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THE IMPACT OF DIGITAL TRANSFORMATION ON SUPPLY CHAIN EFFICIENCY AND EFFECTIVENESS

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ABSTRACT

The supply chain has been playing a significant role in manufacturing organizations towards improving their performance. Digital transformation is still evolving in various fields. Adaption of digital tools extensively are seen in COVID 19. With the help of these digital tool's organization have been able to engage their remote workforce. Large portion of the organizational budgets are been utilized for digital engagement and employee connect., Embracing digitalization is not a luxury these days, but has become a necessity of every organization. Industries that are not getting transformed digitally will be losing customers and employees to the competitors and very soon enter into the decline stage and finally becomes extinct. This study will be a great input for the academicians, corporate professionals, senior managers, and leaders of any industry as not much research has been done previously on the impact of digital transformation on supply chain management. The research establishes the correlation between supply chain management and digital transformation which together drive the efficiency and effectiveness performance in the companies. This in-turn also ensures the competitiveness of the company in the marketplace. The significance of the study is the establishment of this relationship in the Indian context which will enable Indian companies to drive their investments and focus towards better information quality in supply chains and working towards maturing the supply chain to get better differentiation and competitive advantage in the society.

Keywords: supply chain, digital transformation, organization, management

1. INTRODUCTION

Nowadays, digital transformation and digital supply chain are much-discussed terms and have become hot topics. But it can be an ambiguous buzzword used by practitioners and academicians. Increasing industrialization indicates the development of a nation's economy, and efficient management of the supply chain is vital for the success of industries. Supply chain management encompasses the activities involved in orchestrating, executing, and regulating the seamless movement and storage of products, services, and associated data from their source to their final destination, all aimed at fulfilling customer demands. The effective management of the supply chain is vital for an organization's success. SCM has emerged as the conjunction of three prime business streams such as procurement and supply management- which involves activities related to purchasing, materials management- that involves forecasting, scheduling, store management, etc., and logistics management [1].

The rising tide of globalization has transformed the business environment into a highly uncertain market. A few decades ago, companies held power and produced goods in large quantities with acceptable quality in limited variety. The companies were charging premium prices to deliver average products, and customers had no option other than to purchase the products/services offered by businesses. These products successfully fulfilled consumers' basic needs. In that era, running a business was relatively easy. But recent technological developments have penetrated almost every aspect of consumers' lives. The emergence of e-commerce, exaggerated use of social medial platforms, the exponential growth of internet usage in day-to-day life, and the use of mobile and smart devices over the last decade have driven a radical change in the way customers live, consume and communicate with their surroundings. Digitization has opened unprecedented levels of alternatives and convenience to customers but, at the same time, has opened up new opportunities for organizations to have a major shift in their business models and supply chains so that they can respond to changing needs of consumers [2]. Emerging digital technologies like internet of things (IoT), artificial intelligence (AI), big data analytics (BDA), blockchain, augmented reality (AR), cloud computing (CC), etc., have rationalized the supply chains, opened up opportunities for organizations to digitally transform their supply chains, DSC allow organizations to compete effectively through proactive customer engagements, improved efficiency, high quality, and faster responsiveness. Though the recent analysis on DSC has featured its necessity, potential, and impact on societies, industries, and supply chains, there is much difference between the hype created about digital transformation and its actual implementation. The progress of digitalization seems to be much slower than expected. Transformation from a conventional to a digital supply chain requires huge costs, time, and structural changes. The rest of the paper is organized as: section 1 presents the introduction about the DSC systems Section 2 covers the basis and related work, Section 3 presents the overview of DSC systems in various sectors, Section 4 discusses the hypothesis of presenting rules, and Section V remembers the conclusions and follow-up work.

