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Digital Transformation From the Industry Perspective: Definitions, Goals, Conceptual Model, and Processes

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ABSTRACT Digital transformation (DT) is a unique transformation that organizations undergo, as it depends on understanding the role of data and available technologies, which bring drastic changes to an organization's structure and capabilities. Studies discussing DT concepts, frameworks, and tools are increasing rapidly. However, few studies empirically present the industrial understanding and practices of the DT process and how to successfully implement DT. In this study, I interviewed nine senior DT leaders to provide a holistic and comprehensive understanding of DT in practice. The DT leaders provided definitions of DT, its core goals and motivations, its concepts and relationships, and its implementation processes. Through analyzing the leaders' responses, an empirically driven definition of DT and its goals are presented. In addition, the study provides a conceptual model that depicts the basic entities in the DT context and their relationships. Finally, it provides a comprehensive representation of phases and processes through which organizations, that have already implemented DT successfully in some of their business units, undergo.

INDEX TERMS Digital transformation, digital strategy, business mode, conceptual model, industry, digital transformation process, digital transformation goals.

I. INTRODUCTION

Digital transformation (DT) refers to the utilization of disruptive technologies to transform business digitally that is, to optimize provided services and products, sustain economic growth, and enhance the user experience [1]. DT results in drastic changes to an organization's structure and capabilities, business models, and the way products are developed and delivered [1], [2]. Hence, understanding the process of DT, the changes it brings about, and how it impacts organizations is crucial.

However, businesses encounter numerous challenges during the transformation, such as a lack of a shared and holistic understanding of DT (why and when) [3], [4], a lack of a clear vision and achievable goals [4], and questions regarding the suitability of DT strategies in connection with an organization's capabilities [5]. Although research in this field is growing rapidly, there is limited research on the context of DT from the perspective of industry practitioners in studies where those challenges have been discussed and

addressed. Understanding how businesses experience DT in practice will enrich the overall understanding of DT and result in realistic perspectives and effective practices

Hence, this study examines DT from the perspective of senior DT leaders whose organizations have implemented DT successfully in at least one business unit. Interviews were conducted to synthesize a definition of DT, the DT core goals, the DT conceptual model, and the DT phases and processes. DT core goals are the shared and common goals for which a business undergoes the transformation; it is important to identify and quantify these goals to measure and assess the DT outputs. In addition, the conceptual model contributes to understanding how organizations will be changed or affected by the DT. It captures the organizations' entities and the DT's elements and their relationships. Lastly, this study synthesizes a holistic definition of DT phases and processes that illustrates how the DT journey begins in practice and its phases.

The remainder of this paper is organized as follows. Section II presents background information on DT. Section III summarizes some recent studies that discussed and addressed DT challenges. Section IV illustrates the

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research method followed in this study, and Section V presents the results of the interview analysis as well as the definition of DT, its core goals, its conceptual model, and its phases/processes models. Lastly, Section VI discusses the findings and limitations of the study, and Section VII draws the conclusion.

II. BACKGROUND

DT refers to a continuous, digital-based transformation of business operations that leads to many major changes in business models, products, and organizational structures [5]. The transformation comprises two main phases: exploitation and integration. The former is concerned with exploring digital technologies and selecting the ones that would help achieve the strategic goals of a corporation, whereas the latter is concerned with the actual implementation and adoption of those digital solutions into the running of the business of the corporation. A DT strategy refers to a strategy that coordinates and prioritizes the implementation of digital strategies across an organization to create value [6].

The integration of information technology (IT) strategies into business processes should be distinguished from DT. Digital business transformation (digitization) refers to the integration of IT strategies and business strategies in a way that would enable improvements in the business process. It is associated with the IT Governance (ITG) that is meant to manage IT within an organization to ensure that IT-related activities achieve the organization objectives, IT-business alignment, and comply with regulations and policies [7]. Meanwhile, DT brings transformational insights, through monitoring and analyzing data flow, on business opportunities in the future, how to reach the future state, and how to own and sustain the digital technologies after the transformation [8]. Hence, a DT strategy does not only affect the business operations and IT strategies, but it goes beyond that to impact business models as a whole and the entire organizational capabilities and structure [8]. For that, the Digital Governance concept was brought up to function as an updated view of the ITG in the DT era. Digital governance is a new view of ITG practices, such as regulations, communications, top management commitment, IT-business alignment, and IT staff competencies [9]. It extends the ITG by supporting the adaptation of the continuous change of technology and customer needs, providing frameworks for all digital initiatives and processes/products across all internal units of companies and external entities, and enabling innovations to stay on the top of competition [10].

Four aspects need to be considered when designing and identifying DT strategies: technology, value creation, the organizational structure, and the necessary finances. DT strategies address the questions of what technologies are to be used and what value the selected technologies would bring to the organization and customers. In addition, they specify whether products, processes, or skills are going to be changed. The financial abilities of an organization are an

important aspect that should be considered as well; financial abilities may fully support or prevent the transformation [5].

