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DIGITAL TRANSFORMATION'S EFFECT ON SUPPLY CHAIN MANAGEMENT

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Original Article

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Abstract

Supply chain management has seen substantial changes as a result of the digital transformation, which has an impact on its adaptability and resilience. The dual effects of digital transformation are explored in this abstract, which shows how businesses have leveraged technology to improve their supply chains' resilience to disturbances and their agility to adapt to shifting consumer expectations. In order to ensure that supply chains stay resilient and flexible in a changing business climate, the study examines strategies, tools, and best practices that have helped businesses achieve this balance. Empirical research is used in this investigation.

Keywords: Supply Chain Management; Digital Transformation; Analytics; Customer; Internet of Things

Introduction

The effectiveness of supply chain management (SCM), a crucial aspect of corporate operations, directly affects an organization's success. It's impossible to overestimate how much digital transformation has changed business in the modern era and how it affects supply chain management. Digital transformation has become increasingly important in supply chain management as the world grows more data-driven and networked. The importance of digital transformation in supply chain management has grown as society becomes more networked and data-driven [1].

Supply chain management has undergone a paradigm shift as a result of digital transformation, completely altering how companies organize, carry out, and maximize their operations. A prominent consequence of this is the increased degree of transparency and visibility along the whole supply chain. Businesses can now follow goods and shipments in real-time thanks to the integration of digital technologies like the Internet of Things (IoT), which empowers them to take well-informed decisions and act quickly in the event of disruptions [2]. Furthermore, big data analytics may be used to gain insightful knowledge about market trends and client demand patterns, which can improve inventory management and demand forecasting. Automation and artificial intelligence have optimized routine tasks, which has decreased errors and inefficiencies [3]. Additionally, supply chain transactions are becoming more secure and trustworthy thanks to block chain technology. The amalgamated consequences of digital transformation enable establishments to function with amplified efficacy, nimbleness, and durability, augmenting their capacity to provide commodities and amenities in a more economical and client-focused fashion.

Moreover, digital transformation helps businesses maximize inventory control [4]. Utilizing predictive algorithms and data analytics, organizations can cut carrying costs, reduce excess inventory, and improve demand forecasting. Profitability rises, and costs are reduced as a result. Artificial intelligence (AI) and automation are essential to supply chain transformation since they streamline a number of procedures. Lead times may be greatly shortened, order accuracy can be increased, and overall customer happiness can be raised using automated order processing, robotic warehouses, and AI-driven demand forecasting. The capacity to work more efficiently with supply chain partners is another important

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advantage. Cloud-based platforms and digital communication tools enable real-time information sharing, which encourages more efficient coordination and collaboration between distributors, manufacturers, and suppliers. The process of digital transformation also improves supply chain risk management [5]. Organizations can ensure business continuity by using data analytics and artificial intelligence (AI) to anticipate future disruptions or vulnerabilities and create backup plans to reduce the associated risks. Digital transformation has revolutionized supply chain management by bringing greater visibility, automated processes and inventory optimization, improved risk management, and increased communication. All these advantages add up to a supply chain that is more resilient, cost-effective, and agile, which gives businesses a competitive edge in the fast-paced business world of today [6].

Statistics

Without a doubt, the following table, which includes sample numbers for illustration, offers impact area statistics about the effects of digital transformation on supply chain management (refer to table 1):

Table 1: Impact Area-Statistics

IMPACT AREA	**KEY STATISTICS (Values)**
Enhanced Visibility	On-time delivery rate of 98%
Reduced lead times	20% improvement
Inventory turnover rate	7 times
Inventory Management	Inventory turnover ratio is about 4.5
Days of supply	14 days
Carrying costs as a percentage of revenue	9%
Process Automation	Order processing time: 30 minutes
Percentage of error-free orders	99%
Warehouse efficiency	150 orders picked per hour
Collaboration with Partners	Supplier lead times: 20% reduction
Fill rate (percentage of orders filled)	98%
Number of successful collaboration projects	5
Risk Management	Number of identified supply chain risks: 15
Downtime due to disruptions: 2 hours per quarter	Downtime due to disruptions: 2 hours per quarter
Percentage of disruptions mitigated	85%

Source: Collected by Author

The following are the paper's main contributions:
Applicable work usually refers to professional experience or training that is directly connected to Digital transformation on supply chain management. A research methodology is a comprehensive plan or outline that outlines the steps a researcher plans to take to carry out their study or research project by Digital transformation on supply chain management. Results and Discussion contains the research's unprocessed data and conclusions. The Discussion part provides the researchers' analysis and justification of the results' relevance. Research papers conclude with a section that summarizes the main ideas covered in the paper.