2. LITERATURE REVIEW

Farahani et al., (2017) [3] mentioned that increased supply chain complexities and volatility in demand have become the key challenges across businesses. Milovanović et al., (2022) [4]

advocated that seamless end-to-end visibility, transparency, and traceability across the supply chain will be needed to work with a global network of partners, which is only possible by leveraging new digital technologies in the traditional supply chain to transform into a digital supply chain. Digital supply chains have the capability for real-time data and information availability to all the members, enhanced communication, and greater collaboration across digital platforms that result in superior agility, reliability, and effectiveness. Nasiri et al., (2020) [5] discussed the role of smart technologies in managing supply chains and concluded that the digitalization of supply chain promises to lower inefficiencies and costs while enhancing agility, visibility, and traceability across the supply chain. The current digital paradigm is the next generation of modern supply chain management.

According to Khan et al, (2019) [6] Digital transformation comprises three categories: digital transformation within organization, digital transformation between organizations and their customers, and digital transformation between organizations and their partners. The transformation is driven by two trends. On one side, digital technology like IoT, AI, AR, cloud computing, BDA, etc. are propelling into the market and on the other side, it is the challenges of meeting more customized demands of consumers, and appropriately responding to competitors' move. Horvath and Szabo (2019) [7] have identified four major drivers of this transformation; the leading driver is satisfying ever-increasing demands of customers, followed by a diminishing product life cycle, maintaining product/service flexibility and lastly, appropriately responding to competitors' actions.

Frederico et al. (2020) conducted a comprehensive review of the literature, unveiling twenty-one dimensions related to Supply Chain 4.0, which they categorized into four distinct constructs: technological tools, managerial and capacity-enhancing factors, performance requisites for processes, and strategic outcomes. They then constructed a conceptual framework illustrating the influence of Industry 4.0 on the supply chain. Agarwal and Narain (2018) delved into the ramifications of digitalization on procurement and supply chain management. They explored potential obstacles and facilitators, emphasizing that the degree of digitalization within an organization plays a pivotal role in determining its future success or failure. The literature review presents the various dimensions of the digital supply chain. The literature review depicts critical issues related to DSC implementation, such as adoption strategies, roadmaps, barriers, and enablers. To address these research gaps, this study focuses on Impact of the transformation of supply chain into a digital supply chain. In view of this, a questionnaire-based survey has been conducted to assess the impact of digital transformation of supply chain in Indian organizations and other issues related to it. The findings of the survey are discussed in the following sections.

3. METHODOLOGY

A survey is selected as a method to collect empirical data as it is an efficient way of collecting a large sample of quantitative data on the subject under consideration. For this survey, a questionnaire was designed through an extensive review of existing literature to get the opinion of experts. Data has been collected through an online survey to explore the status of DSC within the organizations. Statistical analysis was conducted using SPSS version 16.0. factor analysis

was employed to obtain a more concentrated perspective on the variables. To assess the data's reliability, Cronbach's coefficient alpha (α) was computed.

Respondents were contacted through email and social media channels like Facebook, LinkedIn, etc. The respondents were selected mainly from four sectors, namely, software and consultancy (IT), automobile, e-commerce, and FMCG. Since IT companies increasingly take part in the ongoing digital transformation process, therefore, viable responses to the questions were expected to come from the respondents of this sector. Besides, there has been an increase in demand for automobiles and also the use of e-commerce due to rapid urbanization, and escalated use of the internet and smart devices, which serve as one of the drivers of digital transformation [10].

3.1. Reliability

To check the consistency of data, a reliability test has been performed. The results have been shown in table 1. For data to be decisive, the value of Cronbach's alpha (α) should be greater than 0.7 (Leech et al., 2005). It can be observed from the table that all the scales have high reliability.

Table 1: Reliability analysis of the survey data

S. No.	Constructs	Cronbach's alpha (α)
01	Market Conditions	0.791
02	Business Objectives	0.873
03	Enablers of DSC	0.795
04	Critical Factors	0.844
05	Drivers of DSC	0.786
06	Barriers to DSC	0.817
07	Digital Talent Management	0.761
08	Initiatives required for DSC	0.931
09	Expected benefits of DSC	0.906

3.2. Findings of the survey

Demographic profile of the organizations Figures 1(a) and 1(b) show the characteristics of the respondent organizations. Figure 1 shows that 98.3% of the respondents are from private sector and only 1.7% are from the public sector. From figure 2, it is clear that majority of respondents (91.52%) are from large-scale organizations. 6.77% are from medium scale and 1.7% are from small scale organizations. One of the possible reasons for huge participation from large scale organizations could be that, digital transformation requires huge investment to be made and it is therefore considered as deterrent by medium and small-scale enterprises.



