

A Significant Review, Major Synthesis, Opportunities For Future Research With Reference To Digital Transformation Strategies For Manufacturing Sector

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Abstract:

Firms across practically all industries have undertaken a variety of projects in recent years to investigate new digital technologies and capitalise on their benefits. This typically entails changes to essential company activities and has an impact on goods, processes, organisational structures, and management philosophies. To manage these complicated shifts, businesses must adopt management practises. Formulating a digital transformation strategy, which acts as a primary idea for integrating the complete coordination, prioritizing, and implementation of digital changes inside a company, is an essential technique. We define digital transformation strategies and distinguish them from comparable ideas, outline their essential characteristics as components of a larger framework, and suggest areas for further research. Scholarly interest has been steadily increasing in recent years, resulting in a large increase in the number of articles covering various technological and organisational elements of digital transformation. We map the terrain by providing crucial macro- and micro-level observations, and offer future study prospects for this widespread subject in this work, which consolidates current data mostly from the literature of information systems. Fast development, growth, innovation, and disruption are all hallmarks of the digital era. Organizations must be prepared to adapt to the new digital terrain if they are to survive. Implementing new technology, investing in tools, and upgrading current systems are all part of the digital transformation process. These stages are necessary, but they do not complete the picture. If a company wants to be competitive, it must not just be able to adapt to changes, but also anticipate them and encourage innovation. Companies must plan forward and be active designers of their future in order to achieve this. The digital transformation plan comes into play here. The digital transformation plan assists corporate executives in answering questions such as their present degree of digitization, future vision,

and how to get there. In this paper however we will be discussing how manufacturing could develop a digital transformation strategy majorly including a different aspect of strategy tailored mainly to manufacturing sector.

Keywords: *Digital transformation, Digital disruption, Technological disruption, corporate entrepreneurship, Literature review, Research agenda, manufacturing*

Date of Submission: 10-12-2021

Date of Acceptance: 25-12-2021

I. Introduction:

By affecting goods, business processes, sales channels, and supply chains, the exploitation and integration of digital technology typically affects huge areas of enterprises and even extends beyond their borders. Increases in sales or productivity, innovations in value creation, and unique forms of consumer connection are just a few of the many potential advantages of digitization. As a result, business models might be altered or eliminated entirely (**Downes and Nunes 2013**).

A digital transformation plan attempts to manage and prioritize the numerous different threads of digital transformation due to their broad breadth and far-reaching impacts. They cut beyond other business goals and should be matched with them because of their company-spanning qualities. While there are many different types of IT strategies (**Teubner 2013**), they all define the current and future operational activities, as well as the necessary application systems and infrastructures, as well as the appropriate organisational and financial framework for providing IT to support a company's business operations. As a result, IT plans generally concentrate on IT administration within a company, with only a little influence on driving business growth innovation. This limits the product-centric and customer-centric opportunities that emerge from new digital technologies, which frequently cross corporate boundaries. Furthermore, IT plans provide system-centric roadmaps for a company's future technology usage, but they may not always account for the change of goods, processes, and structural factors that come with technology integration. Different aims and perspectives are pursued by digital transformation initiatives. They focus on the change of goods, processes, and organisational characteristics as a result of new technology from a business standpoint. Their scope is more expansive, expressly including digital activities at the customer interface or entirely on the customer's side, such as digital technology embedded in end-user goods. This distinguishes digital transformation plans from process automation and optimization, since digital transformation strategies encompass changes to and consequences for goods, services, and business models as a whole.

Digital transformation, defined as "changes in a company's business model, goods, or organisational structures brought about by digital technology" (Hess et al. 2016, p. 124), is likely the most ubiquitous management challenge for incumbent enterprises in the recent and future decades. However, in order to unveil its disruptive power, digital possibilities must be combined with competent personnel and executives. As a result, both technology and people are required for digital transformation. Scholarly interest has been steadily increasing in recent years, notably in the information systems (IS) literature, resulting in a large increase in the number of publications addressing various technological and organisational elements of digital transformation. Given this growth, we believe it is now the appropriate moment to map the terrain and reflect on the existing level of knowledge. As a result, the goal of this study is to provide a descriptive, thematic analysis of the subject by critically evaluating where, how, and by whom digital transformation research is undertaken. We identify future research possibilities based on this study.

