Review of the literature on digitisation in the automobile supply chain

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Abstract:

Digitalization is changing the face of the automotive industry by restructuring the supply chain (SC). This study uses a systematic literature review method to analyse current and future research trends in digitalization in the automobile SC. The Scopus database is identified for carrying out this study. With the keywords search, twenty-one articles finalized for the study. This study identified the research done year-wise, the number of articles published in the journals, and the research methods used. This research provides current and future research trends. This research will benefit the automotive sector as it will help them learn about digitalization and its technology. This research offers the future of digital technology in automobile SC.

Keywords: Digitalization; Automobile SC; Automotive Sector; Systematic Literature Review.

JEL Codes: M10, M11

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INTRODUCTION

In the automobile sector as a whole, digital transformation is developing swiftly. This, in addition to traditional continuous improvement, will allow forward-thinking companies to achieve these performance targets (Bader et al. 2021). As a result, the automotive industry has begun implementing complex and digitalization technologies to enhance the effectiveness of conventional methods (Ferreira 2021; Kaur and Prakash Singh 2021). Corresponding author: suryakantpal6676@gmail.com

Consider, for example, managing paperwork, acquiring information, or working with those involved inside the automotive SC. The vast majority of paper documents have been transformed into digital formats to aid in communication or collaboration and to meet the growing demands of clients who are used to more efficient and dynamic online communication centred on the customer's requirements. (Laosillapacharoen et al. 2019) examined the connection between information processing capability and requirements. In addition, the willingness to adapt is explored for its potential role as a mediator in the link between the information processing requirements of the Thai car industry and the information processing capabilities of the Thai automobile industry.

The digital world has enabled insurmountable cultural, organisational, and communicative boundaries (Mukherjee, Baral, Chittipaka, et al. 2022). As a result of this accomplishment, businesses can now address new markets and opportunities for creative goods and trends (Baral et al. 2022). Lean and agile production processes are made possible by digitization, which significantly shortens the time to market. By using innovative methods and new design tools, businesses can avoid feasibility risks and excessive costs while developing a more proactive SC (Mukherjee, Baral, and Venkataiah 2022).

Kumar et al. (2022) provided a methodology for measuring the "strategic fit" of the automotive SC based on data source triangulation. It used a sentiment and conjoint analysis to assess the responsiveness of the Indian vehicle SC, which included the top ten leading automobile manufacturers. Kusi-Sarpong et al. (2021) offered a context for the risks businesses may face when using big data analytics in sustainable SC and strategies for overcoming those risks. The results show that technical risks, followed by organisational and human risks, are the most important dangers connected with major data analytics adoption in SCs.

Any automotive firm can dramatically decrease expenses by deploying new technology that allows them to handle several clients simultaneously by employing current tools that support a customer-centric Yu, Khan, et al. (2022). The best possible customer experience is generated by these solutions, for illustration, using advertising and omnichannel interactions. Customer satisfaction and cross-departmental collaboration are essential aspects of digital transformation (Kumar et al. 2021; Eldem et al., 2022). Businesses systematically and effectively transform themselves to take advantage of new growth markets (Bajar et al. 2022). Adoption of a more fundamental digital transformation centred on enterprise data management and precise analytics to generate value through data and optimize operations across the organisation is the call of the hour for automotive industry (Carrillo et al. 2022).

Kamble et al. (2021) used a thorough group decision-making methodology to identify and rank the most significant data-driven circular economy operations in the automotive component business. Decision-makers from the buying, production, and logistics and marketing divisions of the auto-component manufacturing business supply information on the most effective big data-driven circular economy strategies. Belhadi et al. (2021) focused on how the COVID-19 epidemic affected the automotive and aviation SCs. In three discrete phases, the two SCs' immediate and long-term reaction strategies are analysed using a combination of qualitative and quantitative methodologies.

Liu et al. (2021) implemented a low-impact method of SC management for monitoring intermediary vendors. This article presents a stakeholder theory and a literature review to support its 25 arguments in favour of a manufacturer using second-tier suppliers in low-tier green supply chain management. Hickie and Hickie (2021) explained how two global manufacturing companies use Industry 4.0 technologies. Then it suggests how the widespread acceptance and integration of these technologies may impact how these regions are distributed geographically, potentially involving new areas and possibly changing the significance of existing ones.

