STM JOURNALS

Journal of
Advances in Shell Programming

ISSN: 2395-6690
Volume 11, Issue 2, 2024
May–August
DOI (Journal): 10.37591/JoASP

https://journals.stmjournals.com/joasp

Review JoASP

# Impact of Information Technology Tools and AI on Supply Chain Management of Indian Automobile Industry

Sumit Chandak[1,*], Sunil Pipleya[2], Amit Chandak[3]

***Abstract***

*This article aims to enhance the efficiency and effectiveness of the supply chain within the Indian automotive sector through the application of innovative information technology tools and artificial intelligence. To achieve this goal, the study focuses on three main objectives: identifying key driving factors through an extensive literature review, analyzing the interrelationships among these factors, and prioritizing them based on their importance. In today's competitive environment, customer satisfaction is paramount for businesses. Through rigorous literature review, 10influential factors, particularly those related to information technology tools, have been identified. A unified model is proposed to strengthen the supply chain of the Indian automotive sector, thereby improving marketing activities and future efficacy. By employing the Design Making Trial and Evaluation Laboratory (DEMATEL), data on the impact and effectiveness of each factor are collected, and a multilevel structured model is constructed to determine causal relationships. Factor ranking is established using the DEMATEL Multiple Criteria Decision Making method. The findings suggest that implementing strategies based on these identified factors can significantly enhance the marketing effectiveness of Indian micro, small, and medium enterprises, ultimately leading to a more efficient supply chain in the Indian automotive industry.*

**Keywords:** Supply chain management, information technology, artificial intelligence

## INTRODUCTION

The supply chain of the automotive industry is notably complex due to the multitude of components involved in vehicle manufacturing. The performance of automotive companies significantly relies on the efficiency of their supply chains. In today's technological landscape, integrating information technology tools and artificial intelligence (AI) into supply chain management is imperative. With India's large population, rapid economic growth, and youthful demographic, global automotive companies are keen on the Indian market. Indian automotive companies must ramp up technology adoption in their supply chains to compete globally. However, foreign companies currently lead in this aspect. In today's competitive environment, companies must execute diverse business strategies adeptly to thrive. The future of India's automotive industry seems promising, given its abundant resources and manpower. Policies emphasizing maximal technology utilization will bolster the Indian automotive industry. Despite efforts, the Indian automotive industry's supply chain lags behind its foreign counterparts. Nevertheless, companies are increasingly motivated to incorporate technological innovations.

***Author for Correspondence**
Sumit Chandak
E-mail: sumichandak@gmail.com

[1]Associate Professor, Mechanical Engineering Department, Shri Vaishnav Institute of Technology and Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India
[2]Assistant Professor, Mechanical Engineering Department, Shri Vaishnav Institute of Technology and Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India
[3]Associate Professor, Mechanical Engineering Department, Institute of Engineering and Science, IPS, Indore, India

Received Date: June 14, 2024
Accepted Date: June 24, 2024
Published Date: July 04, 2024

**Citation:** Sumit Chandak, Sunil Pipleya, Amit Chandak. Impact of Information Technology Tools and AI on Supply Chain Management of Indian Automobile Industry. Journal of Advances in Shell Programming. 2024; 11(2): 19–27p.

 

Integrating information technology tools and AI into supply chain management is crucial for the automotive industry's performance, especially for Indian companies striving to compete globally, even though foreign companies currently lead in this aspect [1–3]. The advent of technology has revolutionized shopping behaviors, with a significant shift from traditional to online shopping facilitated by modern innovations. Marketing performance serves as a comprehensive evaluation of a company's achievements derived from its marketing activities, encompassing successful audience targeting and goal attainment. According to Morgan [4], integrating technology and AI into supply chain management will be pivotal in enhancing companies' performance soon. These strategies aim to boost supply chain efficiency, thereby driving sales progress, overall productivity, and customer satisfaction. The proliferation of e-commerce in India enhances purchasing convenience for consumers. E-commerce, an information technology (IT)-driven business model, focuses on facilitating online transactions. Competitive advantage is contingent upon customers' perception of a company's products relative to competitors. Companies with products offering a competitive edge are perceived as greater value creators.