This goal is approached in two stages. First, we take an inductive approach and undertake a comprehensive literature assessment of 58 peer-reviewed works dealing with digital transformation (**following Tranfield et al. 2003; Webster and Watson 2002**). We identify essential core themes in the literature that are particularly pronounced and/or distinctive in changes facilitated by digital technology by using aspects of grounded theory and content analysis (**Corley and Gioia 2004; Gioia et al. 1994**). In a second stage, we augment the mostly IS-based digital transformation literature with a broader management viewpoint to aid in breaking down disciplinary silos (**Jones and Gatrell 2014**) and preventing the construction of an ivory tower (**Bartunek et al. 2006; Fuetsch and Suess-Reyes 2017**). As a result of examining 28 publications on technology disruption and 32 papers on corporate entrepreneurship, we've included cross-disciplinary contributions. For two reasons, we believe these study topics are particularly well-suited to informing digital transformation research. First, we intend to infer implications for technology adoption and integration by analysing the literature on technological disruption. Because incumbents are burdened by the legacy of outdated technology, bureaucratic processes, and fundamental rigidities (**Leonard-Barton 1992**), they may confront significant obstacles in this area during their digital transformation path. Second, we anticipate corporate entrepreneurship to provide a more comprehensive perspective on firm internal characteristics such as managerial influence or the effect of knowledge and organisational learning during the transformation process. In addition, additional research into the many alternatives for integrating digital transformation inside

organisational structures and current processes is needed, as a result of our assessment. Third, we reinforce the relevant management viewpoint inside the primarily is based discussion on digital transformation by evaluating the neighboring literature on technology disruption and corporate entrepreneurship. This avoids the need to reinvent the wheel while also allowing for the identification of cross-disciplinary research possibilities. We believe that by stimulating debate across these disparate but closely linked fields, we will be able to facilitate mutual learning and a beneficial exchange of ideas.

It is vital to establish a close match between digital transformation plans, IT strategies, and all other organisational and functional strategies, similar to the prior debate on the alignment of business and IT strategies (Henderson and Venkatraman 1993). This subject has been researched, with the goal of combining IT and business strategies into a coherent "digital business plan" (Bharadwaj et al. 2013). The potential and implications of digital technology for businesses are frequently discussed in digital business strategy. For example, **Oestreicher-Singer and Zalmanson (2013)** explore the relationship between content and community, demonstrating that community-based digital business models may generate sustainable income streams even in the era of "freemium" business models. **Drnevich and Croson (2013)** demonstrate how information technology might affect a company's business plans and capabilities.

Digitization has become ingrained in our daily routines. It is reshaping the traditional ways in which buyers and businesses collaborate. Digitization, particularly social media, is said to be changing customer behaviour, with substantial implications for businesses and brands. Customers are increasingly spending time on the internet and on social media. They use online services for reading, storing and playing music, emailing, and accessing Facebook, Twitter, and other social media platforms using various connected devices, such as modern mobile phones, tablets, and PCs, and this is transforming how people use the internet. The adage "if an organisation can't be located on Google, it doesn't exist" seems to sum up modern shopping behaviour. It should go without saying that modern digital platforms are important for brands.

It should be a movement that organisations should join if they want to stay serious and grow. When the rise of devices to access digital media spurred unanticipated development in 2010, digital marketing grew more advanced. Insights from 2012 and 2013 showed that sophisticated marketing was growing at the time. Customers have grown extremely reliant on web-based networking media in their day-to-day lives as a result of the advancement of digital marketing in the 2000s, such as LinkedIn, Facebook, YouTube, and Twitter.

Digital Transformation Valuable Players for Manufacturing:

We've compiled a list of some of the most important actors and applications of digitalization in manufacturing in this area. We identified categories for those advantages in the beginning, and in this part, we'll go over the top use cases that assist Manufacturing gain from digitalization technologies and activities. The first and most important digitalization player in production is Additive Manufacturing, often known as 3D Printing. Additive manufacturing is a term that encompasses a wide range of methods and materials that all have one thing in common: they all translate 3D data into physical form. This method of production allows for unprecedented design freedom, and as the technology progresses, we are seeing a profusion of applications in industries such as medical, automotive, aerospace, and lifestyle. Another frequent use case and participant in manufacturing is Asset Performance Management (APM), which is supplied as a standard offering by most digitalization solution providers. Because of the capacity to undertake data analyses, receive equipment from OEMs, and integrate data from numerous plants and sites, APM now incorporates a larger variety of functions with the advent of Industry 4.0. APM offers a number of technologies for increasing the availability of manufacturing equipment and plants.