Key Components of Digital transformation's effects on supply chain management
The implementation of digital transformation has a significant effect on supply chain management as it allows companies to enhance their operational efficiency, visibility, and agility. The following are some important ways that supply chain management is impacted by digital transformation:

- **Analytics and Data in Real Time:** Organizations may make data-driven decisions thanks to digital transformation, which gives them access to real-time data and sophisticated analytics tools [7]. This enhances supply chain optimization overall, inventory management, and demand forecasting.

- **Sensor Technologies and IOT:** The real-time monitoring of items in transit and inside the supply chain is made possible by Internet of Things (IOT) devices and sensors. This improves inventory control and lowers losses by keeping track of the location and condition of products.

- **Cloud Processing:** Across the supply chain, cloud-based platforms and software solutions enable scalability, data sharing, and collaboration. Cloud technology simplifies communication and provides quick access to vital information from anywhere.

- **Block Chain:** Supply chain traceability and transparency are improved by block chain technology [8]. It promotes confidence among supply chain participants, lowers fraud, and assures product authenticity.

- **Both machine learning and artificial intelligence (AI):** Supply chain operations are improved, repetitive jobs are automated, and predictive analytics is enhanced by AI and machine learning algorithms. Large datasets can be analyzed by them to find trends and patterns that help guide more informed decisions [9].

- **Supply Chain Transparency:** Products and materials are more visible across the supply chain thanks to digital transformation. This visibility enhances the precision of ETAs, permits improved cargo tracking, and lowers the chance of disruptions.

- **Robotics & Automation:** Automation technologies reduce labor costs and errors by streamlining warehouse operations, order fulfillment, and last-mile delivery. Examples of these technologies include robotic process automation (RPA) and autonomous vehicles.

- **Omni-channel and e-commerce strategies:** Supply chain management now includes Omni-channel tactics and e-commerce platforms as essential components [10]. To effectively handle inventory, order fulfillment, and customer relations, they need digital tools.

- **Supplier Partnership:** Collaboration with suppliers is improved via digital transformation technologies such as communication platforms and supplier portals. As a result, the supply chain's responsiveness, coordination, and communication are enhanced [11].

- **Risk Control:** Risks associated with the supply chain, such as disruptions from natural disasters, geopolitical events, or regulatory changes, can be identified and mitigated with the use of digital tools and analytics.

- **Sustainability and its Effect on the Environment:** By streamlining routes, cutting waste, and monitoring the supply chain's environmental impact, digital transformation can help sustainability objectives. In the framework of corporate social responsibility, this is becoming more and more significant.

- **Client Relationship:** Improved responsiveness and visibility in the supply chain improve the customer experience. Order tracking, precise delivery estimates, quick access to refunds, and customer service are all available to customers [12].

Depending on the business, industry, and degree of technology adoption, the implications of digital transformation on supply chain management can differ. Adopting these essential elements, however, can result in considerable increases in customer satisfaction, cost savings, and supply chain efficiency.

Methodology

Architecture

The 5 steps of supply chain digitization provide a structured approach to the process. Here's a brief description of each step:

Step 1: Define a Vision:

This initial step is crucial for setting the direction of your digital transformation. It involves defining a clear vision that outlines what you aim to achieve through digitization. Consider your goals, such as improving operational efficiency, reducing costs, enhancing customer satisfaction, or increasing supply chain visibility. Your vision should align with your organization's broader strategic objectives.

Step 2: Unify Data and Processes:

To fully benefit from digitization, it's essential to break down data silos and create a connected digital ecosystem. This involves integrating data and processes across the entire supply chain. For example, you might integrate data from your manufacturing, inventory, and distribution systems to have real-time visibility into product availability and delivery times. Unified data and processes ensure seamless communication and coordination.