Technology has completely changed the way people shop. Thanks to advancements in technology, there has been a notable shift from traditional in-store shopping to online shopping. Marketing performance is an all-encompassing assessment of the accomplishments a business has made from its marketing endeavors, including effective target audience identification and goal achievement. Morgan (2012) [4] asserts that soon, improving supply chain management using technology and artificial intelligence will be essential to raising corporate performance. By increasing supply chain efficiency, these tactics hope to advance sales, increase overall productivity, and improve customer satisfaction. Consumer convenience is increased by the growth of e-commerce in India [5–7]. The goal of e-commerce, an IT-driven business model, is to make online transactions easier. Competitive advantage depends on how consumers view a company's offerings in comparison to those of its rivals. Businesses are thought to create more value when their products give them a competitive advantage.

In the supply chain, adopting minor technological innovations, digital techniques, ensuring product quality, and fostering strong customer relationships are imperative for sustained existence and growth. Success hinges on adaptability to evolving business conditions, as businesses responsive to change are more likely to succeed. A company's growth and achievements are more influenced by its commitment than its resources. Flourishing in a competitive market necessitates strong reverse skills, particularly for companies engaged in export-related activities. Technical tools in supply chain management, particularly in the automotive industry, are crucial for progress and sustainability. Information and communication technologies (ICTs) play a pivotal role in this regard, without which companies would struggle to survive in the competitive landscape. Awareness is paramount for company growth, as information discrepancies and lack of awareness can lead to marketing strategy failures. Given the intense competition and rapid technological advancements, updated knowledge in production facilities and marketing processes is indispensable for success. Automotive companies invest significantly in their supply chains and thus require collaboration and support from other established entities. Comprehensive understanding of supply chain management dimensions, including product information, quality, target customers, inventory control, and post-sales service, is imperative.

## LITERATURE REVIEW

International competition is increasingly significant for Indian automotive companies' supply chain management. Embracing technical strategies to remain competitive in foreign markets will enhance companies' core outcomes soon. Complexity in the supply chain significantly impacts production capacity, often leading to customer dissatisfaction and delayed deliveries. Manufacturing and production capacity are influenced by various factors, including raw material availability, employee expertise, technology adoption, and flexible manufacturing systems. Customer loyalty and satisfaction are central, with product quality and after-sales service playing pivotal roles in customer retention. Guidelines provided by Behl et al. [8] emphasize leveraging modern technology and production techniques to achieve product competitiveness and excel in competitive markets. There has been a lot

 

of scholarly interest in how AI and IT tools affect supply chain management (SCM), especially in the automotive sector. The transformative potential of these technologies in boosting supply chain efficiency and competitiveness is highlighted in this literature review, which summarizes major findings from recent studies.

**Information Technology Tools in Supply Chain Management**

IT tools that provide real-time data and enhanced supply chain visibility, such as internet of things (IoT), enterprise resource planning (ERP), and advanced data analytics, have completely changed SCM. ERP systems, according to Kumar et al., [5], make it easier to integrate different supply chain tasks, which improves coordination and decision-making. IoT devices make it possible to track shipments and inventory in real time, which greatly cuts down on delays and improves logistics operations. Advanced data analytics enables precise demand forecasting and inventory management, both of which are critical to maintaining supply and demand equilibrium in the automotive industry [2].

It has been demonstrated that integrating IT tools into SCM increases operational effectiveness, lowers costs, and boosts customer satisfaction. By eliminating the need for physical infrastructure and facilitating scalability, Singh and Sharma [1], for example, show how the adoption of cloud-based SCM solutions can result in significant cost savings. Real-time data sharing also promotes transparency and trust among supply chain participants, all of which are necessary for productive teamwork and risk management.

**Artificial Intelligence in Supply Chain Management**

AI technologies, such as machine learning, predictive analytics, and autonomous systems, provide sophisticated answers to challenging supply chain problems. Large-scale data can be analyzed by AI-driven predictive analytics to improve inventory levels, spot possible disruptions, and forecast demand more precisely [1]. Algorithms for machine learning can improve delivery schedules and route optimization, which can lower transportation costs and improve delivery performance.

Gupta et al. [2] point out that AI applications in SCM can greatly enhance operational efficiency and decision-making processes in the context of the Indian automotive industry. To reduce excess inventory and minimize stockouts, manufacturers can better align their production schedules with market demands with the aid of AI-powered demand forecasting. Robotic process automation (RPA) and other autonomous systems can automate routine tasks, freeing up human resources for more strategic endeavors.

**Challenges and Opportunities in the Indian Automotive Sector**

Even with the obvious advantages of IT and AI in SCM, the Indian automotive sector still has several obstacles when it comes to implementing these technologies. High implementation costs, a shortage of qualified staff, and resistance to change are all major obstacles, according to Chandak and Kumar [7]. On the other hand, Indian automakers are investing in technological advancements due to growing competition and pressure to meet international standards.

