STM JOURNALS

International Journal of
Manufacturing and Production Engineering

Volume 2, Issue 1, 2024
DOI (Journal): 10.37591/IJMPE
(January–June)

https://journals.stmjournals.com/ijmpe

Review IJMPE

Assessing the Impact of E-business Technology on Supply Chain Management in Context of Indian Industries

Mamta Sinha[1,*], Om Prakash Patel[2], Amit Sharma[3]

Abstract

E-business processes and internet technologies offer powerful competitive tools for higher revenues and profits in the industry. Creating an efficient supply chain network is crucial for providing affordable products with high quality, which is essential for gaining a competitive edge. Implementing e-business processes in the supply chain aims to improve overall performance by leveraging information technology advancements for easier coordination and reduced information costs. The research focuses on assessing the impact of e-commerce processes on supply chain management performance, with cost reduction and customer satisfaction as key performance indicators. Operational efficiency, inventory management, logistics, supply chain flexibility, and integration are tested as independent variables affecting supply chain performance. The study reveals that e-business processes significantly impact supply chain performance, including operational efficiency, inventory management, logistics performance, flexibility, and integration. Information technology tools and e-commerce processes create value within the supply chain, leading to improved performance and profitability. The research validates its findings through a survey of top and middle managers in selected Indian automobile companies, with a target size of 115 participants. The study recommends focusing on increasing operational efficiency, coordination, customer satisfaction, and gaining a competitive advantage through enhanced supply chain management capabilities and e-business process implementation.

Keywords: Supply chain management, supply chain performance, supply chain integration, supply chain flexibility, e-business, operational efficiency, inventory management, logistics performance

***Author for Correspondence**
Mamta Sinha
E-mail: mamtasinharkdf@gmail.com

[1]Student, Department of Mechanical Engineering, RKDF University, Bhopal, Madhya Pradesh, India
[2]Assistant Professor, Department of Mechanical Engineering, RKDF University, Bhopal, Madhya Pradesh, India
[3]Associate Professor, Department of Mechanical Engineering, RKDF University, Bhopal, Madhya Pradesh, India

Received Date: March 27, 2024
Accepted Date: April 06, 2024
Published Date: April 17, 2024

Citation: Mamta Sinha, Om Prakash Patel, Amit Sharma. Assessing the Impact of E-business Technology on Supply Chain Management in Context of Indian Industries. International Journal of Manufacturing and Production Engineering. 2024; 2(1): 9–16p.

INTRODUCTION

Over the past 20 years, India's role in the global economy has changed, and this has had a big impact on a lot of different industries, including the car industry. Trade liberalization and substantial investments from global companies since 1991 have transformed the industry, although challenges persist in fully integrating local firms into the global market. The topic of digital transformation, or DT, has become increasingly important, especially in supply chain management and logistics.

However, the precise definition of DT remains somewhat ambiguous, often used interchangeably with terms like digitalization and Industry 4.0. In the context of logistics and supply chain management,

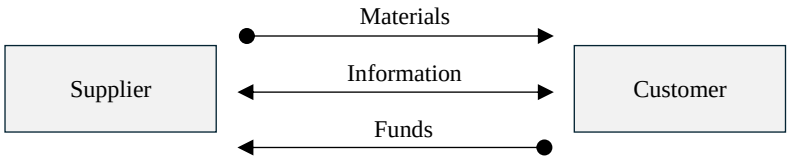

Figure 1. DT strategies.

DT refers to leveraging digital transformation technologies (DTT) to enhance value creation, adapt strategies and processes, and utilize enablers such as innovation and leadership to achieve goals like agility, productivity, and customer-centric operations. Manufacturers are driven to invest in logistics and supply chain management to achieve real-time visibility, faster innovation cycles, reduced costs, and improved planning capabilities. Despite these benefits, several inhibitors of DT exist, including resistance to change, complex decision-making processes, lack of management commitment, and concerns about data security. Research by Matt et al. emphasizes the importance of evaluating DT based on technology usage, changes in value creation, structural shifts, and financial impacts, highlighting the need for DT strategies to align with operational and functional goals, impacting leadership as well. Leadership plays a critical role in DT success, with identified skills such as openness, adaptability, empathy, motivation, communication, and technological understanding being essential for driving successful digital transformations. While DTT are crucial, it's the strategy, scope, and leadership that primarily determine the success of DT initiatives. Although the social and environmental dimensions of DT in logistics and supply chain management may have a lesser immediate impact than economic aspects, DT is expected to bring significant social and environmental benefits by increasing efficiency, reducing energy consumption, and cutting emissions (Figure 1). Sustainability is a growing trend, driven by customer demand and public sector initiatives. Effective technology deployment must consider economic, environmental, and social sustainability dimensions to ensure long-term viability and success.