APM software collects, consolidates, visualises, and analyses data from all equipment. Predictive forecasting, condition monitoring, and equipment dependability maintenance are all made easier

using APM. Manufacturers are seeing the immense potential of this technology approach to radically revolutionize the way they operate, and the Industrial Internet of Things (IIoT) is expanding at a rapid pace. Predictive maintenance, condition/status monitoring, digital twin, data-based research and development, and fleet management are some of the most common Industry 4.0 use cases.

Customers can monitor their machines' consumption trends and enhance operations by optimizing replenishment schedules thanks to Associated Products and Services' analytical insights. Predictive maintenance services, for example, assist clients in reducing machine downtime and lowering maintenance costs. Customers may use programmes to check stock and request replenishment from anywhere using remote ordering services. Appliance makers may also use data from their products to move to on-demand manufacturing and inventory management. In comparison to the client-server technique, cloud platforms are new technologies for developing and hosting applications. In terms of administration and maintenance costs, this new technology for developing and delivering applications offers significant benefits over client-server. When compared to the client-server paradigm, it is significantly cheaper and faster to obtain extra processing capacity if needed. Edge Computing improves computing power, allowing user end-devices to do additional tasks. This lowers latency by decreasing

the pressure on the Internet of Things and cloud, as well as data security threats and delivery costs. This processing power offers up a slew of possibilities for IoT applications, including obstacle avoidance, language processing, object identification, facial recognition, and other machine learning applications. Fog computing exists in the space between endpoints of the Internet of Things and the cloud. Fog computing, in other terms, is a network that connects data entry points to cloud machines where the data is stored. Fog is a processing region in the middle that controls data from the edge and jobs that don't need cloud computers but can't be handled by edge devices.

Conceptual foundations for the study concerned:

For a long time, scholars have recognised technology as a fundamental influence of organisational form and structure (**Thompson and Bates 1957; Woodward 1965; Scott 1992**).

After a major drop in interest in this connection until the mid-1990s (**Zammuto et al. 2007**), advances in information technology (IT) and the advent of pre-internet technologies have reignited its significance in the context of organisational change. Thus, one of the scholarly roots of digital transformation research can be found in the literature on IT-enabled organisational transformation, a concept that comes from the field of information systems (IS) and has gotten a lot of attention since the early 1990s (**Ranganathan et al. 2004; Besson and Rowe 2012**). **Morton (1991)** claimed in his key work that for effective IT deployment, businesses must undergo fundamental changes. Over time, the focus of emphasis has shifted from technology to administrative and organisational challenges (**Markus and Benjamin 1997; Doherty and King 2005**). Leadership, culture, and staff training, among other non-technical factors, were determined to be as critical for effective IT-enabled change (Markus 2004). This is reinforced by **Orlikowski (1996)**, who discovered empirical evidence from a two-year case study that technology enabled, but not caused, organisational transformation. Information technologies have evolved into "one of the threads from which the organization's fabric is currently fashioned" (Zammuto et al. 2007, p. 750). Given its disruptive character and cross-organizational and systemic consequences, digital technologies are seen as a crucial tool for driving organisational transformation (**Besson and Rowe 2012**). Changes at various levels within the organisation are required to achieve successful digital transformation, including core business adaptation (**Karimi and Walter 2015**), resource and capability exchange (**Cha et al. 2015; Yeow et al. 2018**), process and structure reconfiguration (**Resca et al. 2013**), leadership adjustments (**Hansen and Sia 2015; Singh and Hess 2017**), and the implementation of a vibrant digital culture (**Hansen and Sia 2015; Singh and Hess 2017**) (**Llopis et al. 2004**). As a result, the focus of our investigation is limited to digital transformation at the organisational level (in contrast to implications at the individual level). We define digital transformation in this study as the intersection of disruptive digital technology adoption on one hand and actor-guided organisational change of capabilities, structures, processes, and business model components on the other. In other words, we define digital transformation as organisational change caused by digital technology, as defined by **Hess et al. (2016)**. As a result, we believe that a technology-centric and an actor-centric view on digital transformation within businesses must be recorded. We combine research on technological disruption (e.g. **Tushman and Anderson 1986; Anderson and Tushman 1990**) with research on digital transformation to utilise the technology-centric perspective. We extract fundamental implications for the actor-centric approach from the field of corporate entrepreneurship (**Guth and Ginsberg 1990**), which we believe may provide useful insights into actor-driven innovation and renewal processes inside organisations. We'll give you a quick overview of both concepts and how they relate to digital transformation in the sections below.