Figure 1: (a) Organizations profile (b) Type of organizations

Figure 2 shows the ranking of business objectives of the organizations given by the respondents. It can be seen from the figure that to maximize customer service/satisfaction has been ranked top most business objective. The other most important business objectives

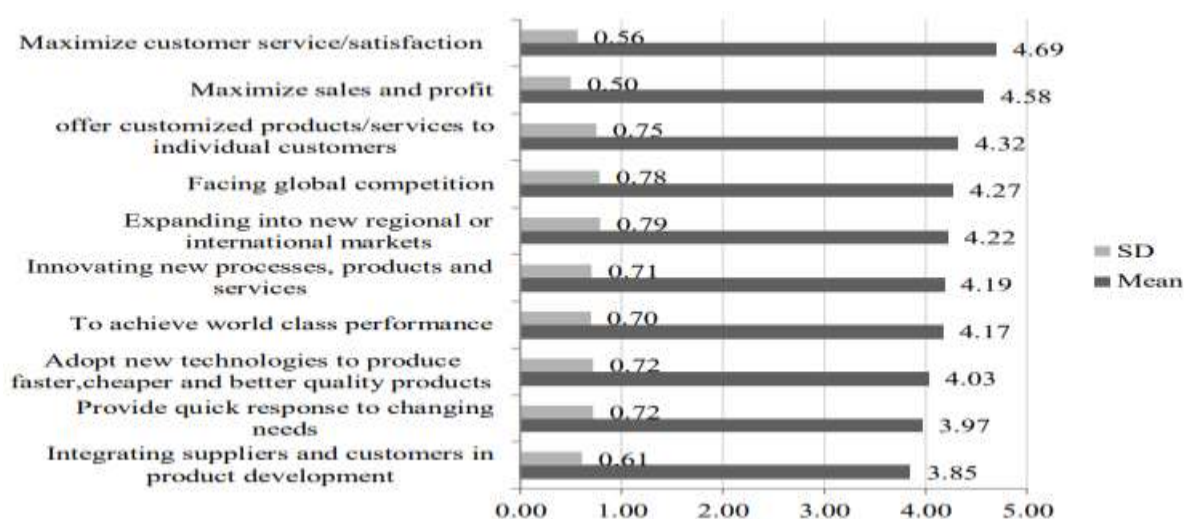


Figure 2: Objectives of organizations

To identify the major barriers responsible for hindering the digital transformation of supply chain, the respondents were asked to rate the parameters as listed in Table 2. It has been reported that “no sense of urgency” is the most prominent barrier among all, which is quite obvious because of the human nature that perform only those actions which are extremely

Table 2: Factor analysis – Barriers to DSC

Scale Items	Component			Variable Name
	BA1	BA2	BA3	
Lack of industry specific guidelines	.916			
No sense of urgency	.884			Sense of Complacency
Lack of digital skills and talent	.820			
High implementation cost	.672			

Inappropriate organizational structure and culture		.859		
Risk of taking initiatives		.827		Cultural barrier
Inflexible business processes		.737		
Lack of strategic orientation		.656		
Lack of support from top management		.646		
Lack of technology infrastructure and insufficient IT system			.839	Technological Barrier
Misaligned traditional and digital supply chain objectives			.737	
Lack of cyber security			.599	

Recent innovations in technology enable digital transformation of the SC. Thus, lack of technology infrastructure is turned as one of the major reasons for limited adoption and slow growth of DSC among Indian organizations. The next considerable barriers reported by respondents include lack of top management support and lack of cyber security. Transformation to DSC will not be possible without the commitment of top management and lack of cyber security is one of the prominent barriers to DSC specified in the available literature.

