Journal of Global Entrepreneurial Management

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AI-Driven ERP Systems: Enhancing Supply Chain Resilience through Real-Time Data Integration

Abstract

Global supply chains face unprecedented disruptions due to geopolitical tensions, trade restrictions, and natural disasters, exposing the vulnerabilities caused by low digital maturity. Enterprise Resource Planning (ERP) systems, particularly AI-driven solutions, have emerged as a transformative force, enabling organizations to integrate financial and non-financial data in real time to enhance supply chain resilience. This paper explores the role of ERP systems in enabling real-time decision-making through seamless data integration. By consolidating diverse data sources - including procurement, inventory management, demand forecasting, and financial reporting - ERP systems provide organizations with enhanced visibility, agility, and efficiency. The study employs a conceptual solution verification and qualitative analysis to assess ERP capabilities, drawing insights from industry reports, expert interviews, and case studies. The findings highlight key benefits such as AI-driven demand forecasting, risk mitigation, and cost optimization, while also addressing challenges related to data governance, user adoption, and system customization. As digital supply chains continue to evolve, ERP systems stand at the forefront of innovation, equipping organizations with the tools to navigate disruptions and maintain competitive advantage. This paper contributes to the discourse on supply chain digital transformation by proposing a framework for effective ERP deployment, offering actionable insights for practitioners and policymakers.

Keywords: AI-driven ERP; Supply chain resilience; Real-time data integration; Demand forecasting; Supply chain agility; Enterprise resource planning; Data-driven decision-making

Research Article

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Received: 8 April, 2025; **Accepted:** 21 April, 2025; **Published:** 25 April, 2025

Introduction

Global supply chains are getting disrupted more than ever due to geopolitical tensions, changing tariffs, trade restrictions, and natural disasters. The digital maturity of supply chains remains a critical issue. A survey by McKinsey found that the median maturity index score across their survey population is just 30%, with an average of 36%. This lack of digital maturity underscores the urgent need for companies to bolster their key capabilities across supply chain networks.

The rapid pace of digital transformation has fundamentally reshaped supply chain management, emphasizing the need for real-time decision-making and seamless data integration. Enterprise Resource Planning (ERP) systems have emerged as transformative tools, enabling organizations to integrate financial and non-financial data across the supply chain and enhance operational efficiency.

ERP systems, including tools such as Microsoft Dynamics 365 (D365), stand out for their modular architecture, real-time analytics, and ability to unify disparate data sources, ranging from procurement and inventory management to customer demand forecasting and financial reporting. By providing a centralized platform, ERP systems enable organizations to make informed decisions, respond swiftly to disruptions, and optimize resource allocation. However, while the potential of these systems is

evident, there is limited research exploring their application in supply chain innovation.

This paper addresses this gap by examining how ERP systems integrate multiple data sources to enable real-time decision-making in supply chain management. Through a conceptual solution verification, the paper highlights the capabilities of ERP systems and proposes a framework for their effective deployment. By doing so, it contributes to the discourse on supply chain innovation and provides actionable insights for practitioners.

Literature Review

The integration of financial and non-financial data for supply chain management has gained significant attention in academic and industry research. Traditional supply chain systems often operate in silos, leading to inefficiencies, delayed decision-making, and limited visibility across operations [1]. ERP systems, with their ability to unify data across functions, have emerged as a critical solution for these challenges.

ERP systems are recognized for their advanced integration capabilities, combining real-time analytics, machine learning, and cloud-based functionalities [2]. Studies highlight how ERP supports end-to-end visibility, from procurement and production to distribution and customer service. For instance, Smith and Brown [3] emphasize ERP's capacity to consolidate financial metrics with supply chain data, enabling organizations to identify cost-saving opportunities and optimize workflows. Similarly, Jones et al. [4] discuss the role of AI-driven insights in enhancing demand forecasting and inventory management.

Despite these advancements, implementing integrated data solutions remains a challenge. Research underscores the importance of robust data governance, cross-functional collaboration, and user training to maximize the value of ERP systems [5]. This paper builds on existing literature by demonstrating how ERP systems facilitate data integration and real-time decision-making in supply chain contexts.

Supply chain system evolution and future trends

Supply chain management has evolved significantly over the decades. Early systems were heavily reliant on manual processes, focusing primarily on inventory control and procurement. With the advent of Material Requirements Planning (MRP) systems in the 1970s, organizations began to leverage technology for production scheduling and inventory management. The 1990s saw the emergence of ERP systems, integrating multiple functions within a unified platform to streamline operations and enhance data visibility [6].