According to the literature, these obstacles can be addressed by taking a strategic approach to technology adoption that is backed by industry cooperation and governmental regulations. Policies that encourage technological innovation and offer workforce training programs can hasten the adoption of IT and AI in SCM, as highlighted by Mohsen [3].

The efficiency and competitiveness of the Indian automotive industry could be significantly increased by integrating AI and IT tools into SCM. Although there are obstacles to overcome, supply chain performance can be significantly improved by the thoughtful application of these technologies in conjunction with supportive policies. To fully realize the potential of IT and AI in SCM, industry collaboration and ongoing research are imperative. Table 1 represents various enablers of IT and AI that influence SCM of Indian automobile industries.

 

**Table 1.** Enablers of information technology (IT) and artificial intelligence (AI) that affect supply chain management (SCM) of Indian automobile industries.

| Code | Driver | Description | Impact | Citation |
|---|---|---|---|---|
| ADA | Advanced Data Analytics | Large-scale force chain data analysis is accomplished through the application of daedal algorithms and data processing techniques in advanced data analytics. Businesses can use this to improve decision-making processes, optimize inventory situations, and gain insight into demand patterns. | Businesses can improve overall supply chain efficiency, get more accurate market trend predictions, and cut down on excess inventory by utilizing advanced data analytics. | Singh & Sharma (2014) [1] |
| IoT | Internet of Things | IoT technology allows for real-time data exchange and monitoring by establishing connections between physical objects, machinery, and automobiles via the internet. | IoT provides better visibility throughout the supply chain, enabling proactive equipment maintenance, better inventory management, and real-time shipment tracking. As a result, there is less downtime and greater operational effectiveness. | Gupta et al. (2023) [2] |
| AIML | Artificial Intelligence and Machine Learning | Demand forecasting, inventory management, and route optimization are just a few of the supply chain operations that AI and machine learning technologies automate and optimize using data-driven algorithms. | Supply chain responsiveness is increased, and operating costs are decreased when AI and machine learning are used to automate repetitive tasks, optimize transportation routes, and improve forecasting accuracy. | Mohsen (2023) [3] |
| CC | Cloud Computing | Cloud computing offers adaptable and scalable IT infrastructure, facilitating real-time information sharing and collaboration between supply chain participants via cloud-based platforms. | Cloud computing lowers IT expenses, increases data accessibility, and eliminates the need for physical infrastructure. This facilitates improved communication and expedites decision-making along the entire supply chain. | Singh and Sharma (2014) [1] |
| RPA | Robotic Process Automation | To automate repetitive and routine tasks in the supply chain, like order processing, data entry, and inventory updates, RPA uses software robots. | RPA makes processes more efficient, lowers the possibility of human error, and frees up human labor for more strategic tasks. Higher productivity and more efficient supply chain operations result from this. | Chandak and Kumar (2020) [7] |
| BT | Blockchain Technology | Blockchain technology offers a transparent and safe ledger for transaction recording, which is especially helpful for guaranteeing authenticity and traceability in the supply chain. | Due to its immutable record of transactions, blockchain increases trust among supply chain partners, decreases fraud, and increases transparency. Improved supply chain processes and improved compliance follow from this. | Gupta et al. (2023) [2] |
| DT | Digital Twins | Real-time monitoring and simulation are made possible by digital twin technology, which builds a virtual image of the physical assets, systems, and processes in the supply chain. | Through simulations, digital twins can predict possible problems, optimize processes, and offer insightful information about how well a system is performing. Decision-making and operational efficiency are improved as a result. | Wason et al. (2020) [9] |
| BDA | Big Data Analytics | To find patterns, trends, and correlations, big data analytics analyzes vast and complicated data | Businesses can boost supply chain networks, improve risk management, and improve demand forecasting by utilizing big data | Maheshwari et al. (2021) [10] |

 

| Code | Driver | Description | Impact | Citation |
|---|---|---|---|---|
| | | sets that are produced throughout the supply chain. | analytics. This enhances the performance of the supply chain as a whole and leads to better strategic decisions. | |
| CPS | Cyber-Physical Systems | To facilitate intelligent interactions and automation within the supply chain, CPS integrates computation, networking, and physical processes. | Supply chain operations are made more reliable, flexible, and efficient by CPS's improvements to real-time data exchange, process automation, and system monitoring. | Rajput and Singh (2018) [11] |
| AR | Augmented Reality | Augmented reality (AR) technology improves the visualization and interaction of supply chain data and processes by superimposing digital information on the real world. | By offering real-time visual guidance and information, AR enhances warehouse operations, training, and maintenance. This boosts worker efficiency, increases accuracy, and expedites the completion of tasks. | Sharma et al. (2022) [12] |