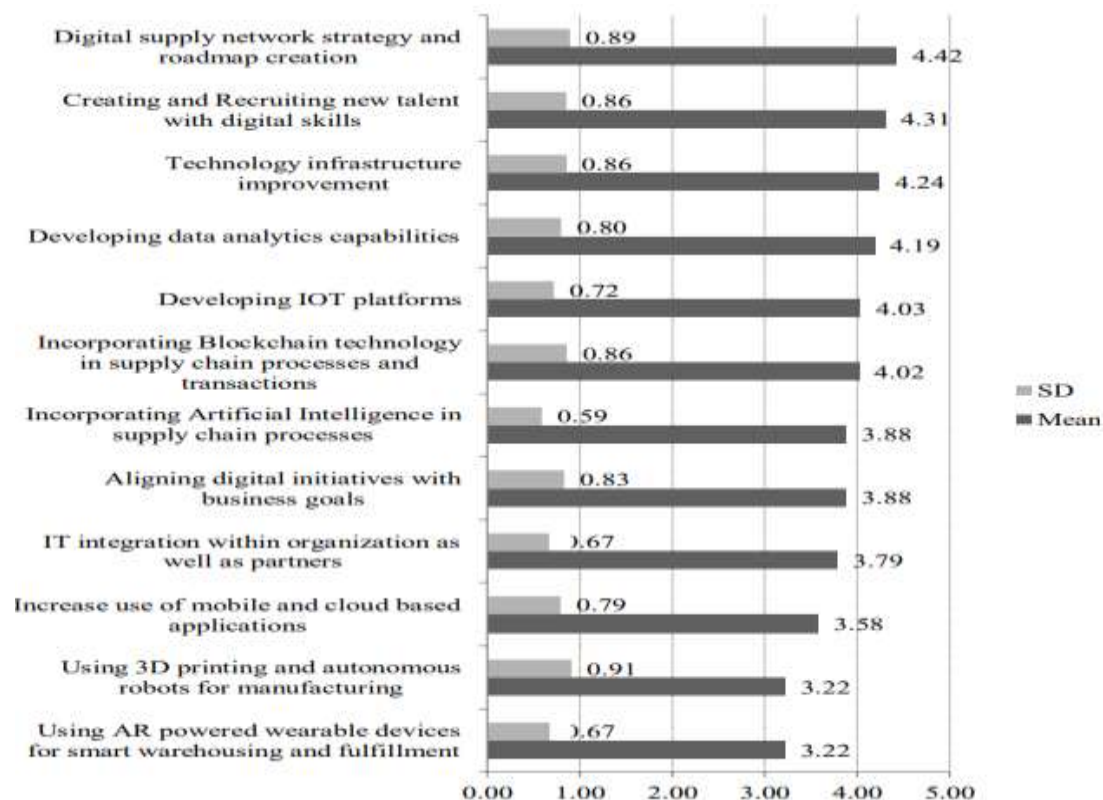


Figure 3: Initiatives required for digital transformation of supply chain

The respondents were then asked to rate the initiatives that should be taken on a priority basis for digital transformation. Figure 3 shows the rankings given by respondents to the various

actions that need to be implemented for DSC. Developing a roadmap for implementation of DSC is indicated as most important initiative, which is quite obvious because organizations

Numerous benefits of DSC are mentioned in the available literature. So, the respondents were asked to rate various benefits of the digital supply chain. Their responses are given in figure 4. Improvements in customer service and experience have been given the highest rating. The main focus of DSC is on delivering unprecedented services and experiences to customers throughout their purchasing process so as to let them have a feel of the difference brought about through DSCM.

