study framework and

proving expertise in how AI enhances route optimization and demand forecasting.

### ***Evidence for Blockchain, Transparency, and Cross-Border Integration***

Celestin and Mishra (2025b) address the digital transformation of financial disclosure, revolutionizing corporate transparency and providing direct evidence that blockchain ensures secure digital documentation essential for reducing customs delays between India and Nepal. Mbonigaba and Mishra (2025) link green bonds to public sector budgeting, supporting the sustainable development context and the need for digital tools to verify green finance in logistics infrastructure.

### ***Evidence for Digital Infrastructure and E-Bidding***

KC et al. (2020) assess the effectiveness of e-bidding in Nepal, validating the claim that digital infrastructure improves supply-chain visibility by enhancing transparency and competition through digital systems.

### **Digital Transformation in Logistics**

Traditional logistics and supplychain systems in India and Nepal have long depended on manual recordkeeping, fragmented coordination, and minimal technological integration. These structural weaknesses have degraded operational performance and produced inefficiencies such as delayed shipments, lack of realtime tracking, high transportation costs, and poor inventory control. Although India has introduced planned digital reforms to modernize delivery systems, many small and medium enterprises (SMEs) still struggle to adopt new technologies effectively. Nepal faces additional constraints: limited digital infrastructure, connectivity gaps, inconsistent legislation, and continued dependence on conventional transport networks. Crossborder trade between the two countries is further slowed

by complex documentation and inadequate digital synchronization.

Existing research and practical applications of digital technologies in logistics reveal several persistent limitations. Digital integration is often fragmented—technologies such as blockchain, artificial intelligence, and the Internet of Things are deployed in isolation without seamless interoperability. India's reforms (for example, Goods and Services Tax and electronic waybills) have improved transparency, but compliance costs and limited technical capacity hinder many SMEs from realizing full benefits. In Nepal, intermittent internet access, weak infrastructure, and gaps in regulatory frameworks obstruct adoption of advanced logistics technologies.

A major crossborder challenge is the absence of standardized digital synchronization between India and Nepal, which contributes to customs delays and prolonged verification processes. Security and privacy risks arise when using cloudbased or distributed ledger systems. In addition, inadequate workforce training and resistance to technological change impede effective deployment of digital solutions. Most studies focus on urban or largescale logistics networks and neglect the specific difficulties of rural and semiurban areas.

These shortcomings indicate the need for an integrated, scalable, and contextsensitive digital transformation strategy tailored to the logistics ecosystems of India and Nepal.

### **Innovation Model**

The study adopts a Digital Supply Chain Integration Model comprising four core components:

#### ***Digital Infrastructure Development***

Implementation of cloud-based logistics platforms, IoT tracking devices, blockchain documentation, and automated warehouse systems.

### Smart Operational Management

AI-based route optimization, demand forecasting, digital inventory management, and real-time shipment monitoring.

### Data-Driven Decision Support

Use of big data analytics for predictive planning, risk management, and supply chain optimization.