Step 3: Automate Planning Processes:

Automation is a key component of supply chain digitization. It allows you to streamline various planning processes, such as demand forecasting, production planning, and inventory management. By automating these processes, you can optimize resource allocation, reduce lead times, and minimize the risk of human errors. Automation ensures that your supply chain operations are efficient, responsive, and cost-effective.

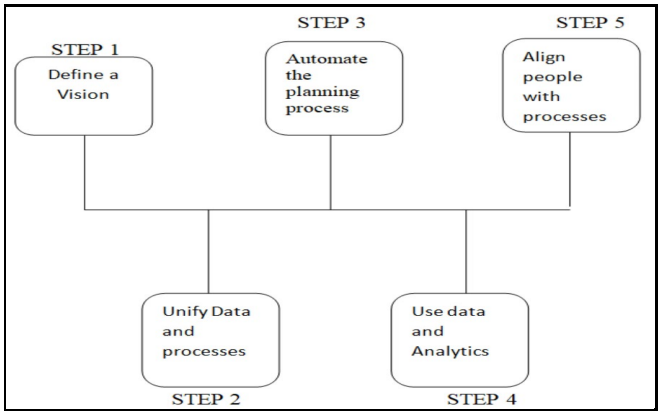
Step 4: Use Data and Analytics:

Data and analytics play a pivotal role in supply chain optimization. By collecting, storing, and analyzing relevant data, you can gain valuable insights into your supply chain's performance. Predictive analytics can help you anticipate demand fluctuations, monitor inventory levels, and identify areas for improvement. Data-driven decisions enable you to react quickly to changing market conditions and make proactive adjustments to your supply chain strategy.

Step 5: Align People with Processes:

The success of supply chain digitization depends not only on technology but also on your workforce. You need to ensure that your team is prepared and aligned with the new processes and technologies. Provide training and support to help employees adapt to the changes and take advantage of the digital tools at their disposal. An informed and engaged workforce is essential for implementing and sustaining supply chain digitization.

Figure 1A: 5 Steps of Supply Chain Digitization



Source: Collected by Author

Results and Discussion

Difficulties in using Digital transformation's effects on supply chain management

Supply chain management could be greatly impacted by digital transformation, but there are a number of obstacles and issues that come with it. Here are a few of the main problems and things to think about:

- **Integration of Digital Technologies:** It might be difficult to integrate new digital technologies into supply chain procedures that are already in place. New technologies may not be readily adapted by legacy systems and conventional procedures, which could result in resistance and implementation challenges [13].

- **Analytics and Data Management:** Digital transformation produces enormous volumes of data, which, if not properly handled, can overwhelm enterprises. Establishing strong data management procedures and analytics skills is essential to gaining insightful knowledge and facilitating decision-making.

- **Privacy and Security Issues:** Supply chains are more susceptible to cyber security attacks as they become more digital. One of the biggest challenges is maintaining the privacy of partners and customers while safeguarding sensitive data.

- **Talent and Skills Gap:** Organizations require workers with the appropriate knowledge and experience to fully utilize digital technologies. It can be very difficult to find and keep personnel who understand data analytics, artificial intelligence, the Internet of Things, and other digital tools.

- **Change Management:** A company's culture frequently needs to change as a result of digital transformation. Change may be resisted by workers, and different departments or stakeholders may not grasp it or be on board.

- **Infrastructure and Cost:** Putting digital technologies into practice, like blockchain, RFID, or Internet of Things sensors, may need a large investment in both. It's critical to carefully budget for and plan for these costs [14].

- **Scalability and Flexibility:** Digital supply chain solutions need to be both as company demands change and as scalable as possible in order to accommodate new markets, interruptions, and shifts in demand.

- **Risk Management:** Digital technologies have the potential to improve supply chain visibility and predictability, but they can also bring up new hazards. Some of these include reliance on a single technology provider, data breaches, and disruptions brought on by technological malfunctions.

While digital transformation offers numerous opportunities to improve supply chain management, it also comes with a host of difficulties and challenges that organizations must navigate. Effective planning, change management, and a clear strategy are essential to successfully leverage the benefits of digital transformation in supply chains [15].