Today, the focus has shifted towards digital supply chains, driven by advancements in big data, artificial intelligence, and the Internet of Things (IoT). These technologies enable real-time data collection, predictive analytics, and automation, empowering organizations to make proactive decisions and enhance resilience against disruptions [4]. Future trends in supply chain innovation include:

Increased data integration: Seamlessly connecting financial, operational, and external data sources to create a unified view of the supply chain.

AI-Driven Decision-Making: Leveraging machine learning algorithms to predict demand, optimize routes, and identify risks.

Sustainability initiatives: Incorporating environmental and social metrics into supply chain planning to meet regulatory requirements and consumer expectations.

ERP systems are at the forefront of these developments, offering organizations the tools to adapt to these emerging trends and maintain competitive advantage.

Methodology

To investigate the potential of ERP systems for supply chain innovation, this study employs a mixed-methods approach combining conceptual solution verification and qualitative analysis. The methodology aims to provide a comprehensive understanding of ERP systems' integration capabilities and their impact on supply chain decision-making.

Research design: The study is structured around a conceptual solution verification, focusing on how ERP systems integrate multiple data sources across the supply chain. Qualitative insights are derived from industry reports, expert interviews, and existing case studies to validate the proposed framework.

Data collection: Qualitative Data: Interviews with supply chain and IT professionals familiar with ERP system implementation. Topics include data integration

challenges, system capabilities, and operational improvements.

Secondary data: Analysis of industry use cases and white papers detailing ERP applications in supply chain management.

Analysis framework: Thematic analysis of qualitative data to identify recurring insights on data integration and real-time decision-making. Synthesis of findings from secondary sources to contextualize ERP systems' role in addressing supply chain challenges.

Validation: The findings are cross-validated with industry benchmarks and existing literature to ensure robustness and relevance.

Results and Discussion

This section explores how ERP systems facilitate data integration and real-time decision-making across the supply chain, highlighting their potential for driving innovation.

Results

1. Integration of financial and non-financial data

ERP systems effectively consolidate diverse data sources, including procurement, production, inventory, distribution, and financial metrics. Key features include:

Unified data model: ERP systems' architecture allows seamless integration of structured and unstructured data, providing a holistic view of supply chain operations.

Real-time data updates: Cloud-based platforms ensure real-time synchronization across departments, reducing delays in information flow.

Advanced analytics: Embedded tools enable organizations to analyze trends, identify bottlenecks, and predict future demands.

2. Enhanced decision-making

By integrating data from multiple sources, ERP systems support informed and agile decision-making in supply chain management:

Demand forecasting: AI-driven insights help organizations anticipate market trends and adjust production schedules accordingly.

Risk mitigation: Real-time visibility enables early detection of disruptions, such as supplier delays or inventory shortages, allowing for proactive responses.

Cost optimization: Consolidated data facilitates better resource allocation, minimizing waste and reducing operational costs.

3. Challenges and opportunities

Interviews and secondary data highlight key challenges in implementing ERP systems for supply chain innovation:

Data quality and governance: Ensuring the accuracy and consistency of integrated data remains a critical concern.

User adoption: Organizations often face resistance from employees unfamiliar with advanced ERP functionalities.

Customization needs: Tailoring ERP systems to specific supply chain requirements requires significant initial investment and expertise.

Discussion

The findings underscore the transformative potential of ERP systems in supply chain management. By integrating financial and non-financial data, these platforms enhance operational visibility, agility, and efficiency.

Strategic value: The unified data model empowers organizations to align supply chain strategies with financial goals, driving long-term growth.

Innovation potential: Real-time analytics and AI-driven insights position ERP systems as catalysts for supply chain innovation, enabling organizations to adapt to dynamic market conditions.

Implementation considerations: Successful deployment requires a focus on data governance, user training, and scalable customization.

Conclusion

ERP systems offer a powerful solution for integrating multiple data sources across the supply chain, enabling real-time decision-making and driving operational innovation. By consolidating financial and non-financial data, these platforms provide unparalleled visibility and agility, positioning organizations to navigate the complexities of modern supply chain management. While challenges such as data quality and user adoption persist, the benefits of ERP systems underscore their potential as a cornerstone of supply chain digital transformation.

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Citation: Binbin, Cui. “AI-Driven ERP Systems: Enhancing Supply Chain Resilience through Real-Time Data Integration.” J Glob Entrep Manage (2025): 124. DOI: 10.59462/JGEM.3.1.124