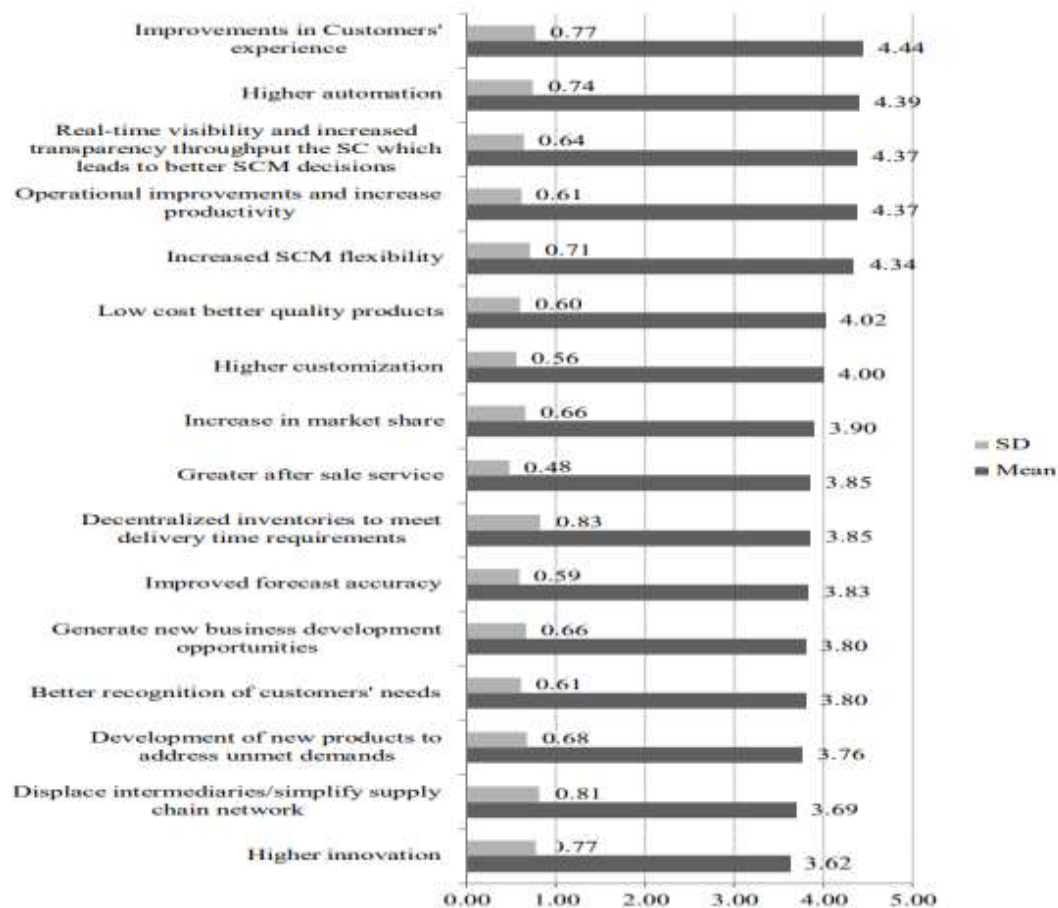


Figure 4: Expected benefits of digital transformation of supply chain

Digital transformation of the supply chain has become a hot topic these days. Factors like rapid technological innovations, increasing customers' demand, and higher penetration of the internet in our day-to-day lives are compelling organizations to implement DSC. Therefore, many organizations are approaching towards the digital transformation of SC owing to many benefits and competitive edge that DSC offers. But digital transformation is a risky endeavour because it requires huge financial investments, time, and structural changes. So before starting the implementation of DSC, organizations should be well versed with its enablers, barriers, success factors, and other parameters related to the DSC. This survey has highlighted different aspects of the digital transformation of SC that need to be considered for its successful implementation.

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4. HYPOTHESIS TESTING

Digital transformation of the supply chain leads to improved supply chain performance, profitability, and customer experience through product and process enhancement. The adoption of emerging digital technologies in the supply chain will lead to process and product enhancements through several transformations in the supply chain, such as product optimization, design process optimization, logistics optimization, operational efficiency, etc. Digital transformation of the supply chain will enhance the maintenance, sales, and logistics processes by introducing the concepts of descriptive, predictive, prescriptive analysis, information sharing, smart manufacturing, etc. following section presents the research model and associated hypotheses.