One of the most common goals for which companies go through DT is monetization. Monetization is a new phenomenon that emerged from the advancement of data-driven technologies such as Internet of Things (IoT), Artificial Intelligent (AI), and big data and their applications in industry [11]. It is usually associated with data-driven business models (DDBM) and it is about using data to create new services, products, and platforms and enhance customer experience [11], [12]. It enables companies to create value for customers through innovative and personalized digital services, hence, getting customers to value their products and paying for them. In other words, companies shall rethink their monetization and revenue models in a way that leverages data in order to maximize the perceived value of their digital solutions and increase revenue [12], [13]. In addition, data monetization brings many benefits, besides the financial ones, such as increasing process efficiency, or cutting on maintenance costs. There are many strategies for data monetization that companies can adopt to succeed in their digital transformation journeys such as customer experience personalization [14], [15], contextualization [16], [17], services innovations, and optimizations [15], [18], [19].

III. RELATED WORK

Many studies in the domain of DT have attempted to explain the context of DT from different perspectives. Baslyman *et al.* proposed a goal-oriented model that depicts the main elements of DT (e.g., organization, technology, and digital maturity assessment), their relationships, and how they contribute to the main goals of DT [20]. Stjepic *et al.* argued that there are core goals that DT leaders have to achieve in their DT journey that are optimization, customer-centerdness, and upgrading business models [8]. Mugge *et al.* proposed different patterns for digitization, including technologies and change management, based on the CMM of organizations [21]. Stjepic *et al.* synthesized a theoretical framework that links DT and business process management [8]. Hanelt *et al.* presented a theoretical multi-dimensional framework that suggests that DT is shaped and triggered by contextual conditions, and that desired outcomes are achieved through mechanisms that leverage innovation and integration of technology [22]. Nadkarni and Prügl created inductive semantic maps of studies that identified technology, such as technological capabilities, and actors, such as organization culture, as two main dimensions of DT [23].

Ojo presented the process of designing and implementing the DT based on COBIT (Control Objectives for Information and Related Technology) [24]. The process starts with forming a digital transformation team that includes top management and executives; then, goals and new strategies have to be identified in order to prioritize the implementation of the digital initiatives. One of the important steps in the process is to evaluate and activate the readiness of

organizations in terms of culture, innovation and digital capabilities, IT governance, etc. Ziyadin *et al.* proposed six sequential phases of implementing the DT that are realization of digital opportunities and risks, integration of digital strategies into business strategies, assessment of organizations' digital capabilities, communicating goals and new strategies to business unit, implementation, and sustaining of the results [25].

The design and implementation of digital strategies depend on the digital maturity of an organization. Many studies have proposed different maturity assessment models to support decision-making and appropriate selection of digital strategies, such as the studies of Santos and Martinho [26], Colli *et al.* [27], and Aguiar *et al.* [28]. In terms of implementation, Alessa *et al.* proposed a framework to ensure appropriate implementation of digital strategies based on an analysis of three case studies [6]. In addition, Bosch and Olsson proposed a model of the main dimensions (product upgrade, business model, data, and AI) of change when shifting from traditional to digital companies based on multicase analysis [29].

Moving to industry perspectives, Lucija *et al.* conducted interviews with four executives of three companies to analyze three case studies of their DT [30]. The results showed that there are important factors that impact the DT such as organizations' readiness and commitment to changes related to the DT, and operational excellence and IT governance. Moreover, they identified seven dimensions of DT of which their priorities vary from an organization to another. The dimensions are customer, technology, strategy, ecosystem, people, technology, and organization. Gudergan and Mugge discussed identified the gap between industry practices and literature coverage of DT [31]. The conducted discussion groups involved experts from industry and academia. Some of the identified barriers are the absence of definitions and concepts of DT and the confusion of existing ones. Another study discussed the importance of big data management, and data and processing requirements, such as data models and real-time processing, to be an integral part of the industrial practices during the DT [32]. Nwankpa and Roumani used a survey of 167 of CIOs firms in the United States to examine the relationship between IT capabilities of organization and DT, DT and organization performance, and DT and innovation [33]. The results showed that there is a positive impact of IT capabilities on the implementation of DT. In addition, DT influences IT capabilities, organization performance, and innovation. Steiber *et al.* analyzed two industrial case studies, which are General Electric and Siemens EHR/Health Services, to extract the contributors and hinders of DT in practice [34]. The main challenge both business cases face is sustaining the change introduced in organizations' structures and capabilities during the DT. Examples of the factors that contribute to the success of DT are finding triggers to change, looking for feasible solutions, and conducting pilot studies before broader implementation.