LITERATURE SURVEY

Frank Straube and Anna Lisa Junge [1]: The study's conclusions are presented in relation to the potential applications of digital transformation technologies (DTT) for more environmentally friendly supply chain and logistics management in the manufacturing sector.

DTT can enable improvements in terms of energy efficiency, reduction of transport and distribution distances and optimization of logistics resources. Manufacturers' qualitative case studies served as the foundation for this study. Since current research frequently focuses on the economic dimension, special attention is given to sustainability in the social and environmental domains. According to the findings, the application of DTT in supply chain management and logistics has a somewhat favorable effect on sustainability's social and environmental facets.

Michael Dircksen, Carsten Feldmann [2]: Additive manufacturing (AM) is associated with potentially strong incentives for revenue and cost savings, as well as reduced environmental sustainability impacts. But choosing between local and AM production in the target market and international product distribution calls for a comprehensive analysis. Only a few aspects have been evaluated by research thus far. There is a dearth of thorough information about time, distribution costs, and environmental effects. With the help of a case study that validates the framework, this paper develops a decision-making model that evaluates the effects of AM on greenhouse gas emissions, distribution costs, and delivery times in global supply chains. Details about the distribution and effects on the environment costs and time are limited. This paper develops a decision-making model assessing the impacts of AM on GHG emissions, distribution costs and delivery times in global supply chains, including a case study validating the framework.

Wouter Boon, Bert van Wee [3]: Consumer 3D printing is on the rise and has the potential to significantly change the transportation and logistics sector. The current literature on 3D printing and

transport studies does not provide a systematic model of the impact of 3D printing on transport and related (policy relevant) areas such as traffic safety, location decisions, accessibility and environmental impacts. Based on a literature review and two rounds of expert consultations, we propose and refine a conceptual model to approach this gap in the literature. The expert consultation shows that the conceptual model contains relevant and important elements for assessing the impact of 3D printing on transport and transport-related issues. Location, needs, and resistance to traffic are important: (a) The most likely locations for 3D printers are city-level centers because they can coordinate material flows and pool expertise; (b) mass individualization and personification dictates the needs of 3D printers; c) Although there would not be many empty cars and distribution networks will be more effectively arranged, raw materials still need to be transported. Regarding the effects of 3D printing on traffic volumes and the environment, experts were divided.

Craig R. Carter, Dale S. Rogers [4]: As our discipline matured, we began to develop theories of supply chain management. However, we argue that a major omission in theory development in the discipline of supply chain management is that we have failed to theorize what we manage a theory of the supply chain. Using a conceptual theory building approach, we present basic assumptions about the structure and boundaries of the supply chain that can serve as a foundation for much-needed further development of supply chain theory.

Zhen Chen [5]: 3D printing technology has been developing rapidly in recent years. When 3D printing becomes widely available, the industrial structure of the world will change dramatically in the near future. This paper applies the system dynamics method to build an international supply chain model based on available data. Additionally, it mimics the trend of supply chain reconstruction following the use of 3D printing. The conclusion demonstrates that there will be a significant global decrease in the amount of transportation when 3D printing becomes widely used. Manufacturing will increasingly relocate to nations closer to the end users. Countries that are relevant should act to meet this challenge and opportunity with workable solutions. The actions include remodeling logistics facilities, coordinating logistics with the source of 3D printing supplies, and providing customized transportation for both traditional processing and 3D printing supplies.

Biniam Tekle Praveen Maghelal and Teweldebrhan [6]: The way that supply chains of businesses are organized and run in the future will shift as a result of three-dimensional printing (3DP). This study quantitatively estimates the impact of 3DP on shipping volume and fleet type, whereas the majority of studies concentrate on qualitative assessments. Specifically, (i) it calculates the reduction in shipping volume resulting from the incorporation of 3DP and (ii) identifies the types of shipping fleets that could be impacted by a change in the supply chain. Several statistical forecasting tools and linear programming models were taken into consideration, along with the Middle East's (ME) automotive supply chain were used to forecast vehicle demand and quantify reductions in shipping volume. Using a range of 3D printers (1–10), a 26–39% reduction in tonne miles of shipping has been predicted by 2040. In addition, a 29–45% possible shift in shipping volume from car carriers (roll-on/roll-off) to bulk fleet types was also predicted. This study also identified potential locations of 3DP factories in the ME region and identified potential losses and benefits to be gained by the shipping industry. In terms of fleet quantities and types, it aids shipping manufacturers, operators, and owners in anticipating future demand.