## Research Approach

India is transforming from developing to a developed nation. The Indian economy is anchored by the automobile sector. The current study's goal is to use AI and IT to collect data from the automotive industry about supply chain management. The Indian automobile industry faces several obstacles in its quest to compete in global markets. This research will assist the Indian automotive industry in addressing the global market in a calculated manner. Since technology is advancing quickly and is being used by all international players to improve supply chain management, it is imperative that IT and AI be used in this field. The main objective of this study is to determine and evaluate the different IT and AI enablers that impact supply chain management in the Indian automotive sector. The Indian government has been concentrating on the Digital India plan for the past 10 years to strengthen the country's economy.

Consequently, the Indian government offers numerous schemes to bolster the country's automotive sector. All of India's industries will compete as a result, fostering the country's economic development. Ten enablers in all were found after a comprehensive literature review. Through an expert panel led by the case enterprise, the input data for these 10 Enablers for the Decision-Making Trial and Evaluation Laboratory (DEMATEL) analysis was obtained. The total number of experts were chosen for data collection, and the Delphi technique was employed. These 16 experts are all key personnel of the course company, all at the managerial level. These professionals have all worked for the company for more than 10 years and have a combined experience of more than 15 years. Each of these professionals has over 10 years of experience working in the fields of SCM and IT. These specialists were chosen based on their knowledge of IT and AI as well as their specialization in SCM for global marketing.

“Expert intelligences may be significant in the absence of reliable scientific explanation,” as noted by Dalkey and Helmer in 1963 [13]. A universal, iterative process known as the Delphi technique uses structured, unidentified conclusions and effective fine-tuning to elicit responses from a diverse range of professionals with varying backgrounds. This study used the Delphi technique, which is a popular approach for creating assessment index systems through expert consultation. A precise methodology comprising multiple steps was adhered to by the researchers. In the beginning, they organized brainstorming sessions, held group discussions, consulted with experts, and carried out an extensive literature review. The experts' views on general information, authority evaluation, and the assessment of indicator significance, representativeness, and feasibility were then incorporated by the researchers into the development of a Delphi questionnaire. According to Bike and Ruichang [14], the self-assessed authorities assigned a score of one for total agreement or two for partial agreement to each indicator based on its significance, representativeness, and feasibility. Sixteen experts of automobile organizations are designated as panel members in this study. To prevent bias in the outcome, experts are

 

chosen from a range of backgrounds and areas of expertise. The mean values of Table 2 present the tabulated data gathered from each of the 16 experts. Based on expert input, the procedures were carried out using the DEMATEL technique, as shown in Figure 1.

**The DEMATEL (Decision-Making Trial and Evaluation Laboratory) Technique**

The challenges are causally related, with the DEMATEL process being used to identify the more significant ones. Confirming the model's strength is done through an understanding assessment. The given detail provides a broad sketch of each action in the model. Cause and effect enablers that will SCM and effectiveness in the Indian automobile industry are identified through the application of the DEMATEL technique. DEMATEL gives policymakers quantifiable observations of challenges using diagrams and matrices [15]. Ten enablers are connected, and this relationship is used to gather expert panel opinions on a four-point scale from the case organization Tables 3 to 5. Experts are asked to weigh in on the relative impacts of the two enablers using the DEMATEL comparison scale. Zero for no influence, one for low influence, and two for medium influence; while three for very high influence/high influence. Figure 1 represents the methodology adopted for conducting the research .