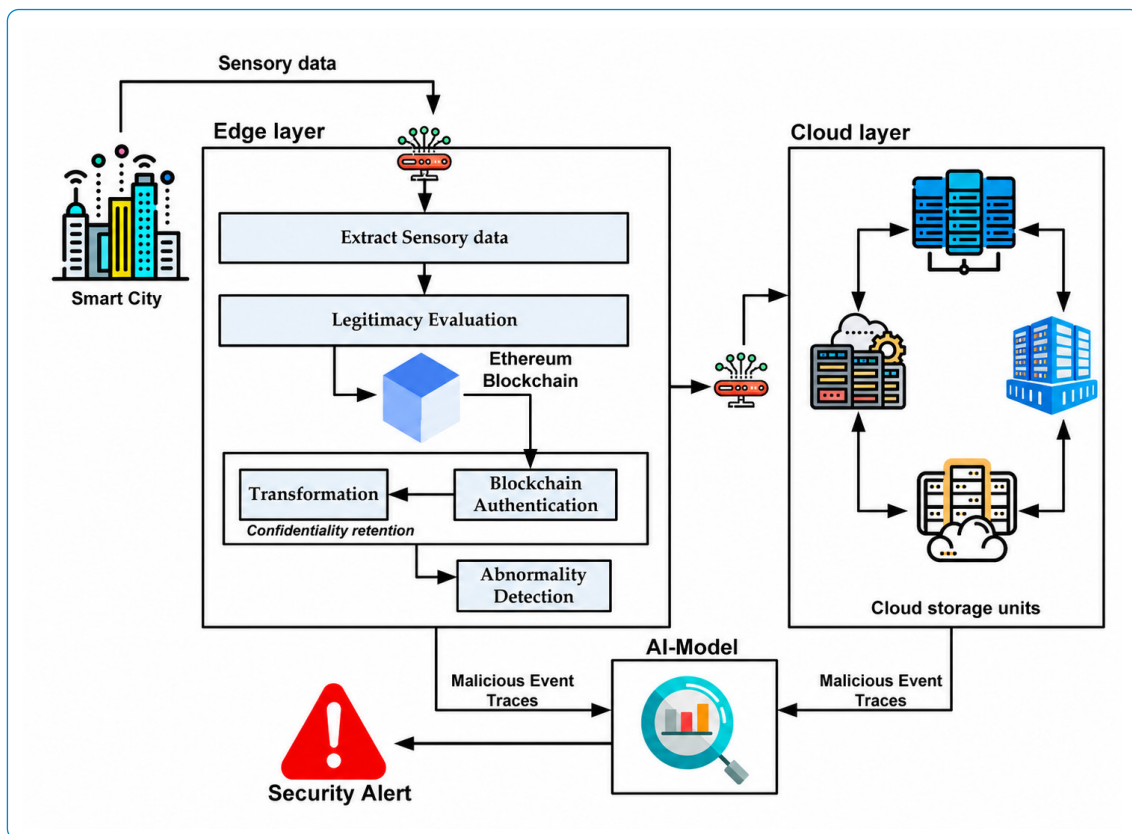
### Cross-Border Digital Synchronization

Integration of digital customs systems, electronic documentation, and trade compliance frameworks between India and Nepal. These components collectively enhance transparency, efficiency, and competitiveness within regional supply chain ecosystems.

The digital transformation framework is depicted, with the base being comprised of digital infrastructure (including the cloud, internet of things, and blockchain). The operational efficiency of Smart Logistics Operations, which include artificial intelligence route optimization, automated warehousing, and real-time tracking, is improved above it. The use of data analytics and decision support systems makes it possible to engage in risk management and predictive planning. In order to enhance openness and cooperation, the framework incorporates several stakeholders from throughout India and Nepal. These stakeholders include merchants, transporters, warehouses, customs agencies, and companies that supply goods.