Bardia Naghshineh, Helena Carvalho [7]: Additive manufacturing changes the structure and dynamics of supply chains and affects their ability to cope with disruptions, i.e., supply chain resilience. To date, no empirical research has examined how the use of this technology affects resilience in the supply chain. Therefore, this research aims to explore this knowledge gap in an industry context using a survey method. The outcomes of this study will assist managers and decision makers in choosing resilience strategies to use in their supply chains when utilizing additive manufacturing technology to improve the delivery of goods and services.

Christian F. Durach Stefan Kurpjuweit [8]: Purpose: This article's objective is to provide an empirical viewpoint on newly developed additive manufacturing (AM) processes, the obstacles to their adoption, and a forecast of the supply chain effects that the manufacturing sector should expect. *Design, methodology, and approach:* With the participation of sixteen experts from academia and industry, a multistage exploratory study was carried out. *Results:* Just two newly emerging critical processes and five of the seven AM processes in use today will be relevant in the future. It is anticipated that all fifteen of the obstacles to their adoption will be eliminated in the next ten years. In terms of changes in supply chain structure, customer orientation, logistics, and supply chain capability, eight hypotheses are derived that speculate on whether and when supply chain impacts can be anticipated. *Investigation Restrictions/implications:* Traditionally, the literature has concentrated on "technical" barriers; however, "soft" barriers are a recent addition. Often debated obstacles like production speed and cost do not accurately represent the true worries of the research panel. Furthermore, it was discovered that a few of the supply chain implications covered in scholarly publications and the media were unlikely to come to pass. *Practical implications:* Industry experts were consulted to compile a summary of AM processes, technologies, obstacles, and supply chain implications for this study. *Originality/value:* This is among the first studies to make an empirical contribution to the extensive conceptual discussion. Furthermore, it is the first study to give a chronology of supply chain constraints and their effects.

Tina Shahedi, Amir Aghsami [9]: In the past decade, there have been numerous studies focusing on the closed supply chain. Accordingly, both the uncertainty conditions and the environmental impacts of the facility are still open questions. In order to improve performance under uncertainty related to the tire industry, this research suggests a novel bi-objective mixed integer linear programming model for the design of a closed-loop supply chain tire retreading network with regard to environmental issues. This model aims to minimize environmental impacts across the supply chain network while maximizing profits across the network, which includes customer centers, collection centers, recycling centers, manufacturing/remanufacturing plants, and distribution centers. The solution methodology of the suggested model is another new feature. For medium and large sample problems, optimal and Pareto solutions were found using an exact approach, an extended ε constraint method, and a meta-heuristic algorithm, the well-known Grasshopper Optimization Algorithm (GOA). We examine the efficacy of these meta-heuristics through numerical trials. Additionally, a sensitivity analysis was carried out for a few model parameters. Ultimately, findings and recommendations for additional study are provided.

Jan Holmström, Jouni Partanen Purpose [10]: To outline and assess possible strategies for integrating rapid manufacturing into the supply chain for spare parts. Design, procedure, and strategy: Proposals have been made for alternative conceptual designs that aim to implement rapid manufacturing technology within the spare parts supply chain. The aerospace industry is given examples of the possible advantages. The literature is used to discuss general feasibility. Results: The potential advantages for the supply chain from concurrently enhanced service and inventory reduction make the dispersed implementation of quick manufacturing very attractive for spare parts supply. However, given the trade-offs affecting deployment, it is suggested that centralized original equipment manufacturers (OEM) deployment or near-point-of-use deployment by general rapid manufacturing service providers is most feasible. Limitations: The limited range of parts that can currently be produced using this technology means that a service supply chain based on rapid manufacturing is only feasible in very specific situations. Practical Implications: Original Equipment Manufacturers (OEMs) should include rapid manufacturing considerations in their long-term service supply chain development.

Research Model

The shift from local to global markets, coupled with the influx of a large young population, is reshaping the dynamics of supply chain management and product development. Here are key points highlighting the challenges and strategies in today's market environment:

- Shorter product life cycles

- Focus on supply chain management
- Manufacturing process optimization
- Customer-centric approach
- Complexity in supply chain
- Research and analysis
- Value-based pricing

Research Questions

1. What is the effect of inventory management on supply chain performance using e-business process?
2. What is the influence of supply chain flexibility on supply chain performance using e-business process?
3. What is the impression of logistics performance on supply chain performance using e-business process?
4. What is the consequence of supply chain integration on supply chain performance using e-business process?

Objectives

To determine the impact of following parameters on the performance of supply chain of Indian industries (cost reduction and customer satisfaction).