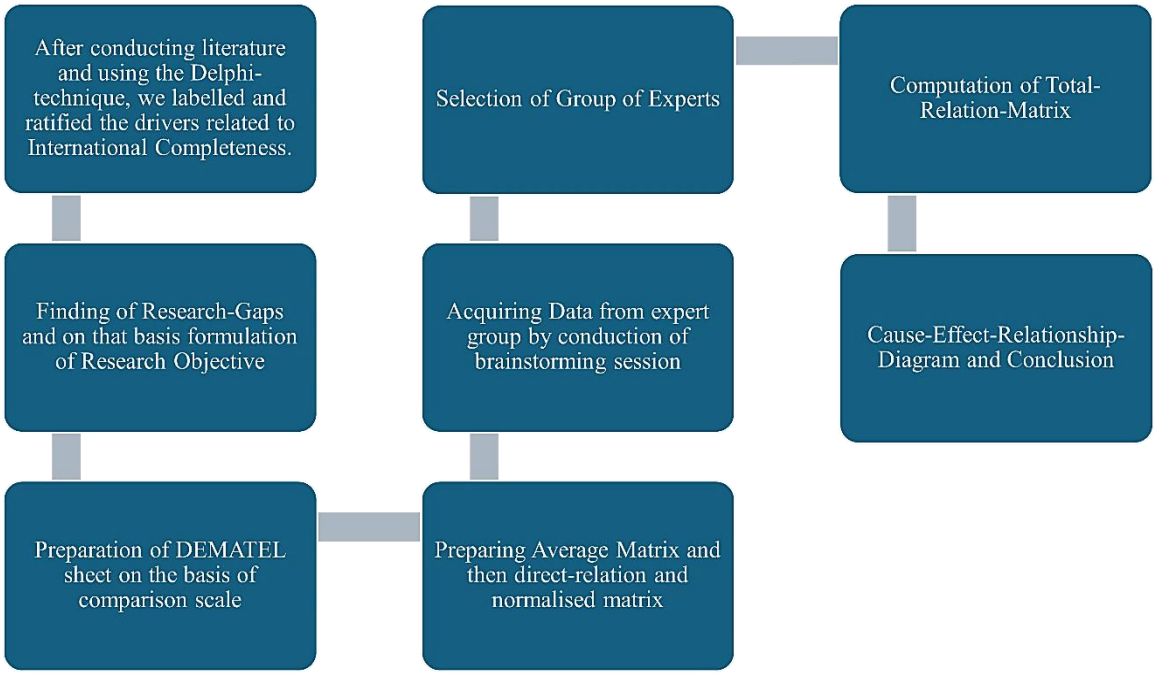


**Figure 1.** Methodology adopted for conduction the research.

**Table 2.** Average Matrix

| Enablers | ADA | IoT | AIML | CC | RPA | BT | DT | BDA | CPS | AR |
|---|---|---|---|---|---|---|---|---|---|---|
| ADA | 0 | 3.24 | 3.15 | 3.32 | 3.36 | 3.33 | 3.5 | 3.22 | 3.14 | 3.35 |
| IoT | 3.25 | 0 | 3.6 | 3.25 | 3.41 | 3.33 | 3.18 | 3.26 | 3.4 | 3.32 |
| AIML | 3.33 | 3.26 | 0 | 3.3 | 3.41 | 3.41 | 3.33 | 3.18 | 3.55 | 3.32 |
| CC | 3.6 | 3.33 | 3.35 | 0 | 3.18 | 3.3 | 3.33 | 3.25 | 3.18 | 3.3 |
| RPA | 3.4 | 3.5 | 3.25 | 3.3 | 0 | 3.58 | 3.36 | 3.17 | 3.25 | 3.2 |
| BT | 3.33 | 3.6 | 3.25 | 3.33 | 3.2 | 0 | 3.6 | 3.3 | 3.41 | 3.18 |
| DT | 3.25 | 3.2 | 3.18 | 3.41 | 3.25 | 3.33 | 0 | 3.2 | 3.4 | 3.6 |
| BDA | 3.6 | 3.33 | 3.33 | 3.4 | 3.25 | 3.18 | 3.25 | 0 | 3.66 | 3.25 |
| CPS | 3.4 | 3.33 | 3.2 | 3.6 | 3.33 | 3.33 | 3.2 | 3.2 | 0 | 3.25 |
| AR | 3.2 | 3.35 | 3.2 | 3.6 | 3.51 | 3.32 | 3.55 | 3.45 | 3.2 | 0 |

 

