

Analysing the relationship of digitalization on competitive advantage: A empirical study from the Indian manufacturing sector

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Abstract

Digitalization and related digital technologies offer excellent opportunities to the manufacturing sector. It provides unique growth opportunities, new revenue streams, new ways of cutting costs the potential for achieving a distinct competitive position. This study intends to empirically examine the relationship between digitalization(DIG) and competitive advantage(CA) in the Indian manufacturing sector. In this context, a scientific research model consisting of a hypothesis has been developed from the existing literature. The proposed model was tested using statistical data collected VP/AVP/DVP/Chief Manager/ project Managers/ senior Managers/divisional Managers. Data were analysed and tested through SPSS 24.0. Our empirical result indicated no significant relationship between digitalization and competitive advantage in the Indian manufacturing sector. The possible reason could be that technology alone is not enough to generate a competitive advantage.

Keywords: Digitalization, Competitive advantage, Indian manufacturing sector

1. Introduction

The manufacturing industry are undergoing digital transformation in the direction of industry 4.0, where the companies are agile enough to anticipate changes and react to them quickly. The application of industry 4.0 technology is changing and reshaping modern manufacturing. Digital technologies such as cloud platforms, Internet of Things, analytics, AI, 3D printing, machine learning, AR-VR (Augmented Reality – Virtual Reality) and robotics are driving growth of manufacturing industries and has a potential lead to increased automation, predictive maintenance, self-optimization of process improvements.

Digitalization is a process that takes advantage of digital technologies in order to enhance operational efficiency, improve inventory and supply chain management, and even change a company's business model entirely. According to David (2019), integrating digital technologies into applications and solutions supports the digitalization of manufacturing and enhances productivity and competitiveness. Also, the organization that adopt the appropriate digital technologies and redesigns their supply chain can take the digital advantage for the future and gain a competitive edge digital world. According to Gartner's glossary "...Digitalization uses digital technologies to change a business model and provide new revenue and value-producing opportunities and streamline the highly technologically advanced products and solutions". Digital transformation helps an organization to remain competitive in the market.

According to IBEF (2021), "India has potential to become a global manufacturing hub and by 2030, it can add more than US\$ 500 billion annually to the global economy". The ambitious target of manufacturing contribution has been set to 25%–30% of Gross Domestic Product (GDP) by 2025 as against 16% which is the current status. The revenue generated is to touch US\$ 1 trillion by 2025 and human resources required for the same will be near about 90 million. The digital transformation market size in manufacturing has valued at USD 521.5 billion and it is poised to reach USD 1247.5 billion by 2026 with CAGR of 19.1% (MarketsandMarkets.com).

In India, many large manufacturing industries are already working with Industry 4.0 technologies or are starting pilot projects, which may significantly affect supply chain processes, flexibility, logistics, and a clear competitive advantage. Based on above insight,

our study empirically examines the relationship of digitalization on competitive advantage in Indian manufacturing sector. The following research question have been identified in our study.

RQ1. Does digitalization positively affect competitive advantage in Indian manufacturing sector?

To answer the above question, a conceptual model is developed to analyze the relationship between digitalization and competitive advantage and then model was tested statistically using SPSS 24.0.

The organization of the paper is as follows. Section 2 provides the literature review; Section 3 explains the Model Conceptualization and Hypotheses; Section 4 describes the research methods; whereas section 5 presents the Analysis and Results followed by Result Discussion, Conclusion, limitations, and further direction of research.

2. Literature survey

2.1 Digitalization and Industry 4.0

Industry 4.0 is driven by a set of four clusters of disruptive technologies. The first cluster is Data and connectivity. This field includes for instance the Internet of Things (IoT), Big Data and cloud computing. The second cluster is Analytics and Intelligence. Examples for this field is Artificial Intelligence (AI). The third cluster is human machine interaction (HMI). Augmented Reality (AR) and Virtual Reality (VR) could be examples for human machine interaction. The fourth cluster of disruptive technologies is digital to physical conversion. Examples for this cluster are Cyber Physical Systems (CPS) and 3D-printing.