Analysis for Discussion using Results

Table 2: Impact Area by Digital transformation on supply chain management

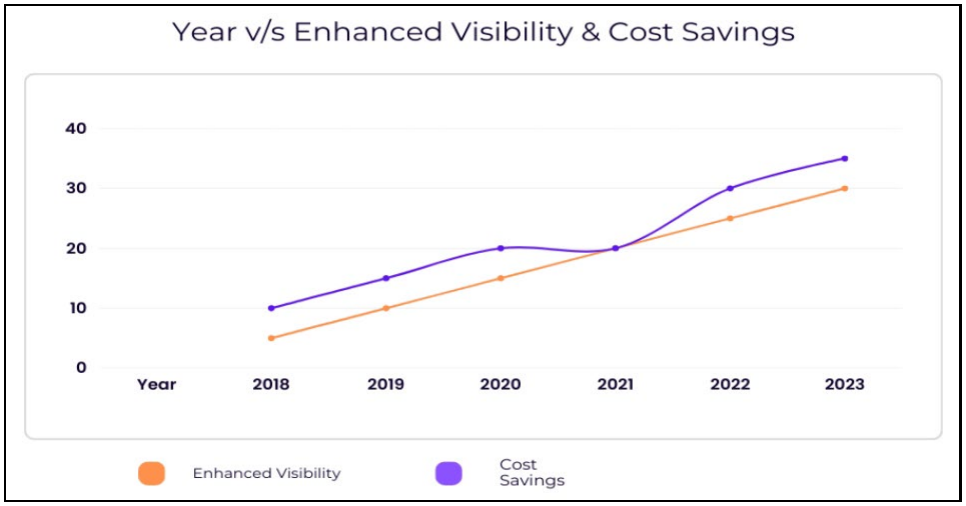
Year	Enhanced Visibility (%)	Cost Savings (%)	Inventory Management (x times)	Process Automation (minutes)	Collaboration with Partners (%)	Risk Management (%)
2018	5	10	3	75	2	60
2019	10	15	4	70	4	55
2020	15	20	5	65	6	50

2021	20	20	6	60	8	50
2022	25	30	7	55	10	40
2023	30	35	8	50	12	35

Source: Collected by Author

These values represent the change or impact in each area year by year (refer to table 2).

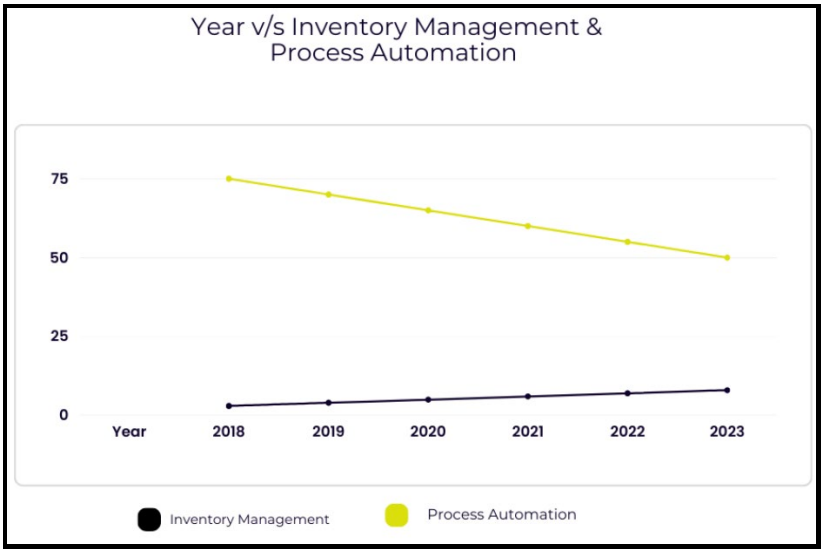
Figure 1B: Plotting between year v/s Enhanced visibility & Cost Savings



Source: Collected by Author

The above graph represents the linear relationship between year verses Enhanced Visibility and Cost savings. Enhanced Visibility & Cost savings parameters are measured in %. In the year 2018 Enhanced Visibility was just 5% and Cost savings was about 10%. In the next 2 years Impact Area by Digital transformation on supply chain management in 2 respective fields had been increased by 5 % constantly till 2020. Later unexpectedly Cost savings remains same with 20 % but Enhanced Visibility increased by 5 % as usual in the year 2021. And then in the year 2022 &2023 Impact Area by Digital transformation on supply chain management in 2 respective fields had been increased by 5 % constantly and reached 30% and 35 % (refer to figure 1).