As related studies have shown, many theoretical frameworks and conceptual models have attempted to explain DT, its dimensions, and its stages. However, most studies have been synthesized from past literature reviews. It is important to understand DT and its concepts and relationships (what affects the other) from the perspective of practitioners and those who have had a successful DT journey. In addition, most presented frameworks and methods are presented with free text that does not support adoption and implementation. Hence, this study proposes, empirically, a holistic understanding of DT from the perspective of industry practitioners that includes: a DT conceptual model, the goals of DT, and a comprehensive DT process. In addition, it discusses how the DT conceptual model can be implemented to mitigate the risks of, for example, losing focus on vision and goals, or lack of digital strategy/business model alignment.

IV. RESEARCH METHOD

Interviewing was the main research method in this study. After investigating the literature, I found the gap in past studies to be a lack of industry input and information on the industrial practices of DT. Hence, I chose the interview method to collect data on definitions, relationships, goals, and DT processes. The following sections explain the interview questions and describe the participants and interview sessions.

A. INTERVIEW QUESTIONS

Participants were asked four main open questions to collect data on the definition of DT, its main goals and drivers, its concepts and elements and their relationships, and the phases/process of implementing the DT. The interviews questions were as follows:

- 1) Can you define DT based on your practice?
- 2) What are the main goals and drivers of DT?
- 3) Can you explain how DT impacts/changes the current organizational structure and capability? What are the new elements that are introduced to the organization due to DT, and what are their relationships with existing elements in the organization? Can you explain the context of DT, concepts, elements, and relationships?
- 4) Can you explain how the decision to go through DT is taken? What are the processes and phases that an organization goes through in its DT journey?

B. ANALYSIS METHOD

Content analysis was used to identify the concepts and their relationships [35], [36]. After the participants were interviewed, a commercial tool was used to transform the data from voice to text. The results were validated several times to ensure the quality and validity of the transcribed voice to text. Then, for each question, the data were coded first and categorized into meaningful groups. For example, in the second question related to the main goals of DT, answers that were related to money (e.g., answers related to profits and revenues) were grouped under the "growth"

category of goals. The common vocabulary and terms used in literature in the context of DT were used to select coding terms and identifying concepts. For questions 3 and 4, further investigation of the relationships between the concepts (occurrences of a group of terms together) was conducted to develop the conceptual model and design the DT phases and processes.

C. PARTICIPANTS

Nine individuals agreed to participate in this study. Seven of these individuals had, on average, five years of experience working in DT. Meanwhile, the other two had only recently started working in the DT domain (i.e., two years). All participants were of senior management level at their organizations (three were directors of DT, three were head of research and development, two were digital solution managers, and one was chief executive officer of digital transformation), and all had either a digital/technology or business background. The participants represented large corporations that had implemented DT successfully in at least one of their business units. Two of the large corporations sold digital solutions to external clients.

At the beginning of the interview, each participant's consent to participate in the study was collected. The participants were asked to raise any concerns they had and were aware they could withdraw at any time during the study.

D. INTERVIEW SESSION

Nine interview sessions were conducted, and each lasted an hour on average. The interview sessions were conducted online via Microsoft Teams. Each interview session was recorded to convert voice to text and to review the session when needed. Participants were asked whether they accepted or rejected recording the interview.

V. RESULT

This section presents the definition and core goals of DT. In addition, it also presents the DT conceptual model, which reflects how DT changes organizations and depicts the relationships between organization entities and DT elements. Further, this section illustrates a comprehensive set of phases and processes for the implementation of DT in organizations.

A. DT DEFINITION

The participants' definitions of DT are provided in this section. Most participants (6) provided similar definitions of DT: That is, leveraging data-driven techniques and disruptive technologies for business process optimization. The optimization includes problem discovery, anticipation, prediction, and recommendation of actions. One participant elaborated on that definition by mentioning data flow as a key term in the process of optimization. Data flow refers to what type of data is needed and when in order to optimize processes and provide a better experience. Two participants added to the definition "*optimization of customer experience*" in addition to *business process optimization*.

DT was also defined "*as leveraging business strategies with digital strategies*" and "*transforming business processes using disruptive technologies*." One participant defined DT from two different perspectives: improving business and providing services to clients. For the former perspective, DT was defined as enterprise-wide and business-driven disruptive changes. For the latter, it was defined as technology innovation for improvements and continuity of business.

Regardless of the differences between the definitions, all definitions have in common technology and business, with different focuses on these aspects. While the first definition focuses on how technology can drive changes and bring opportunities in optimizing business processes, the other two definitions are of a business-centric view, in which more stress was added on business needs as the starting point for exploring digital technologies, but not the opposite.

B. GOALS AND DRIVERS OF DT

This section focuses on answering why businesses go through a DT journey, when goals of DT are identified, what the main goals of DT are, and how to assess the achievement of those goals. There are two major reasons, as participants reported, why organizations go through DT: to solve existing performance issues (six participants), or to innovate to win the market (five participants). For the first reason, an organization may struggle to fulfill a certain performance or financial goal. In this case, they look up for existing technologies that could be used to solve their current problems and optimize business processes. On the other hand, an organization might be doing well in terms of fulfilling performance and business objectives, but they go through DT to explore opportunities to increase their share in the market and provide better experience to their customers.