Disruptive innovations, according to Rice et al. (1998), are "game changers" that have the potential to "(1) provide a 5–10 times improvement in performance compared to existing products; (2) provide the foundation for a 30–50 percent cost reduction; or (3) have new-to-the-world performance features" (p. 52). Similarly, **Utterback (1994)** stresses disruption at the business and industry levels, defining a "game changer" as "change that wipes away most of a firm's current investment in technical skills and knowledge, designs, manufacturing process, plant and equipment" (p. 200). **Tushman and Anderson (1986)** distinguish between disruptiveness of products and disruptiveness of processes. New product classes, product substitutes, and fundamental product enhancements are all examples of product disruption.

Process disruption can take the shape of process substitutes or innovations that dramatically increase industry-specific merit parameters. Disruptive business model innovations, as defined by **Christensen and Raynor (2003)**, are disruptive innovations that include the deployment of fundamentally changing business models in an existing firm. All of these notions of disruptive innovation, we suggest, may include digital technology. They might represent ground-breaking product advances, disrupting old processes, and allowing for the creation of wholly new business models. E-commerce, for example, is characterised as a disruptive technology (**Johnson 2010**) that entails major changes to an organization's culture, business processes, skills, and markets (**Zeng et al. 2008; Cui and Pan 2015**), as summarised in a recent research by **Li et al. (2017)**.

In a two-step process, we evaluate the literature on digital transformation, technological disruption, and corporate entrepreneurship.

We begin by reviewing, analysing, and synthesizing existing digital transformation publications.

Then, in a second phase, we add to these findings by analysing the literature on technology disruption and corporate entrepreneurship at the same time. We feel that a distinct study and comparison of the research streams is necessary for two reasons: first, it gives the reader a clearer picture of the current state of digital transformation knowledge and avoids conflation of concepts from other literature domains. Second, with such a systematic approach, white spots and future research prospects in the area of digital transformation become much more obvious.

Digital Transformation Strategy

For the overall success of digital implementation in manufacturing, a well-defined digital transformation plan is essential. From creation and manufacturing to improved quality control, delivery, and analysis, the plan should embrace every facet of corporate activity. To identify possible issues, the health of the company's legacy systems should be considered. Before the new system is implemented, as much data as possible should be collected from the machines in their present and previous states. Understanding the issues that industrial firms experience during the digital transformation path is crucial for them to properly adopt digital technologies. Several difficulties must be addressed and handled as part of the digital transformation strategy.

Creation of Digital Transformation Vision and Objectives

Organizations must first define their vision and goals for undertaking digital transformation as a first step. However, rather of concentrating on the problems they are attempting to tackle with innovations, they should consider their ultimate purpose and what they want to accomplish. They should set long-term objectives and concentrate on the type of experience they want to provide to their customers and staff. It is vital to develop a worldwide future vision. This vision, on the other hand, must cope with reality. As a result, firms must develop a strategic vision for the goals and short-term resources available to them now. Organizations must first focus on their competitive advantage, after which they must identify holes in their present structure and develop implementation roadmaps to address them.

Organizations frequently make two blunders while implementing new technology.

They must approve any technology created by other departments or adapted by the innovation or IT departments.

This might include new applications that have been accepted by rivals and other industry participants.