“Digitization”, “digitalization” and “digital transformation” are three distinct terms that used closely associated and the term gets used interchangeably in the literature (Ritter et al., 2020; Morakanyane et al., 2017; Brennen and Kreiss, 2016). At a fundamental level, digitization refers to digital representation of analog information so that it can be used by computers to store, process and transmit such information (Bloomberg J, 2018). Digitization creates excellent sources of data, and can be defined as “moving from analogue to digital data for streamlining existing processes” (Ritter et al, 2020; Morakanyane et al., 2017) whereas digitalization uses digital technologies to transform businesses and improve their Performance. According to i-scoop.eu, “digitalization most often refers to enabling, improving and/or transforming business operations and/or business functions and/or business models/processes and/or activities, by leveraging digital technologies and a broader use and context of digitized data, turned into intelligence and actionable knowledge”. According to Gartner Glossary, “Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.” According to Banalieva and Dhanaraj (2019), “Digitalization is defined as adopting digital technologies to facilitate business operations”. Digitalization is a process that takes advantage of digital technologies in order to improve operational efficiency, eliminate error probability, enhance productivity and reduce operating cost. Digital technologies such as 3D printing, AI (artificial intelligence), AR-VR (Augmented Reality – Virtual Reality), Cloud computing (IoT) Internet of Things and robotics are driving growth of manufacturing industries ([x]cube LABS, 2020). According to Gobble (2018), “...Digitalization is the use of digital technology, digital information, and other resources to create value in new ways.”. According to Gartner’s glossary “...Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities...”. Digitalization is about using digital data to streamline processes. Digital transformation is wider adoption of digital technologies to reinvent the business. It's a transition in how organizations use digital technologies to add value to customer interactions and invent new business models (factory.dev, nd). According to Westerman et al. (2012), digital transformation “the use of technology to radically improve the performance or reach of enterprises.” In a nutshell, digitization refers to information, while digitalization refers to processes. According to Adrodegari et al. (2017), “the manufacturers are using digital technologies to increase the efficiency of service delivery and raise the value of their product-service system offerings”. Lenka et al. (2017) described that digitalization enables the processes, resources interactions and outcome between manufacturing firms and the customer to co-create value at the new frontiers of the business. Agrawal and Narain (2018) identified the following potential benefits of digitalization such as “greater transparency, reduced inventory levels, clear visibility of inventory, more decentralized warehousing, delivery times reduction, better understanding of customer’s requirements, higher sales and profit margins, improved supply chain flexibility, better decision-making processes and maintaining competitive advantages”. The use of cloud based systems and big data analytics and digital technologies in context to industry 4.0 can provide significant improvements in operational efficiencies (Wan et al., 2017; Mourtzis et al., 2016; Lee et al., 2015; Sanders et al., 2016; Garg et al, 2021, Garg et al, 2020) has established factors to measure the benefits of implementing industry 4.0 technology. Digitalisation has an ability to improve their agility and responsiveness through dynamic market conditions and customer demands (Oulton A, 2021). By adopting digitization in manufacturing, it gives an instant boost to productivity and allow quick project execution so that manufacturers can meet the aggressive deadlines. With digitalization, manufacturer can share real time data across the globe also data can have accessed by anyone, at any point of time (Engness Team, 2021).

2.2 Competitive advantage

A competitive gain exists while a firm has a services or products that its goal market clients perceive as higher than its competitors (Dess et al, 2007). The value of a company’s aggressive benefit is the difference among the perceived value created and the fees to supply the good or carrier compared to its direct competition. If the economic price created is greater than that of its competition,