In terms of the goals of DT, there are two types: strategic long-term goals and short-term goals. Strategic goals are fixed for a certain period time, most likely five or ten years (an example of such a strategic goal is increasing the company's share in the market), while short term goals focus on solving existing problems or improving current processes. Achieving long-term goals is accomplished through achieving short-term goals. The goals of DT fall under the long-term category, in which organizations have to achieve over a specific time through adopting appropriate digital strategies and enhancement of business models.

Participants identified six groups of DT goals: optimization (nine participants), growth (six participants), competition (two participants), customer (six participants), value in business (one participant), and innovation (three participant). In terms of the optimization, participants indicated that the main goal of implementing DT is to optimize current business processes, production, and the workforce. The second main goal is increasing and sustaining the growth of corporations. Another important goal is winning or sharing winning with competitors. Improving customer satisfaction, increasing the loyalty of customers, and optimizing customer experience is essential for increasing revenue and for securing

the continuity of a business. However, the importance and focus of goals related to customer experience vary from one domain to another. For example, optimizing customer experience in the online shopping domain is one of the highly important goals, while it is not as highly important as optimizing production in the oil and gas industry. Optimizing customer experience means providing customers with what they need on time and what they might need in the future, as one participant mentioned. Businesses also go through DT to create value for organizations and end-users, and to provide innovative solutions that keep them competitive and optimize customer experience. Participants addressed that aside from organizations' goals and visions, there are goals of going through DT that are aligned with the organizations' goals. The DT goals are identified in the realization phase (as explained in Section V-D) when exploring technology and designing a DT strategy. Digital teams start by first identifying strategic goals of the DT and investigating DT opportunities. Then, each business unit identifies its goals and a set of indicators for evaluation. The goals of business units achieve the top goals of DT. Hence, assessing the achievement of DT goals happens through appropriate indicators, such as key performance indicators, which are used to evaluate the achievements of business units' goals.

C. DT CONCEPTUAL MODEL

Participants were asked to explain the context of DT from an organizational perspective. In other words, they were asked to answer the following questions: Can you explain the organization structure and entities before the implementation of DT? Can you explain what are the new elements that have been added to or changed in the organization's structure and capabilities in response to DT? What are the relationships between the new elements introduced by DT and the existing organization entities such as units, roles, the structure, capabilities, goals, strategies, etc.?

All participants identified the following entities: the top management, the digital unit, long-term goals, the corporate strategy, business models, the digital strategy, and the digital team/director. The other entities that were identified by the participants were the business unit (three participants), the IT unit (two participants), functions and capabilities (two participants), operational strategies (two participants), the digital operational model (one participant), DT goals (three participants), and the DT vision (three participants). Those elements were grouped into two main categories based on two criteria: 1) whether they existed in the organization before the DT or not, and 2) whether they were introduced by the DT. Entities that matched the first criterion were grouped under the organization category, while those that passed the second criterion were grouped under the DT category. The organization category included structural and strategic elements that existed in the organization before the implementation of DT. The organization elements were the top management, units, the business unit, the IT unit, directors, the corporate strategy, business models, the

operational strategy, and functional capabilities. In terms of DT entity, it includes all elements that are introduced to the organization and are related to prioritization, selection, and implementation of DT in an organization. The elements in the DT category are DT goals, the DT strategy, digital strategies, the digital unit, and the digital operational model.

The elements of the two categories (organization and DT) were modeled. Relationships were added later based on the participants describing those relationships between the elements. Figure 1 illustrates the conceptual model that depicts the DT main concepts and elements and their relationships. As seen in the figure, when an organization decides to go through DT, it has to identify the DT strategy and goals that have to be aligned with the organization's business strategy and goals. The DT strategy prioritizes and selects digital strategies that will be implemented as initiatives of individual business units. Each initiative, which is a new project that implements a new digital strategy, affects the current operational strategies of business units and their functional capabilities, such as manpower and IT capabilities. The DT is managed and implemented by a digital unit separate from existing IT units. While the role of IT units is to keep providing IT services to the organization and support the implementation of the digital operational models, digital units are responsible for searching continuously for new digital opportunities that would enable improvements and optimization. In addition, they define the DT strategy, align it with the organization's goals and business strategy, support the top management in decision making, and support business units in the implementation of the selected digital strategies. In Figure 1, the elements in yellow represent existing elements in organizations, and the elements are impacted by the DT elements. The green boxes capture the new elements introduced to the organization by the implementation of DT.