1. To determine the effect of e-business process on inventory management of supply chain.
2. To determine the impression of e-business process on logistics performance of supply chain.
3. To determine the assessing the impact of e-business process on operational efficiency of supply chain.
4. To determine the influence of e-business process on supply chain flexibility.
5. To determine the consequence of e-business process on supply chain integration.

RESEARCH METHODOLOGY

Population and Sample

Discussions with experts, interviews with supply chain experts and validation surveys of information technology experts are conducted based on the literature survey. Data are collected from supply chain managers and their subordinates (115 in total) who work as middle-level managers of selected Indian industries. From a population size of 100, we got a total of 69 responses with a response rate of about 69.01%. Responses are collected from a specific target group of respondents; therefore, the sampling method used is purposive.

Measures

A five-point Likert scale was used to measure all parameters (Table 1).

Statistical Methods

To achieve the research objectives, descriptive statistics analysis (SPSS 23) is done for the survey data collected through structured questionnaire. These descriptive statistics mainly include mean, standard deviation and frequency distribution. The relationship between variables and expectations among the factors being studied is predicted using regression models. Five independent variables—(operational efficiency, supply chain flexibility, logistics performance, inventory management, and supply chain integration) are used and their relationship with the dependent variable (supply chain performance) is analyzed through multiple regression analysis.

Table 1. Likert scale.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

The following regression model is used for this research analysis.

$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$

Where: X_1 = Inventory Management; X_2 = Logistics Performance; X_3 = Operational Efficiency; X_4 = Supply Chain Flexibility; X_5 = Supply Chain Integration; e = Error, Term β0=Constant,

β1- β5 = Regression Coefficients

(change induced in Y by each X).

Justification for Selecting Indian Industry

As the industry sector is a major contributor to economic growth and in the current scenario, the Indian industry is facing tremendous competition from outsiders. In such a situation, effective and efficient supply chain management practices can be adopted to improve operational efficiency and profitability. The industry has many moving components on their products. The supply chain issue is multifaceted in the industry and changes regularly as the global economy fluctuates. It is therefore very important for the industry to ensure that there are value chains in place and money flowing in the right direction, just like any other industry. Rapid globalization creates challenges in the supply chain of the industry. Due to the improvement of the economy, the purchasing power increased and companies need to focus on the needs of the customers increasing the inventory while staying on any issues that may occur in production and distribution. Therefore, the researcher felt that the Indian industry will be better off. The proposed study is suitable to explore the impact of important elements of SCM (Supply Chain Management) on supply chain performance and organizational performance of industry [11].

Research Instrument (Questionnaire)

Criteria for selection of these companies where they should represent different sectors. The fields are:

1. Manufacturing industry
2. Pharmaceutical/medical technology industry
3. Telecommunication industry
4. Commodity industry
5. Consumer products industry
6. Contract manufacturer
7. Materials
8. Automobile industry
9. Paper industry
10. Construction industry

RESULTS AND DISCUSSION

Correlation Analysis

The research variables for predictive statistics were examined using Pearson's product moment correlation analysis. To examine the relationships between researches variables are Pearson's product moment correlation, because a rating scale was used in the questionnaire.

A strong correlation between supply chain performance and operational efficiency was found in the research through correlation analysis, with a p-value of 0.000 and a correlation coefficient of 0.941. With a correlation coefficient of 0.880 and a p-value of 0.003, the study also demonstrated a positive relationship between supply chain performance and inventory management. With a correlation coefficient of 0.805 and a p-value of 0.000, the study also looks into the possibility of a positive relationship between supply chain performance and logistics performance.

The study also looks into the possibility of a positive relationship between supply chain performance and flexibility, finding a 0.000 p-value and a correlation coefficient of 0.943. Ultimately, the study discovered that, with a correlation coefficient of 0.883 and a p-value of 0.000, supply chain integration and performance are positively correlated (Table 2).

Table 2. Correlation of the study variables.

		Supply chain performance	Operational efficiency	Inventory management	Logistics performance	Supply chain flexibility	Supply chain integration
Supply chain performance	Pearson correlation	1					
	Sig. (2-tailed)						
Operational efficiency	Pearson correlation	.941**	1				
	Sig. (2-tailed)	0					
Inventory management	Pearson correlation	.890**	.913**	1			
	Sig. (2-tailed)	0.003	0				
Logistics performance	Pearson correlation	.805**	.730**	.927**	1		
	Sig. (2-tailed)	0	0	0			
Supply chain flexibility	Pearson correlation	.933**	.832**	.911**	.855**	1	
	Sig. (2-tailed)	0	0	0	0.001		
Supply chain integration	Pearson correlation	.893**	.832**	.911**	.855**	.9021**	1
	Sig. (2-tailed)	0	0	0	0.001	0	

The data results also analyzed that keeping all independent variables zero, supply chain performance will increase by 0.056 per unit increase in inventory management. This shows that there is a significant relationship between inventory management and supply chain performance as the p-value is 0.076.