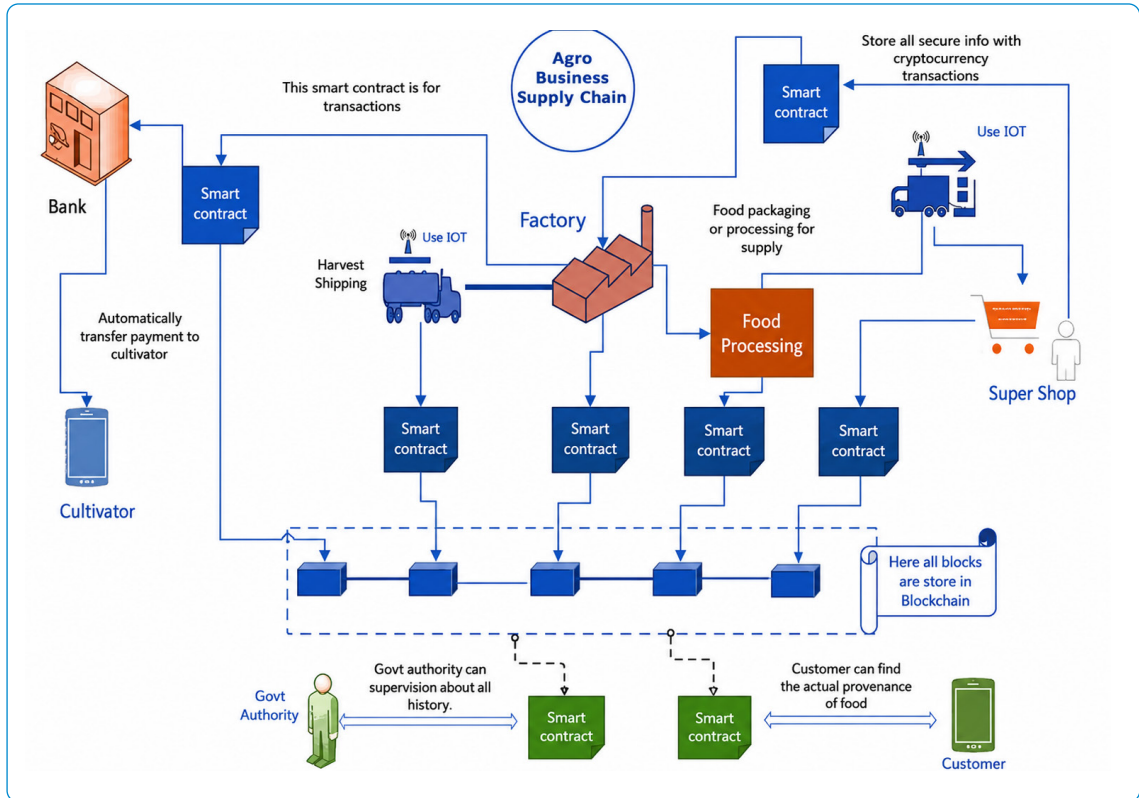
**Figure 1**

*Digital Transformation Framework in Logistics and Supply Chain Management*



**Figure 2**

*Flow Chart of Digitally Enabled Supply Chain Process Between India and Nepal*



## Workflow – Digitally Enabled Logistics and Supply Chain Process (India & Nepal)

### Order Initiation

The process begins when the customer or retailer places an order through a digital platform or enterprise resource planning (ERP) system.

### Digital Demand Processing

The order data is automatically recorded and analyzed using cloud-based systems for demand validation and inventory availability.

### Smart Inventory Management

Warehouse management systems update stock levels in real time and identify the nearest fulfillment center.

### Automated Warehouse Operations

Goods are picked, packed, and labeled using barcode/RFID-enabled systems for accurate tracking.

### Shipment Planning and Route Optimization

AI-based logistics software selects the most efficient transportation route based on traffic, distance, cost, and delivery time.

### IoT-Based Real-Time Tracking

IoT sensors and GPS track goods during transit.

### Digital Documentation

E-way bills, e-invoices, and other transport documents are generated electronically to ensure regulatory compliance.



### ***Blockchain-Based Verification (for Cross-Border Trade)***

Trade documents and shipment records are securely shared between India and Nepal customs authorities for faster clearance.

### ***Customs Clearance and Compliance***

Digital customs systems verify documentation, calculate duties/taxes, and approve cargo movement.

### ***Last-Mile Delivery Management***

Delivery is scheduled and tracked using mobile logistics applications with real-time updates to customers.

### ***Delivery Confirmation***

Proof of delivery is captured digitally through e-signature or OTP-based confirmation.