The following research questions are formulated:

RQ1: What are the current trends of digitalization in the automobile SC?

RQ2: What are future research areas of digitalization in the automobile SC?

METHODOLOGY

This chapter discusses the many aspects of a systematic literature review and highlights research gaps. The identified research gaps aid in the clarification of the predicted research issues. The systematic literature review technique is used to locate publications about digitalization and the vehicle SC. The systematic literature review technique is used to decrease bias and improve the validity of the results. Scopus data is utilised. The scope of the study was specified, and the review was planned during this stage. This is one of the essential phases because the subject delimitation and scope of the literature review are limited. The Stage II review identifies the studies by employing relevant search strings. Using the search string, records were found in one database like "Artificial intelligence", "Machine learning", "Machine intelligence", "Digitalisation technology", "Big data", "Internet of thing", "IoT" "Blockchain", "Cloud computing", "Automobile supply chain". For the Scopus database, we identified 143 articles. Articles considered after removing the duplicability were 111. One hundred eleven articles were screened, but only 64 were eligible for final screening. Finally, the articles considered for final review were 21.

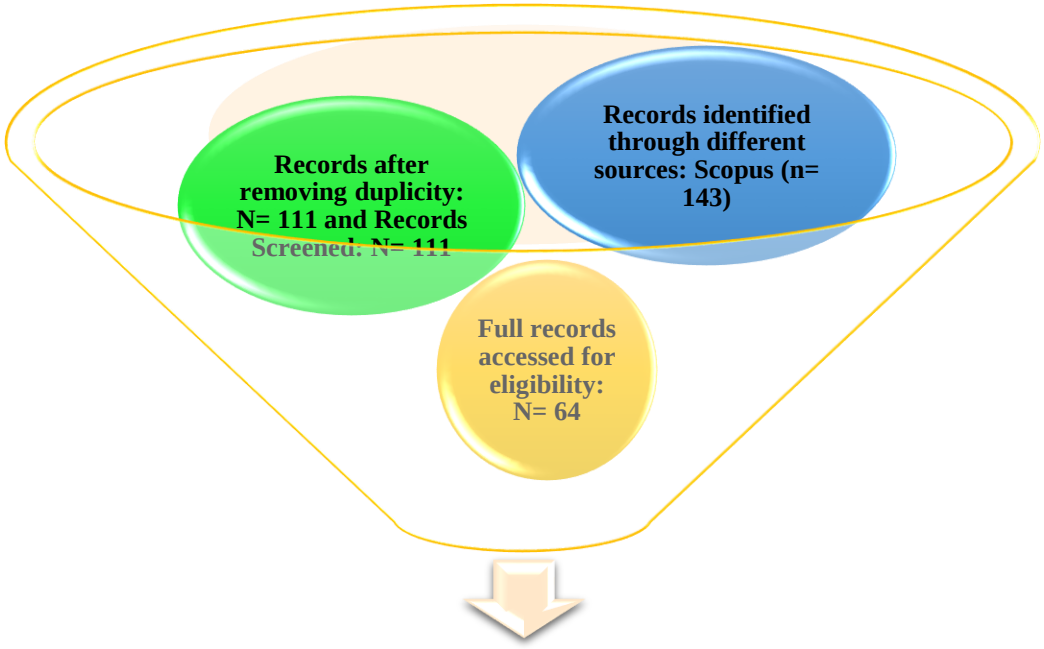

Figure I: The review process

FINDINGS

Publication by year:

The criteria for the publication were set from 2012 to 2022. There are very few papers on digitalization and automobile SC, so six papers were found in 2022, 9 in 2021, 1 in 2020, 1 in 2019 and 3 in 2018.