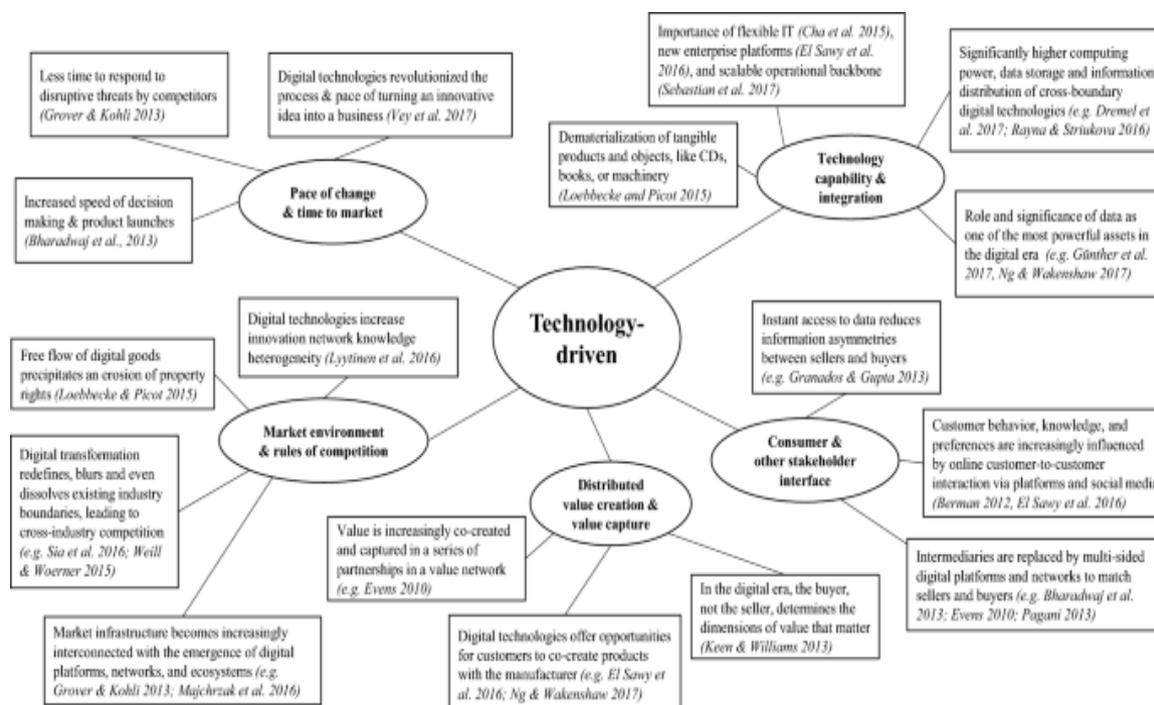
Second, they start with their skills or ecosystem and just improve from there, with no overarching aims or particular challenges to tackle. These mistakes can result in the adoption of isolated and silo technologies that are difficult to integrate and scale across the organisation. First and foremost, businesses should define the goals and vision they intend to achieve through digital transformation. It should contain a definition of effective transformation as well as the implications of customer experience and engagement for their whole business and customers.

Organizations may implement technology with a clear focus on business development rather than restricted improvement of particular operations by identifying the goal. This will aid in the development of a holistic plan that incorporates and changes the whole firm while also preventing siloed technology adoption. When designing a digital transformation plan, it's important to consider the company's existing state. Setting five-year objectives and targets is an excellent practise. The company should begin by prioritizing goals with the greatest return on investment. Identifying performance improvement possibilities that will result in direct or indirect significant advantages to customers and staff is an excellent way to start a digital revolution in manufacturing. Operations, engineering, supply chain, customer service, and support, as well as the company concept itself, are all highlighted.

Assess the Organizations Digital Transformation Capability

The company should evaluate its infrastructure and see how effectively its system, software, and tools are fulfilling current and future demands. The company must identify the important components for its DT strategy, as well as places where new functionality must be developed and the necessary integration to bring everything together. This evaluation will assist the company in determining which technology needs to be upgraded, which processes need to be automated or streamlined, and which tools need to be replaced. As a result, the company will prioritize activities, investments, and efforts in the digital transformation plan to the greatest extent feasible. Conducting market study and benchmarking of the business against new and current firms in comparable sectors is a suitable technique for this assessment. This might be accomplished with the help of a consulting business with greater market and industry experience.