the company has a aggressive gain; if it's miles equal to the competition, the firms are stated to have competitive parity; and if it lower than its rival firms, the firm has a competitive downside (Rothaermel, 2008). aggressive gain is described because the “capability of an enterprise to create a defensible position over its competitors” (Li et al., 2006). Tracey et al. (1999) argue that aggressive gain comprises distinct abilities that set an organisation other than competitors, for that reason giving them an area inside the market. They further upload that it's far an outcome of critical control decisions. competitive benefit traditionally involved deciding on the markets wherein a company would compete, protecting market percentage in surely described segments the use of price and product performance attributes (Day, 1994). today, but, competition is taken into consideration a “warfare of motion” that depends on looking ahead to and fast responding to converting marketplace needs (Stalk et al., 1992). competitive benefit emerges from growing advanced competencies which are leveraged to create customer fee and reap value and/or differentiation blessings, resulting in marketplace percentage and profitability performance (Day and Wensley, 1988; Barney, 1991; Hamel, G., & Prahalad, C. K., 990 ; Coyne, 1986). maintaining aggressive advantage calls for that corporation’s installation obstacles that make imitation hard thru persistent funding to improve the advantage, making this a protracted-run cyclical method (Day and Wensley, 1988). Porter's method to aggressive advantage facilities on a company’s capability to be a low-price manufacturer in its industry or be specific in its industry in a few aspects which might be popularly valued through clients (Porter, 1991). most managers agree that price and nice will maintain to remain the competitive advantage dimensions (D’ Souza and Williams, 2000). Wheelwright (1978) suggests fee, first-rate, dependability and velocity of delivery as a number of the crucial aggressive priorities for production. According to Holweg (2005), there may be good sized acceptance of time to marketplace as a source of competitive benefit. Price/fee, first-rate, delivery dependability, and time to market had been constantly recognized as crucial aggressive talents (Tracey et al., 1999; Fawcett and Smith, 1995; Roth and Miller, 1990; Vokurka et al., 2002; Skinner, 1985). ‘Time’ has been argued to be a dimension of aggressive advantage in other studies contributions (Kessler and Chakrabarti, 1996; Stalk, 1988; Vesey, 1991; Handfield and Pannesi, 1995). In a research framework, Koufteros et al. (1995) describe the following 5 dimensions of aggressive abilities: aggressive pricing, top class pricing, fee-to-patron fine, dependable delivery, and product innovation. those dimensions have been in addition described and applied in different contributions as properly (Koufteros et al., 2002; Li et al. 2006; Cleveland et al., 1989; Tracey et al., 1999; Vickery et al., 1999; Rondeau et al., 2000; Safizadeh et al., 1996; Roth and Miller, 1990). primarily based on these studies, the 5 dimensions of aggressive advantage construct used in this observe are charge/cost, best, shipping dependability, product innovation, and time to market. competitive advantage has been operationalized in the present literature (Zhang, 2001; Koufteros et al., 1997) and the measures were adopted on this take a look at with minor modifications.

2.3 Digitalization and Competitive advantage

According to Autio(2017), “..digitalization refers to the application of digital technologies and infrastructures in business, economy, and society..”. Organizations adopting different types of digital technologies, such as eCommerce, big data analytics, internet of things, machine learning, additive manufacturing, can directly or indirectly create competitive advantages in the digital economy (Autio et al., 2018; Nambisan, 2017; Strange & Zucchella, 2018)

3. Model conceptualization and hypothesis

The conceptual model was developed based on theoretical literature review, practical insights and consultation with the subject experts. The hypothesized model illustrated in Figure 1 sheds light on the relationship between digitalization and competitive advantage. The competitive advantage is taken as a dependent variable whereas digitalization is taken as an independent variable. The instrument that measures the digitalization is conceptualized as a five first order construct adapted from (Hao and Song; 2016; Song, Nason, and Di Benedetto, 2008; Yu et al , 2017) whereas CA is evaluated as second order constructs which are “Price/Cost”, “Quality”, “Delivery Dependability”, “Product Innovation” and “Time to Market” adapted from (Koufteros, 1995; Li et al., 2006). For some of the items wordings have been suitably changed to suit the study.

Hypothesis 1: There is a significant relationship of digitalization on competitive advantage in Indian manufacturing sector.

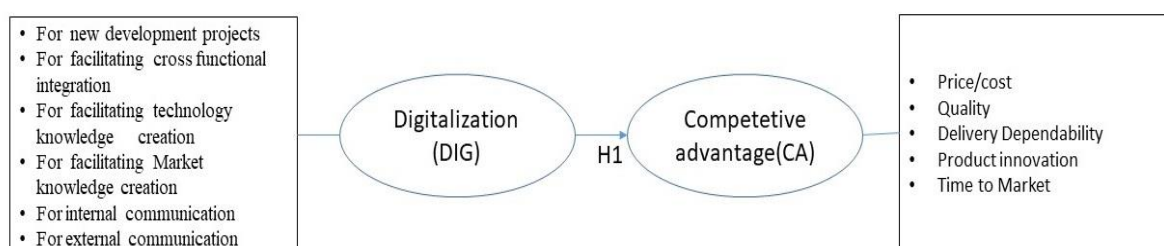


Figure 1: A Conceptual research model and hypothesis

4. Methods

The study sought to choose a mixed approach (qualitative and quantitative) to examine the relationship between digitalization and competitive advantage in the Indian manufacturing context. Based on the literature review and recommendation of expert practitioners acts as an input to develop a questionnaire as per the research objectives. The data used for this study were obtained from the questionnaire method. A preliminary questionnaire was pre-testing on 20 respondents to evaluate the clear and understandable wording of the questionnaire. Google *Doc Forms* was created to facilitate the distribution and collection of the responses from the respondents. The covering letter and the questionnaire link were emailed to the respondents.