D. DT PHASES AND PROCESSES

To synthesize the roadmap of DT systematically, first, the keywords of each phase or step were extracted. Then, similar keywords were grouped to form a phase. Lastly, processes or elements under each group were added, and directions/orders of phases and steps were drawn. Most participants (seven) mentioned that DT comprises three main phases: discovery/exploration, planning and assessment, and implementation and evaluation. However, the processes in each phase might differ slightly from one corporation to another, depending on the organizational structure and capabilities (technical and human resources). Five participants emphasized the importance of creating a new unit/department before starting the DT, which would be concerned mainly with the DT process and have a leader/director who would initiate the DT in the organization. Alternatively, the IT department can start the process. The DT phases and process are as follows:

- 1) **Discovery and exploration**, also called realization: There are two possible starts for this phase. The first

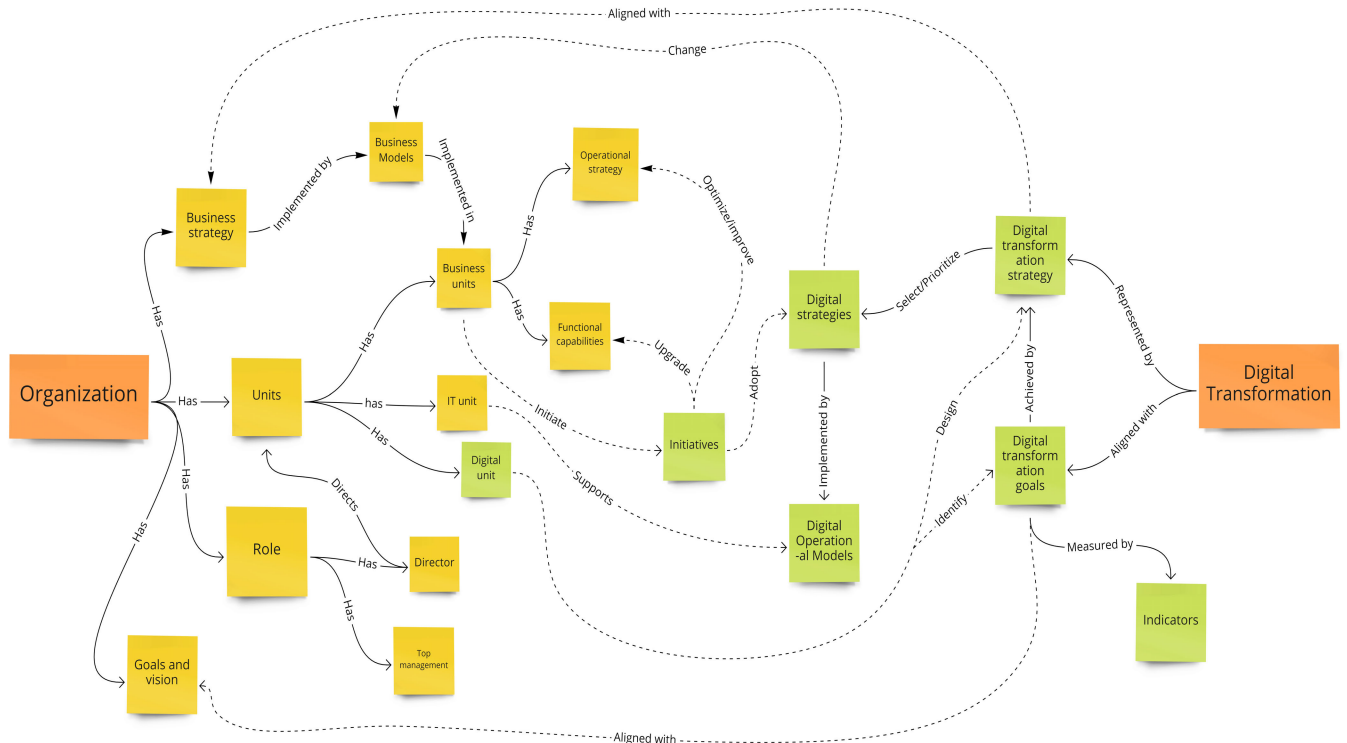


FIGURE 1. The conceptual model of digital transformation (DT) from the perspective of DT leaders. Yellow squares indicate the organization entities, green squares represent the elements introduced by the DT, and dashed lines are the relationships between the organization entities and the DT elements.

one is when an organization discovers performance issues or problems and then attempts to discover how similar businesses/competitors overcome those challenges. The other start is when an organization explores what competitors provide to customers or use internally to optimize the production line, for example—That is to learn from them, keep using cutting edge technologies, and win competitors. In both scenarios, the digital team plays an important role in understating existing digital solutions, developing the digital vision, and identifying goals and strategies to achieve this vision. In addition, the vision and strategies are presented to the top management for their approval to move to the next phase. The digital vision and strategies should be aligned with the corporate strategy.