Papers published by Journals:

The journals where the articles were published two articles "International Journal of Production Economics", two articles on Sustainability, two articles on Technological Forecasting and Social Change, 1 article on Business Strategy and the Environment, 1 article on Competitiveness Review, 1 article on European Planning Studies, 1 article in Industrial Management and Data Systems, 1 article in Information Processing and Management, 1 article in International Journal of Applied Management Science, 1 article in International Journal of Automotive Technology and Management, 1 article in International Journal of Production Research, 1 article in International Journal of Productivity and Performance Management, 1 article in International Journal of SC Management, 1 article in Omega, 1 article in Operations Management Research, 1 article in Production Planning and Control, 1 article in Smart and Sustainable Built Environment, 1 article in Telecommunications Policy.

Research Methods used:

This article used empirical studies, literature reviews, case studies, and interviews-based studies. Twelve articles used empirical studies, four papers used case studies, three used literature reviews, and two used interview-based studies.

DISCUSSION

Automotive companies are under pressure to embrace technological change and efficiency, emphasising digital and information processes to assist and enhance collaboration and communication among OEMs, suppliers, and users. Digital technologies are being implemented across the board in the operations of automotive companies, from product design and development to procurement, production, supply chain management, and even marketing and sales. Several automotive firms have continuously improved their digital capabilities by reorganising and creating digitalization business units and task forces (Roy, Chekuri, et al. 2022). Many others are forming joint ventures, collaborating with companies, and purchasing others to make a more resilient business (Roy, Babakerkhell, et al. 2022). The next 2 to 5 years, the automotive industry will see a connected digital supply chain to enhance its viability and functioning.

Building an intelligent and digital supply chain is crucial for players in the sector to manage the business digitally. In the digital value chain, procurement, logistics, manufacturing, data management, and analytics are all very important (Mukherjee, Baral, Pal, et al. 2022). Despite several procedures and paper-driven inefficiencies on the back of digital connectivity across stakeholders, warehouse flexibility and intelligence, linked visibility, planning, and assuring adherence to proper storage and delivery standards, as well as emergency response/disaster management, will enable smooth connection and agility. Strategic tools will eliminate superfluous operational duties such as procurement and integrate this process more deeply into product development (Roy, Baral, et al. 2022). In addition, they provide more QA/QC controls, flexibility, and an enhanced environment for buyer-seller communication (Kumar et al. 2021; Mukherjee, Nagariya, Baral, Patel, et al., 2022). A manufacturing facility's networked machinery and equipment with human operators may improve output, uptime, capacity utilisation, and responsiveness to market demands. The automotive industry has been

experiencing a digital transformation led partly by mobility services, pushing manufacturers to provide cutting-edge software and hardware (Yu, Umar, and Rehman 2022). Simultaneously, a rising need exists to make production more sustainable, environmentally friendly, and adaptable.

RESULTS

What are the current trends of digitalization in the automobile SC?

Manufacturers and service providers face substantial competition in the market, and businesses must adapt to continuously changing client needs. With recent developments in AI, IoT, and data analytics, digital transformation has gained steam in the automobile industry over the previous 20 years (Mukherjee, Chittipaka, Baral, Pal, et al. 2022). Businesses can profit from digital transformation by establishing new digital-enabled services or enterprises, designing customer-centric products, optimising SCs, enhancing efficiency, and improving quality management.

- Creating digitally enabled services and goods: Following consumer requests and new trends, automotive companies are changing their product design processes and building autos with new features and services (Mukherjee, Chittipaka, Baral, and Srivastava 2022).
- Manufacturing robots are being used more frequently: Since the 1970s, companies in the automotive sector have used robots on assembly lines to enhance production, but this is becoming more prevalent. For example, the BMW Group uses NVidia-developed material-handling robots and intelligent transportation. With data from IoT and neural network techniques, robots can recognise and move items independently (Mukherjee, Venkataiah, Baral, and Pal 2022).
- Vehicle Maintenance/Service: Intelligent components, such as sensors, collect data about vehicle performance and analyse it in the cloud to detect potential future failure sources and inform drivers to avert mishaps. These advanced capabilities can change the car repair business, and we may see next-generation services such as software upgrades (Sepasgozar 2020).
- SC Optimization: Inventory and purchasing operations are managed using real-time data from various sources. Digitalization in SC operations enables businesses to optimise their procedures. As a result, they can respond to market developments faster (Jamwal et al. 2021). Companies can benefit from digital transformation by lowering costs, improving SC transparency, and reducing faults.
- Interactive showrooms: Customers wish to conduct virtual tests before purchasing a vehicle. As a result, businesses must develop digital platforms with virtual reality capabilities. Chatbots can assist in qualifying users, answering pressing questions, and increasing revenue.