H1: Digital transformation of SC facilitates process enhancement

- *through increased flexibility*
- *through higher automation*
- *through operational improvements*
- *through real-time visibility and increased transparency*
- *through better recognition of customers' needs and preferences.*

H2: Digital transformation of SC facilitates product enhancement

- *through better recognition of customers' needs and preferences.*
- *through higher customization*
- *through innovative products*
- *through low-cost better-quality products*

H3: Digital transformation of supply chain facilitates distributed manufacturing

- *through decentralized inventories*
- *through development of new products*

- *through generation of new business development opportunities*

To test the assumed hypotheses, the chi-square test (χ^2 test) has been employed,

The respondents perceived the impact of digital transformation of SC on examined constructs as high. Table 3, 4, and 5 represents the results of the chi-square test (frequencies residual values of the examined constructs).

Table 3: Frequencies residual values of constructs of expected benefits of DSC for process enhancement

Constructs	Mean (n=59)	Factor loading	χ^2 test (frequencies residual values)					Item is supported
			SD (1)	D (2)	N (3)	A (4)	SA (5)	
Higher Automation	4.39	0.756	-11.8	-10.8	-5.8	9.2	19.2	Yes
Operational improvements	4.37	0.824	-11.8	-11.8	-7.8	17.2	14.2	Yes
Real-time visibility and increased transparency	4.37	0.802	-11.8	-11.8	-6.8	15.2	15.2	Yes
Increase SCM Flexibility	4.34	0.847	-11.8	-10.8	-6.8	14.2	15.2	Yes

Table 4: Frequencies residual values of constructs of expected benefits of DSC for product enhancement

Constructs	Mean (n=59)	Factor loading	χ^2 test (frequencies residual values)					Item is supported
			SD (1)	D (2)	N (3)	A (4)	SA (5)	
Low cost better quality products/services	4.02	0.800	-11.8	-10.8	-4.8	29.2	-1.8	Yes
Higher Customization	4.00	0.837	-11.8	-10.8	-5.8	32.2	-3.8	Yes
Better recognition of customers' needs	3.80	0.600	-11.8	-9.8	0.2	29.2	-7.8	Yes
Higher Innovation	3.62	0.708	-11.8	-8.8	11.2	14.2	-4.8	Yes

It can be observed from the table 4 that residual value under ‘Strongly Agree’ (SA) option is negative but the highest positive residual value for the examined constructs come under the option ‘Agree’ (A), and the highest residual value will be the decisive factor, thus, the examined items are supported.

Table 5: frequencies residual values of constructs of expected benefits of DSC for distributed manufacturing

Constructs	Mean (n=59)	Factor loading	x ² test (frequencies residual values)					Item is supported
			SD (1)	D (2)	N (3)	A (4)	SA (5)	
Decentralized inventories to meet delivery time requirements	3.85	0.772	-11.8	-9.8	8.2	10.2	3.2	Yes
Generate new business	3.80	0.845	-11.8	-9.8	2.2	25.2	-5.8	Yes
Development opportunities								
Development of new products to address demands	3.76	0.847	-11.8	-9.8	4.2	23.2	-5.8	Yes

It can be observed from the above tables 5 that the highest residual values for all the examined constructs come under the “Agree” or “Strongly Agree” options. Therefore, all the assumed hypotheses are accepted.

5. CONCLUSIONS

The digitalization of society is changing consumers' buying habits and service expectations, fundamentally altering the relationship between companies and customers. A few years ago, customers were ready to wait for a week for their products. Today's customers are connected, well informed, and empowered, demanding greater variety and availability, rapid fulfilment, and cheaper costs. These drastic changes in the shopping habits and expectations of customers have put huge pressure on organizations and supply chains, forcing them to seek out new approaches, strategies, and technologies and adopt a new business model to deal with the changing behaviour of consumers. It is clear from the work that DSC is one of the most prominent ways to achieve and hold a superior market position. In recent years, growth in its adoption across the countries of the world has been witnessed, and in India, also the rate of

adoption of DSC is picking up, and organizations are approaching towards DSC, which brings the need for research to highlight the important aspects necessary for spreading the use of DSC. Issues related to the adoption of DSC, such as the identification of enablers and barriers, adoption of technologies, development of new capabilities, and development of an implementation framework, need to be addressed to enhance its adoption rate among Indian organizations. Organizations should be aware of the benefits that can be achieved by adopting DSC if implemented properly.

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