### ***Data Analytics and Performance Feedback***

Delivery time, cost efficiency, route performance, and service quality are analyzed to optimize future supply chain operations. This flow chart illustrates the process of digitally enabled supply chain management, beginning with the development of supplier orders and continuing on to digital inventory management, Internet of Things-based shipment monitoring, and artificial intelligence-driven route optimization. In order to facilitate international trade, the procedure incorporates digital customs documentation and verification based on blockchain technology. In conclusion, real-time delivery confirmation and feedback from data analytics contribute to the optimization of future logistics planning between India and Nepal.

### ***Novel Claims***

A comprehensive study framework for analyzing digital transformation in logistics and supply-chain systems in India and Nepal is both timely and essential: by systematically examining how digital infrastructure enhances

supply-chain visibility, IoT enables real-time shipment tracking, and AI improves route optimization and demand forecasting, the framework will clarify the specific performance gains attainable through technology adoption. When coupled with blockchain for secure, tamper-proof documentation and cloud platforms that strengthen coordination among diverse stakeholders, these technologies can meaningfully lower logistics costs and reduce delays. Rigorous application of data analytics within this framework will further sharpen strategic decision-making, while standardized cross-border digital integration between India and Nepal promises to streamline customs procedures and accelerate trade flows. Taken together, this integrated, evidence-based approach will identify scalable, context-sensitive interventions that policymakers, firms, and development partners can implement to modernize regional logistics and unlock substantial economic and operational benefits.

The findings of the study indicate that digital transformation plays a particularly important part in enhancing the performance of cross-border trade in India and Nepal, as well as boosting the efficiency of logistics and operational transparency. At the same time that India is demonstrating advanced digital adoption through government reforms and innovation in the private sector, Nepal is steadily establishing its digital logistics ecosystem. As a result of the integration of Internet of Things (IoT), artificial intelligence (AI), blockchain, and cloud technologies, operational delays are reduced, coordination among stakeholders is improved, and decision-making accuracy is increased. However, there are still significant difficulties in the form of infrastructure shortages and regulatory consistency.

## Conclusion

The current study seeks to investigate the effects that digital transformation has had on the management systems of supply chains and logistics in the countries of India and Nepal. Traditional supply chain operations around the world have been altered as a result of rapid breakthroughs in digital technologies such as artificial intelligence (AI), the internet of things (IoT), blockchain, cloud computing, and big data analytics. Transparency and operational efficiency have both been increased in India as a result of digital changes like as the integration of the Goods and Services Tax (GST), electronic way bill systems, and digital freight platforms. Even while Nepal is making steady progress, the country is still confronted with technological and infrastructure challenges that prevent it from reaching full-scale digital integration. The purpose of this project is to investigate the ways in which digital transformation might improve things like supply chain visibility, cost efficiency, coordination, and international trade between the two countries. In addition to this, the research identifies problems associated with implementation as well as strategic routes for achieving sustainable digital growth in logistics management.

## Acknowledgement

As we publish 'Madhesh Journal of Interdisciplinary Research' initial issue of the University Journal under advisors grace, we take pride in celebrating the achievements of our faculty members, researchers, and students whose dedication, hard work, and commitment to academic excellence have made these accomplishments possible. Their contributions continue to strengthen the university's growing

reputation as a center of learning, innovation, and research.

We also extend our sincere appreciation to all contributors, reviewers, editors, and staff members whose collective efforts have ensured the successful publication of this journal. Their professionalism and commitment to maintaining high academic standards are deeply valued.

While we celebrate these milestones, we recognize that they mark not an endpoint but the beginning of a broader journey. Our continued pursuit of research excellence, innovation, entrepreneurship, and global collaboration will remain central to our mission and vision.

Madhesh University is not merely expanding as an institution; it is fostering a vibrant culture of discovery, creativity, and academic leadership. Through sustained engagement in research, innovation, and international partnerships, the university is laying a strong foundation for a future that will contribute meaningfully to the development of Madhesh Province, Nepal, and the global academic community.

We express our gratitude to everyone who has been part of this journey and look forward to achieving even greater milestones together.

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