What are future research areas of digitalization in the automobile SC?

Digitalization in the automotive sector will enable new use cases and business models such as autonomous driving, new shared mobility models, individualised insurance contracts, remote diagnostics and repair, and preventative maintenance services.

- Autonomous Vehicles: Cars that can operate without human intervention, known as autonomous vehicles, promise to revolutionise urban transportation (Kusi-Sarpong et al. 2021). AV fleets want to broaden the breadth of last-mile deliveries, decrease the amount of time spent in downtime, and improve the safety of public transit (Mukherjee,

Baral, and Chittipaka 2022). AI-enhanced computer vision is one of the sophisticated identification technologies that autonomous cars have to help them identify objects in their route Such technologies will rreduce the number of accidents that are brought on by factors such as driver fatigue or carelessness.

- Vehicle Connectivity: Vehicles now have unchangeable digital IDs that may be used to differentiate them from other automobiles connected to the same network. This makes it feasible to simply record data from cars, which can then be used in a number of settings and applications, such as insurance, driver safety, predictive maintenance, and fleet management (Ferreira 2021). The individual client as well as the mobility ecosystem as a whole can profit from the sharing of vehicle data.
- Shared Mobility: By focusing on shared mobility as an alternative to the traditional practise of vehicle ownership, new business models have emerged as a result of the development of linked cars. As a result, it encourages mobility as a service while reducing the demand for idle automobiles. These sorts of solutions satisfy the requirements of a community or a corporation without the addition of extra automobiles, therefore minimising the length of time that a fleet must wait as well as the emissions that are created by gasoline- or diesel-powered vehicles.
- Human-Machine Interfaces: Vehicle control systems that employ speech or tactile feedback are called human-machine interfaces. The automotive industry as a whole, as well as the way in which drivers engage with their vehicles, will undergo a sea change as a result of connected and self-driving automobiles. These increase the range of responsibilities an automobile user can handle. As a consequence of this, interfaces of this kind make driving a more enjoyable and secure experience (Liu, Feng, and Zhu 2021).
- 3D Printing: There are three ways in which the automotive industry might profit from the use of 3D printing (Rindfleisch, O'Hern, and Sachdev 2017). To begin, it enables quick prototyping through the use of models that have been produced with 3D technology, which speeds up the production design and testing procedures. Additionally, OEMs can print replacement components that are tailored to their needs (Kaur and Prakash Singh 2021). Finally, composite material additive manufacturing results in lighter, stronger, and more lasting vehicle parts (Yeh and Chen 2018).

CONCLUSION

Digital technology is used throughout the SC to enable real-time supply chain monitoring, evaluation, and control of the effects of each occurrence, as well as automation of processes and potential interruption avoidance. This research provides a comprehensive literature review of the articles identified from the Scopus database in digitalization and automobile SCs. Twenty-one articles are finalized for the study. This research provided current and future research in the area of automobile SC. The automobile industry is experiencing a paradigm change because intelligent and data-driven operations are being implemented throughout the whole organisation, including production, supply chain, sales and marketing, and after-sales support. To derive value from data, the sector has to speed up its digital transformation while focusing on integrated systems solutions, data management, and analytics. Many different types of technology, such as automation, sophisticated robotics, machine vision, IoT, data management and analytics, will improve business operations across the value chain. The study has some limitations, like only the Scopus database was selected. The future web of science database can also review the articles. The study's time frame for publications was set from 2012 to 2022. This time frame may not cover all the recent advancements and trends in digitalization

in the automobile supply chain, potentially omitting crucial developments. Although efforts were made to reduce bias by using a systematic literature review approach, there might still be some bias due to the selection of specific keywords and exclusion criteria.

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