The data results also analyzed that supply chain performance will increase by 0.005 per unit increase in logistics performance, keeping all independent variables zero. The fact that the p-value is 0.098 indicates that there is a substantial correlation between supply chain performance and logistics performance. The data results have also been analyzed with respect to supply chain performance, keeping all independent variables zero 0.351 increase per unit increase in supply chain flexibility. Because of the 0.000 p-value, this indicates that supply chain performance and flexibility have a significant relationship.

Finally, the data results also analyzed that keeping all independent variables zero, supply chain performance will increase by 0.024 per unit increase in supply chain integration. This shows that supply chain flexibility affects supply chain performance the most followed by inventory management, operational efficiency, supply chain integration and logistics performance.

CONCLUSION

The conclusion of this study was to examine the impact of e-business processes on supply chain performance in the context of Indian industries with various findings. Based on past experiences, elements of e-business processes were relied upon to positively impact supply chain management performance in the context of the Indian automobile industries. The research reveals that there is a significant positive relationship between the supply chain dimensions which are operational efficiency, inventory management, logistics performance, supply chain flexibility and supply chain integration with supply chain performance in the context of Indian automobile industries. The research also shows that e-business processes are effectively used by Indian companies to improve supply chain performance. This research is limited to the impact of e-business practices on the supply chain management performance of the industries in India. However, this research is needed to facilitate data and information sharing on a broader scale, especially in terms of system integration with other supply chain partners.

REFERENCES

1. Junge AL, Straube F. Sustainable supply chains – Digital transformation technologies' impact on the social and environmental dimension. Procedia Manuf. 2020;43:736–742. DOI: 10.1016/j.promfg.2020.02.110.
2. Michael Dircksen, Carsten Feldmann, Holistic evaluation of the impacts of additive manufacturing on sustainability, distribution costs, and time in global supply chains, Transp Res Procedia. 2020; 48: 2140–2165.
3. Wouter Boon, Bert van Wee, Influence of 3D printing on transport: a theory and experts judgment based conceptual model, Transp Rev. 2018; 38(5): 556–575, DOI: 10.1080/01441647.2017.1370036.
4. Craig R. Carter, Dale S. Rogers, Thomas Y. Choi, Toward the Theory of the Supply Chain, J Supply Chain Manag. 2015; 51(2).
5. Zhen Chen, Research on the Impact of 3D Printing the International Supply Chain, Hindawi Publishing Corporation Advances in Materials Science and Engineering, Volume 2016, Article ID 4173873.
6. Biniam Tekle Teweldebrhan, Praveen Maghelal, Abdulla Galadari, Impact of 3D printing on car shipping supply chain logistics in the Middle East, Asian J Shipp Logist. September 2022,; 38(3): 181–196.
7. Naghshineh B, Carvalho H. The Impact of additive manufacturing on supply chain resilience. In: Camarinha-Matos LM, Farhadi N, Lopes F, Pereira H, editors. Technol Innov Life Improv - 11th IFIP WG 5.5/SOCOLNET Advanced Doctoral Conference on Computing, Electrical and Industrial Systems, DoCEIS 2020, Proceedings. Springer. 2020. p. 214-221. (IFIP Advances in Information and Communication Technology). doi: 10.1007/978-3-030-45124-0_20.
8. Durach CF, Wieland A, Machuca JAD. Antecedents and dimensions of supply chain robustness: A systematic literature review. Int J Phys Distrib Logist Manag. 2015;45:118–137. DOI: 10.1108/IJPDLM-05-2013-0133.
9. Tina Shahedi1, Amir Aghsami, Designing a green closed-loop supply chain network for the automotive tire industry under uncertainty, J Ind Syst Eng. Autumn (November) 2021; 13(4): 226–261.
10. Jan Holmström, Jouni Partanen, Jukka Tuomi, Manfred Walter, Rapid manufacturing in the spare parts supply chain: Alternative approaches to capacity deployment, J Manuf Technol Manag. 12/2009; 21(6): 687–697. DOI:10.1108/17410381011063996
11. Waters CDJ, Rinsler S. Global Logistics: New Directions in Supply Chain Management. 7th edition. London: Kogan Page Publishers; 2014.