2) **Planning and assessment**, also called optimization: The digital team conducts a digital maturity assessment to identify the digital capabilities and opportunities of the organization to select and implement suitable digital strategies. Then, the digital team informs the top management and the directors/managers of each department and unit of new technologies and the organization’s digital capabilities. Each unit/department brings proposals for optimizing their current processes and improving performance utilizing disruptive technologies aligned with the organization’s digital capabilities. The top management and heads of units select and prioritize proposals based on value realization,

identified goals and vision, some measures as return in investment, and organizational capabilities. This phase is called optimization because it is during this phase when directors of units look for digital opportunities to optimize the business process and productions of their units.

3) **Implementation and evaluation**, also called disruptive and execution: This phase is described as being disruptive, as the implementation of the digital strategy would bring many disruptive changes to an organization’s functional (human resource, IT, etc.) and operational strategies (business processes, products, etc.). In this phase, each unit identifies the digital operational model and business strategy (how services will be prepared and provided) and selects an appropriate change management tool. Change management includes upskilling employees, identifying where changes will happen in workflows and the business process, and identifying strategies to minimize resistance to change. For some organizations, implementation means conducting a pilot study to obtain more accurate estimations of the results before implementing the changes on a large scale. If the results are promising and the measures satisfying, then the solutions are implemented on a larger scale and, hence, this is called “replication.” In this phase, the IT team plays a significant role in the implementation of the digital solutions, as they provide the required technical

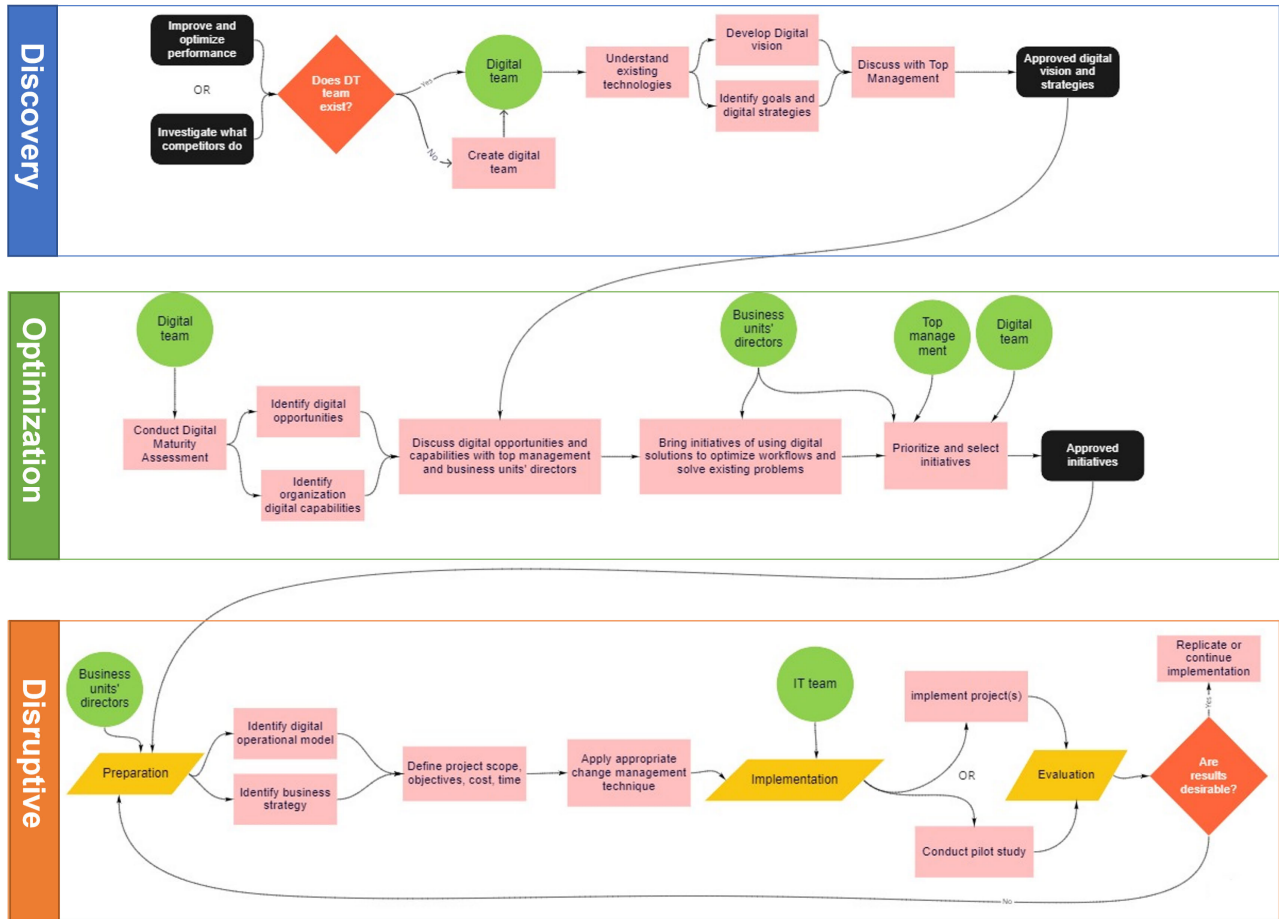


FIGURE 2. The phases and process of the implementation of digital transformation in organizations.

support for the entire organization or a business unit to which they belong, depending on the organization’s structure. Figure 2 illustrates the phases and processes of DT. Table 1 presents some quotes of participants responses during the interview sessions.