**Table 3.** Normalized direct relation matrix.

| Enablers | ADA | IoT | AIML | CC | RPA | BT | DT | BDA | CPS | AR |
|---|---|---|---|---|---|---|---|---|---|---|
| ADA | 0.0000 | 0.1066 | 0.1037 | 0.1093 | 0.1106 | 0.1096 | 0.1152 | 0.1060 | 0.1034 | 0.1103 |
| IoT | 0.1070 | 0.0000 | 0.1185 | 0.1070 | 0.1122 | 0.1096 | 0.1047 | 0.1073 | 0.1119 | 0.1093 |
| AIML | 0.1096 | 0.1073 | 0.0000 | 0.1086 | 0.1122 | 0.1122 | 0.1096 | 0.1047 | 0.1169 | 0.1093 |
| CC | 0.1185 | 0.1096 | 0.1103 | 0.0000 | 0.1047 | 0.1086 | 0.1096 | 0.1070 | 0.1047 | 0.1086 |
| RPA | 0.1119 | 0.1152 | 0.1070 | 0.1086 | 0.0000 | 0.1178 | 0.1106 | 0.1043 | 0.1070 | 0.1053 |
| BT | 0.1096 | 0.1185 | 0.1070 | 0.1096 | 0.1053 | 0.0000 | 0.1185 | 0.1086 | 0.1122 | 0.1047 |
| DT | 0.1070 | 0.1053 | 0.1047 | 0.1122 | 0.1070 | 0.1096 | 0.0000 | 0.1053 | 0.1119 | 0.1185 |
| BDA | 0.1185 | 0.1096 | 0.1096 | 0.1119 | 0.1070 | 0.1047 | 0.1070 | 0.0000 | 0.1205 | 0.1070 |
| CPS | 0.1119 | 0.1096 | 0.1053 | 0.1185 | 0.1096 | 0.1096 | 0.1053 | 0.1053 | 0.0000 | 0.1070 |
| AR | 0.1053 | 0.1103 | 0.1053 | 0.1185 | 0.1155 | 0.1093 | 0.1169 | 0.1136 | 0.1053 | 0.0000 |

**Table 4.** Total relationship matrix.

| Enablers | $W = D(I - D)^{-1}$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***ADA*** | ***IoT*** | ***AIML*** | ***CC*** | ***RPA*** | ***BT*** | ***DT*** | ***BDA*** | ***CPS*** | ***AR*** | ***R-i*** |
| ADA | 7.8005 | 7.8462 | 7.6975 | 7.9341 | 7.7932 | 7.8421 | 7.8909 | 7.6343 | 7.8523 | 7.7645 | 78.0556 |
| IoT | 7.9903 | 7.8424 | 7.8004 | 8.0258 | 7.8865 | 7.9346 | 7.9753 | 7.7254 | 7.9520 | 7.8551 | 78.9878 |
| AIML | 8.0130 | 7.9597 | 7.7143 | 8.0477 | 7.9067 | 7.9571 | 7.9998 | 7.7430 | 7.9763 | 7.8753 | 79.1929 |
| CC | 7.9557 | 7.8975 | 7.7509 | 7.8849 | 7.8369 | 7.8901 | 7.9355 | 7.6826 | 7.9023 | 7.8115 | 78.5479 |
| RPA | 7.9958 | 7.9472 | 7.7925 | 8.0285 | 7.7870 | 7.9428 | 7.9816 | 7.7244 | 7.9494 | 7.8534 | 79.0027 |
| BT | 8.0385 | 7.9941 | 7.8360 | 8.0741 | 7.9262 | 7.8815 | 8.0324 | 7.7709 | 7.9981 | 7.8967 | 79.4484 |
| DT | 7.9476 | 7.8953 | 7.7475 | 7.9872 | 7.8401 | 7.8922 | 7.8379 | 7.6825 | 7.9094 | 7.8207 | 78.5605 |
| BDA | 8.0570 | 7.9980 | 7.8490 | 8.0874 | 7.9387 | 7.9874 | 8.0343 | 7.6838 | 8.0159 | 7.9096 | 79.5610 |
| CPS | 7.9551 | 7.9022 | 7.7514 | 7.9956 | 7.8455 | 7.8956 | 7.9366 | 7.6858 | 7.8122 | 7.8146 | 78.5947 |
| AR | 8.0787 | 8.0308 | 7.8771 | 8.1251 | 7.9775 | 8.0233 | 8.0747 | 7.8171 | 8.0358 | 7.8448 | 79.8849 |
| C-i | 79.8323 | 79.3134 | 77.8167 | 80.1905 | 78.7381 | 79.2469 | 79.6990 | 77.1498 | 79.4038 | 78.4461 | |

**Table 5.** Cause and effect relationship.

| Enablers | R-i | C-i | R-i + C-i | R-i – C-i | Identify |
|---|---|---|---|---|---|
| ADA | 78.056 | 79.832 | 157.888 | -1.777 | Effect |
| IoT | 78.988 | 79.313 | 158.301 | -0.326 | Effect |
| AIML | 79.193 | 77.817 | 157.010 | 1.376 | Cause |
| CC | 78.548 | 80.190 | 158.738 | -1.643 | Effect |
| RPA | 79.003 | 78.738 | 157.741 | 0.265 | Cause |
| BT | 79.448 | 79.247 | 158.695 | 0.202 | Cause |
| DT | 78.561 | 79.699 | 158.259 | -1.138 | Effect |
| BDA | 79.561 | 77.150 | 156.711 | 2.411 | Cause |
| CPS | 78.595 | 79.404 | 157.998 | -0.809 | Effect |
| AR | 79.885 | 78.446 | 158.331 | 1.439 | Cause |