Data was collected from VP/AVP/DVP/Chief Manager/ project Managers/ senior Managers/divisional Managers. After review of questionnaires, 23 incomplete questionnaires were omitted. Therefore, 234 questionnaires were used in the analysis. SPSS software 24.0. was used to analyse the data.

5. Data analysis and results

5.1 Respondent's profile

Respondents' profile in this study is explained in several criteria, including gender, age, designation. Table 1 summarizes the explanation of the respondents' profile.

Table 1 Demography of respondents for final study

Variables	Categories	Frequency	Response Rate (in %)
Gender	Female	55	23.50%
	Male	179	76.50%
Age	25-35c	124	52.99%
	35-50	85	36.33%
	51 and above	25	10.68%
Designation	VP/AVP/DVP/Chief Manager/ project Managers/ senior Managers/divisional Managers	89	38.03%
	Technology experts and consultants	80	34.19%
	Technology product/marketing Managers	35	14.96%
	Others	30	12.82%

5.2 Reliability analysis

According to Hair et al (2010), "The reliability of the research instrument was tested using Cronbach's alpha estimate. If the value of Cronbach's coefficient alpha is greater than or equal to 0.7, which are indicative of good scale reliability", For this study, the value of Cronbach's alpha of both the constructs are ranged from 0.897 to 0.946, which indicates that the constructs measures has a good scale reliability (Table 2).

Table 2: Reliability table

Construct/sub constructs	items	Cronbach (α)
Digitalization(DIG)	Dig1	0.932
	Dig2	
	Dig3	
	Dig4	
	Dig5	
	Dig6	
Price/cost	PC1	0.864
	PC2	
Quality(QL)	QL1	0.885
	QL2	
	QL3	
	QL4	
Delivery Dependability(DD)	DD1	0.856
	DD2	
	DD3	
Product innovation(PI)	PI1	0.901
	PI2	

Time to Market	PI3	0.909
	TM1	
	TM2	
	TM3	
	TM4	

5.3 Correlation analysis

Correlation analyses were performed to examine the interrelationships between digitalization and competitive advantage. According to Simon (2008), “the value of correlation coefficient is +0.01 and above are significant but shows little association, value of correlation coefficient is above +0.3 and are lesser than +0.7 shows a weak positive association while values is above +0.7 to +1.0 shows a strong positive association.” Table 3 shows the very little association between digitalization and competitive advantage.

Table 3: Bivariate Correlations

	DIG
CA	0.033

5.4 Multiple regression analysis

The result of linear regression analysis for digitalization Competitive advantage is shown in Table 4. As depicted in Table 4, As reported in table 4 and figure 1, finding revealed that there is a no significant relationship between DIG and CA, shows that hypotheses 1 is not supported ($\beta = -.029$, $p > .05$).

Table 4 Results of linear regression analysis between dependent Variables and digitalization

Construct	Factors	R	R Square	Adjusted R Square	T value	Standardize B	F Value	Sig. value
Digitalization	Digitalization	0.029	0.001	-.003	.440	0.029	.194	0.660

Dependent variable: Competitive Advantage

6. Result discussions

This study has succeeded in examining the relationship between digitalization and competitive advantage in Indian manufacturing sector. Our study provides empirical evidence that there is no significant relationship between digitalization and competitive advantage in the Indian manufacturing sector; hence hypothesis H1 is not accepted. In literature, some of the authors claimed IT could have direct or indirect effect (Duh et al., 2006, Neirotti and Paolucci, 2007). In contrast, some of the authors suggest that IT cannot be a source of competitive advantage per se since it does not fulfill the requirements of the competitive advantage concept (Carr, 2003,2004,2005). However, many studies show mixed and inconclusive findings on the relationship between IT and competitive advantage. In line with Carr (2005), our study concluded that digitalization alone is not enough to generate a competitive advantage in the Indian manufacturing sector.

7. Conclusion, limitations, and future direction

Very few studies have empirically validated the relationship between digitalization and competitive advantage in the Indian manufacturing sector. Results indicated no significant relationship between digitalization and competitive advantage in the Indian manufacturing sector. The possible reason could be that technology alone is not enough to generate a competitive advantage.

The study has some limitations which suggest new avenues for further research.

- The findings of our research relate solely to Indian manufacturing sector. It does not provide a suitable basis for generalization. This limitation eventually paves the way for future research. To enhance the generalization of the study, the model can be extended to other countries.
- Further studies can explore the relationship of digitalization, with respect to business performance, supply chain effectiveness etc.

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