VI. DISCUSSION

In this section, some of the results, challenges of DT mentioned in the interviews, and recommendations for tackling some of the issues are discussed. Further, some of the limitations that might affect the validity of this study are presented. As presented in the results (Section V), this study brings an industry perspective to the definition of DT, its core goals, its conceptual model, and its phases and processes. The definitions of DT, which were provided by the participants, were aligned and around utilizing technology to optimize business. However, the difference was in the angle from which the definitions were derived. Participants who provided a DT definition with a focus on business needs were of business background or had spent a long time (i.e., more than ten years) working in business. Participants emphasized “business needs” so that businesses do not get lost in the variety of technologies and rapid technological change. Also, the input of the industry contributed to having a detailed and

clear set of processes that organizations may benefit from in their DT journey. This provides researchers and practitioners with a holistic view of the DT process and changes introduced to organizations due to the transformation. Accordingly, researchers and practitioners can provide appropriate forms of support, such as tools and methods to optimize the DT processes or change management activities in the era of DT. In terms of the conceptual model, the participants discussed the definition and elements of DT strategies and the digital operational models. However, their answers were very generic, such as “A DT strategy is a plan of actions that informs how a business should operate in the digital economy.” This makes it challenging to capture the elements that constitute a DT strategy, which should be aligned with the corporate goals and will impact, specifically, existing business strategies and models (see Figure 1).

A. DT CHALLENGES

While describing the processes and phases of DT, participants mentioned some of the challenges that are faced in the DT journey or cause the transformation to fail. These challenges are

- **Technology-focused transformation:** Two participants emphasized that focusing on digital technologies rather

TABLE 1. Samples of participants’ responses during the interview sessions.

Topic	Responses
DT definition	<p>“leveraging the data-driven or agent-based technologies to discover problems and recommend actions in order to compete in market and meet use expectation.”</p> <p>“A transforming the business using disruptive technology. It is reinventing business process, optimizing it, digitalizing it, then augmenting it with some of these disruptive technologies to design product.”</p> <p>“Leveraging business strategies with digital strategies”</p> <p>“the new revolution in industry. It’s business driven, but not technology driven, right?”</p>
Core goal of DT	<p>“Optimization: optimize the efficiency to optimize the production, to optimize the workforce and so on.”</p> <p>“For growth like win the competitors in the industry”</p> <p>“Increase revenue and customer satisfaction”</p> <p>“making products available cheaper and in better quality.”</p>
Elements and phases/processes of DT	<p>“It is a top-down process, otherwise, it will fail.”</p> <p>“The exploration process starts by looking what others did then explaining to the CEO of the company and the executives what people are doing across the globe or what is the leading company in the digital transformation. Then, to make a program successful, probably you would need to get the buy-in from all main stakeholders of business units. All of them. And even though the top managers of the CEO of the company is into it, but without getting the cooperations and the buy-in from the other stakeholders, usually, projects don’t fly. Once we get the buy-in from all of them, which is took us a long time, then we start doing kind of an assessment. We take one site in a business unit as a pilot to start doing a digital transformation initiative into that because it is difficult to do it in all sites and units before testing it.”</p> <p>“A maturity assessment of your company status is important. That kind of maturity and the current status assessment is to assess the digital capabilities as companies are different in terms of digitalization”</p> <p>“Digital team has to work on prioritizing the digital initiatives and work with the stakeholders to make a business case for each based on the business objectives and return of investment”</p>

than business needs is one of the greatest challenges faced, as it may lead to immature decisions and unrecoverable loss. In addition, one participant mentioned that the focus should be always on business improvements not technology advancement. That is because technology keeps changing and the new ones might not be the optimal solution for unresolved business issues.

- **Technical buzz words:** Another challenge associated with technology is the vague definitions of some technical buzz words that are not understood well in the industry. For example, the term cloud computing is used frequently and is associated with DT; hence, it is vital that organizations understand what cloud computing means and its capabilities and limitations. In other words, organizations should make informed decisions with regard to technology selection and adoption. For example, some organizations utilize cloud computing for only some of their services, which leads to missing most benefits of the cloud. Instead, organizations should transfer an entire business domain to the cloud to experience the strong reliability, performance, and security of cloud computing, along with other benefits.¹
- **Change management:** Three participants mentioned that the changes introduced to an organization as a result of DT are drastic. However, there is still a lack of adequate forms of change management support that provide smooth transitions, minimize resistance, and provide efficient management of culture change and people during the journey of DT.