## RESULTS AND DISCUSSION

Objective of this paper is to determine impact and relation of enablers of IT Tools and AI identified form literature review on SCM of Indian automobile industry. To identify relationship data were collected from 16 experts from a case organisation. Table 6 represents ranking of enablers identified from Multi-criteria decision-making (MCDM) DEMATEL analysis.

As per Table 6 (Ri + Ci) value is highest for driver CC (cloud computing) and lowest for driver BDA (big data analysis). The driver BT (block chain technology) is in second position and linked with other enablers. The driver AR (augmented reality) is in third position on the ranking table and has a relationship with other enablers. This result will help the industry and practitioners to make marketing decisions accordingly (Figure 2).

 

**Table 6.** Ranking of enablers with cause and effect.

| Ranking | Enablers | R-i | C-i | R-i + C-i | Identity |
|---|---|---|---|---|---|
| 1 | CC | 78.548 | 80.190 | 158.738 | Effect |
| 2 | BT | 79.448 | 79.247 | 158.695 | Cause |
| 3 | AR | 79.885 | 78.446 | 158.331 | Cause |
| 4 | IoT | 78.988 | 79.313 | 158.301 | Effect |
| 5 | DT | 78.561 | 79.699 | 158.259 | Effect |
| 6 | CPS | 78.595 | 79.404 | 157.998 | Effect |
| 7 | ADA | 78.056 | 79.832 | 157.888 | Effect |
| 8 | RPA | 79.003 | 78.738 | 157.741 | Cause |
| 9 | AIML | 79.193 | 77.817 | 157.010 | Cause |
| 10 | BDA | 79.561 | 77.150 | 156.711 | Cause |

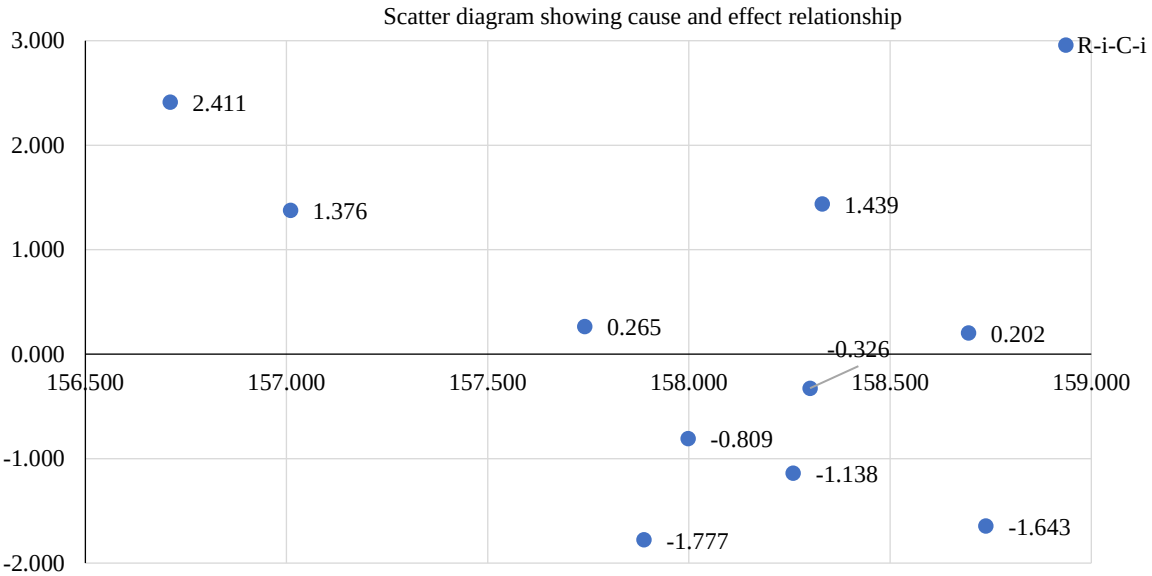


**Figure 2.** Scatter diagram for cause-and-effect relationship.

Five enablers that have negative value of (di-ri), namely, ADA (advanced data analytics) (-1.777), IoT (internet of things) (-0.326), CC (cloud computing) (-1.643), DT (digital twins) (-1.138), and CPS (cyber physical systems) (-0.809) are registered in effect category enablers. From cause-and-effect scatter diagram it is clear that driver CC (cloud computing) has the highest influence on SCM.