Perform a thorough examination of market dynamics before embarking on any digital transformation efforts. Due to frequent technological advancements and market changes, this stage is critical for developing a current and appropriate strategy. Because of Uber as a rival, the largest yellow taxi firm in New York, which had been a leader for decades, went bankrupt not long ago. Almost every company in the automotive business is now investing in self-driving technology and electrified vehicles. They risk lagging behind if they don't. Companies can discover practical answers and a large share of inspiration in other disciplines as the lines between industries continue to blur.



Above image showing Digital transformation: A review, synthesis and opportunities for future research

Procedural Aspects of Digital Transformation Strategies

Digital transformation is a constantly difficult activity that may significantly alter a firm and its operations due to its broad reach. As a result, it's critical to define and implement a digital transformation plan with proper and defined responsibilities. Firms may lose their breadth and run into operational challenges if they pursue digital transformation half-heartedly. Companies should ensure that the individual in charge of the digital transformation strategy has appropriate expertise with transformational initiatives and that his or her incentives are closely linked to the strategy's goals and success. There is no obvious answer as to which top executive should be in charge of a digital transformation plan at this time. Potential possibilities include dedicated business transformation managers or the relatively new job of the Chief Digital Officer, in addition to CIOs or even CEOs (CDO). Given the extended duration of the transformational processes, this should ideally be the same person throughout the process. Furthermore, senior management support is required throughout the whole transformation process, beginning with the first planning phase, because digital transformation initiatives touch the entire firm, and as a result, there may be conflicts. Digital transformation is a constantly difficult activity that may significantly alter a firm and its operations due to its broad reach. As a result, it's critical to define and implement a digital transformation plan with proper and defined responsibilities. Firms may lose their breadth and run into operational challenges if they pursue digital transformation half-heartedly. Companies should ensure that the individual in charge of the digital transformation strategy has appropriate expertise with transformational initiatives and that his or her incentives are closely linked to the strategy's goals and success. There is no obvious answer as to which top executive should be in charge of a digital transformation plan at this time.

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transformation plans, in addition to enough manpower for both the first phase and subsequent execution. This may be a difficult task, and additional help from both inside and outside the firm may be required. Furthermore, because the distribution of digital technologies may change quickly, the underlying assumptions of digital transformation plans are frequently questionable.

As a result, digital transformation initiatives should be reassessed on a regular basis, with both the underlying assumptions and the transformative efforts to date being assessed. Clear methods for reassessing digital transformation programmes are required to guarantee that early measures may be made if expectations are not realised. This includes not only the time between reassessments, but also the design of methods and measures for assessing intermediate progress and setting thresh-olds for remedial action. Such strategies are critical for ensuring managerial credibility and avoiding decision-making biases, such as when substantial sunk costs make counter-steering difficult.

II. Conclusion:

The Digital Transformation Framework is a four-dimensional description of the transformation's pillars. Future study should focus on identifying and coordinating common factors associated with these four aspects. This is especially true when it comes to the many qualities that businesses might use for each of these pieces. Empirical insights might aid in assessing commonalities and variations in digital transformation methods across sectors in order to improve success rates. One significant consideration is what level of digitalization a company should attain, because greater usage of digital technology isn't necessarily good (Grover and Kohli 2013). Future study should look at whether the scale of a company or the extent to which its main goods can be digitized has an impact on this. Furthermore, digital transitions are frequently accompanied by a shift in skill sets that are required not just for the change but also for ongoing operations. This question of source looks to be both difficult and necessary. While present employees may have a different, less tech-savvy attitude and lack the necessary technological capabilities to deal with the future changes, new, highly skilled, and focused employees may be tough to come by, depending on the firm's location. Research might help businesses by advising them on how to analyse their present technology capabilities and how to weigh their current alternatives, as well as how to build training programmes for current staff and new hires. Research should give organisations with recommendations to assist organize these processes in order to accomplish shared goal-setting, strategy alignment, and collaboration across diverse individuals and entities inside a company.

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Jayadatta S, et. al. "A Significant Review, Major Synthesis, Opportunities For Future Research With Reference To Digital Transformation Strategies For Manufacturing Sector." *International Journal of Business and Management Invention (IJBMI)*, vol. 10(12), 2021, pp. 44-51. Journal DOI- 10.35629/8028