- **Clear vision and achievable goals:** All participants mentioned that a lack of a clear vision and achievable goals will lead to an absolute failure because resources will be wasted on unattainable results and on unclear directions.
- **DT strategy:** Most participants mentioned that developing an appropriate DT strategy that is aligned with the organization’s goals and business strategies is challenging as it takes time and involves many stakeholders with diverse backgrounds and conflicting opinions.
- **Role of data:** One participant added that in addition to the importance of identifying goals and visions, value creation is an essential element in the DT. He relayed, “There is a question that has to be periodically answered: Can my organization create value out of existing or to be collected data?” The participant added to his previous comment that understanding the role of data, which is the essence of DT, is by far the greatest challenge that business leaders may face during the DT. He also added that identifying input (direct, indirect, and construct) data and output data, and data flow in business processes, and relevant metrics are not a onetime process; it is an iterative experimental process until the required results are attained. Moreover, one participant mentioned that the lack of key stakeholders understanding of DT, its technologies, and the role of data is one of the main challenges that may lead to unsuccessful DT journey.

B. TOOL SUPPORT

As the literature has identified and this study reports, two of the great challenges faced in DT are the alignment of

¹<https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/debunking-seven-common-myths-about-cloud>

the digital transformation strategy with corporate goals and visions, and the alignment of the DT strategy with the business model of an organization. Regarding the former, Baslyman *et al.* (2020) reported on the common core goals of DT found in the literature [20]. In addition, it proposed a goal model that would enable a systematical alignment of the DT goals with an organization's goals and visions. It also shows that the selection of an appropriate DT strategy depends on the digital maturity of an organization. The study utilized Goal-oriented Requirement Language (GRL) [37] and the tool support jUCMNav [38] to depict the DT goal model. GRL is a part of the User Requirement Notation (URN), which is intended to capture stakeholders and their intentions. It also provides an analysis method to select the best solution that would help achieve the stakeholders' goals. In Baslyman *et al.*'s study, they used GRL to model the transformation goals and capture and analyze the impact of the selected DT strategy on the achievement of corporate goals and business objectives.

In the interviews, the DT goal model proposed by Baslyman *et al.* [20] was presented to the participants. Then, participants were asked whether the DT goal model would guide the selection of the appropriate strategy and whether a tool support would be helpful in practice. Some participants believed that the DT goal model could be used as a reference model to have a holistic understanding of the DT context. Two participants mentioned that a tool support would definitely be needed in terms of the DT strategy and goals alignment. However, the tool has to be easy to use for industry practitioners. The other part of URN is Use Case Map (UCM), which show the behavioral aspect of system [37]. UCM provides a casual representation of the flow of a process and includes tasks, roles, and conditions. This is meant to operationalize goals in goal models. Many studies have used URN in connection with IT strategy/business processes alignment [39], [40], process improvements [41], and technology integration in the business environment [42], [43]. Hence, there is an opportunity to use UCM in the alignment/integration of digital operational models and business strategies, where changes could be highlighted, and the capability of current business processes could be visualized. However, to have an effective alignment of DT strategies and business models, these have to be defined formally. In other words, the attributes and elements of each strategy and rules of interaction have to be defined formally.

C. LIMITATIONS

Despite the benefits of this study, there are several limitations worth mentioning. The first limitation was the small number of participants, which affects the generalizability of the findings. It was challenging to reach experts in senior management in DT positions. Also, some participants refused to answer some questions because the answers were confidential. Another limitation is that the analysis of the findings was carried out by the author, who also conducted the interviews, and this could have introduced bias. To mitigate

this risk, I used an automated tool to transcribe the interviews and generate the interview texts. In addition, an academic assistant reviewed the coding and classification of the texts. The structure of the interview questions could have affected the participants' answers; however, the interview questions were reviewed and revised by an expert to ensure that they would elicit the data intended to be collected. Lastly, the generated conceptual model and phase/process models were validated by a DT expert to ensure that they were valid, understandable, and aligned with industry DT practices.

VII. CONCLUSION

While most studies on DT have been undertaken based on literature, this study provides a holistic understanding of DT from an industry perspective. Nine interviews were conducted with participants who had DT senior positions and belonged to organizations that had implemented DT successfully into some of their practices. Participants defined DT and identified its core goals, which were mainly related to optimization and business growth. In addition, a conceptual model was constructed that illustrates an organization's elements and a DT's elements and the relationships between them, including the changes introduced to the organizational structure and capabilities. Finally, this study provides a comprehensive illustration of the phases and processes of DT implementation.

In the future, I plan to define the elements of the conceptual model formally. This would enable a better tool support to help organizations in designing and selecting an appropriate DT strategy, aligning it with the organizational goals and business models, and highlighting the changes and their impact on the current organizational structure and capabilities and business processes. In addition, the validity of the constructed conceptual model and phases/processes of the DT will be further investigated by recruiting more experts and conducting case studies. I also plan to investigate change management practices in the area of DT.

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