Figure 2: Plotting between year v/s Inventory Management & Process Automation

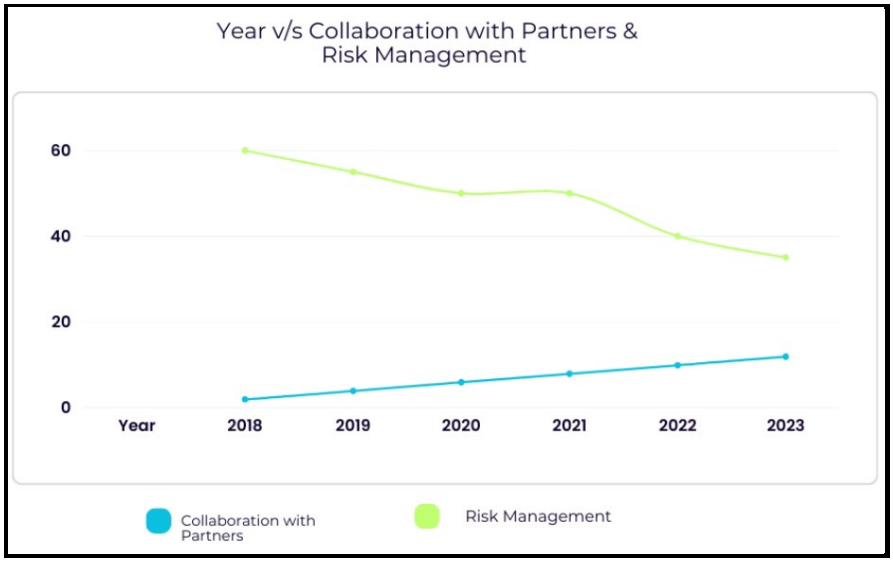


Source: Collected by Author

The above graph represents the linear relationship between the years Inventory Management & Process Automation (figure 2). Inventory Management & Process Automation parameters are measured in X times and minutes respectively.

Starting from the year 2018 with 6 % Inventory Management increased by 1 % per every year till 2023 and reached a maximum of 8 %. Coming to Process Automation in 2018 it took 75 minutes to process which can be said as maximum time consumption and then started to decrease 5% for every upcoming year and took just 50 minutes to process in the year 2023.

Figure 3: Plotting between year v/s Collaboration with partners & Risk Management



The above graph represents the linear relationship between year verses Collaboration with partners & Risk Management (refer to figure 3). Collaboration with partners & Risk Management are measured using the parameters %. In the year 2018 Collaboration with partners was just 2%, later on it increased 2% per every year till 2023 and reached 12 %. Risk Management in the year 2018 it was 60%, in 2019 and 2020 Impact by Digital transformation on supply chain management in Risk Management field was about 55 % and 50 % respectively. In the year 2022 it was 40%. Now, in 2023 it finally reached a minimum of 35 %.

Conclusion

Supply chain management has undergone a digital revolution in every way possible, bringing in a new era of effectiveness, openness, flexibility, and customer-centricity. The profound changes that digitalization has brought about in supply chains, which have affected every important facet of operations, demonstrate the far-reaching effects of this phenomenon. The impacts of digital transformation are wide-ranging and include everything from increasing resilience and sustainability to improving productivity and decision-making. Fundamentally, the landscape of the supply chain has changed as a result of digital transformation, which has increased productivity and efficiency. Automation technologies, which reduce human error and manual work, have upended traditional supply chain operations. Examples of these technologies include advanced warehouse automation systems and robotic process automation (RPA). This efficiency boost reduces costs and speeds up delivery, reinventing supply chains as nimble, agile organizations. The supply chain's digital transformation helps streamline and simplify international business, making it more efficient, effective and reliable. In addition, digital transformation allows businesses to build a global network of partners, suppliers, and customers.

To sum up, it has elevated customer-centricity, efficiency, transparency, and agility. It has also improved cooperation and communication, encouraged a culture of continuous improvement, and supported data-driven decision-making, sustainability, and resilience in supply chains. Because of these changes, the supply chain landscape has been redefined, enabling businesses to prosper in the face of a constantly shifting business climate.

Conflict of Interest

The authors declare that they have no conflict of interests.

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