## CONCLUSION

SCM is consistently involved in managing internal company operations while addressing complex external business challenges. Consequently, supply chain managers may often overlook the various enablers that could significantly enhance their operational efficiency. This research aims to identify and analyze these enablers, providing evidence-based solutions that will facilitate strategic growth in SCM in Indian automobile industries. By understanding the interrelationships among these enablers, managers can improve their global competitiveness and work towards optimizing and streamlining their supply chain processes. This study employed rigorous methodologies to ensure the reliability and validity of the findings, thereby contributing to the existing body of knowledge in supply chain management.

This study identifies 10 key enablers of IT tools and AI that significantly impact SCM in the Indian automobile industry. These enablers were assessed through a systematic evaluation of expert opinions. The validity of the findings was established via rigorous expert evaluations and an exhaustive review of relevant academic and industry literature addressing the specific challenges of the Indian automobile

 

industry. The research framework was constructed based on inputs provided by 16 subject-matter experts within a case organization. The DEMATEL method was employed to rigorously analyze and verify the causal relationships among the complexities and ambiguities encountered, ensuring a robust and reliable understanding of these interdependencies.

## REFERENCES

1. Singh RK, Sharma MK. Prioritising the alternatives for flexibility in supply chains. Prod Plann Control. 2014; 25 (2): 176–192.
2. Gupta S, Modgil S, Choi TM, Kumar A, Antony J. Influences of artificial intelligence and blockchain technology on financial resilience of supply chains. Int J Prod Econ. 2023; 261: 108868.
3. Mohsen BM. Developments of digital technologies related to supply chain management. Procedia Computer Sci. 2023; 220, 788–795.
4. Morgan NA. Marketing and business performance. J Acad Market Sci. 2012; 40 (1): 102–119.
5. Kumar N, Kanchan U, Gupta A. Online shopping behaviour of customers in tier III cities of India: a study of Bareilly region. J Gen Manage Res. 2017; 4 (2): 72–80.
6. Kalia P, Kaur N, Singh T. E-commerce in India: evolution and revolution of online retail. In: Khosrow-Pour M, editor-in-chief. Mobile Commerce: Concepts, Methodologies, Tools, and Applications. Hershey, PA, USA: IGI Global; 2018. pp. 736–758.
7. Chandak S, Kumar N. Development of a framework to improve supply chain performance through e-business and sustainability enablers: an emerging economy perspective. Manage Environ Qual. 2020; 31 (5): 1045–1070.
8. Behl A, Gaur J, Pereira V, Yadav R, Laker B. Role of big data analytics capabilities to improve sustainable competitive advantage of MSME service firms during COVID-19 – a multi-theoretical approach. J Business Res. 2022; 148: 378–389.
9. Wason R, Bhardwaj BR, Jain V. Enabling digital twin through blockchain: a strategic perspective. In: Raj P, Saini K, Surianarayanan C, editors. Blockchain Technology and Applications. Boca Rator, FL, USA: Auerbach Publications; 2020.pp. 185–212.
10. Maheshwari S, Gautam P, Jaggi CK. Role of big data analytics in supply chain management: current trends and future perspectives. Int J Prod Res. 2021; 59 (6): 1875–1900.
11. Rajput S, Singh SP. Current trends in Industry 4.0 and implications in container supply chain management: a key toward Make in India. In: Kar A, Sinha S, Gupta M, editors. Digital India: Advances in Theory and Practice of Emerging Markets. Cham, Switzerland: Springer; 2018. pp. 209–224.
12. Sharma A, Mehtab R, Mohan S, Mohd Shah MK. Augmented reality – an important aspect of Industry 4.0. Indus Robot Int J Robot Res Appl. 2022; 49 (3): 428–441.
13. Dalkey N, Helmer O. An experimental application of the Delphi method to the use of experts. Manage Sci. 1963; 9 (3): 458–467.
14. Bike Z, Ruichang W. Construction of equipment evaluation index system of emergency medical rescue based on Delphi method and analytic hierarchy process. Ain Shams Eng J. 2023; 14 (2): 101870.
15. Bai C, Satir A. Barriers for green supplier development programs in manufacturing industry. Resour Conserv Recycling. 2020; 158 (February): 104756.

 