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**DIGITAL TRANSFORMATION: AN OVERVIEW OF THE PHENOMENON BASED
ON A DYNAMIC CAPABILITIES FRAMEWORK**

**TRANSFORMAÇÃO DIGITAL: UMA VISÃO GERAL DO FENÔMENO A PARTIR
DE UM FRAMEWORK DE CAPACIDADES DINÂMICAS**

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Tese apresentada ao Programa de Pós-Graduação em Administração do Departamento de Administração da Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, como requisito parcial para a obtenção do título de Doutor em Ciências.

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*This is dedicated to my ancestors
Servina, Mariana, João, and Júlio. You
opened the way so that I could be where I am
now. My triumph is yours too.*

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Navigating through a Ph.D. journey is like an emotional roller coaster, and people's support is essential to reach the end of the road.

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“Breaking an old business model is always going to require leaders to follow their instinct. There will always be persuasive reasons not to take a risk. But if you only do what worked in the past, you will wake up one day and find that you’ve been passed by.”

Clayton Christensen

ABSTRACT

This study investigates digital transformation, which is understood as the revolution promoted by digital technologies in an organization's strategy and work systems, generating a reformulation of pre-established business models, creating better interactions with customers and optimizing processes in order to produce favorable and sustainable financial outcomes.

According to empirical data, only some organizations succeed in digital transformation and go beyond the initial change stages. Unrealistic expectations, lack of financial support, limited technology focus, poor governance and underestimate of cultural barriers are examples of failures throughout the digital transformation initiatives, particularly in organizations that established their business models in a pre-Internet environment.

In view of such context, this study aims at analyzing definitions, challenges and explain digital transformation in the light of a framework based on the dynamic capabilities theory.

Considering the complexity of the subject, this study was organized in three intertwined papers that used as methodological approaches the systematic literature review, the Design Science Research (DSR) and multiple case studies, respectively.

The presented outcomes show that digital transformation is a phenomenon that can be explained from triggers, barriers, enablers and impacts on organizations. Elements, such as the review of an organization's value proposition, understanding different types of revenue models supported by the adoption of digital technologies, the silos strengthened by structures that are against changes, the executive support and data governance are examples of some of the components listed in this study to understand the digital transformation.

In addition to the elements surrounding an organization, through the case studies and specialists' opinions this study found out that practices that keep an organization connected with the external environment; the use of data to develop future strategies; the dissemination of a digital mindset; the agility to lead the strategy; the capacity to create digital products; the flexibility of the business model considering partnerships; the navigation through innovation ecosystems; the flexibility of internal structures and the improvement of digital maturity represent capabilities that, when developed internally, will cause organizations to generate a competitive advantage during digital transformation.

Keywords: Digital Transformation; Dynamic Capabilities; Information Systems; Incumbent Organizations.

RESUMO

Esta tese investiga a temática de transformação digital, compreendida como a revolução promovida pelas tecnologias digitais na estratégia e nos sistemas de trabalho de uma organização, gerando uma reformulação dos modelos de negócios pré-estabelecidos, criando melhores interações com as pessoas clientes e otimizando os processos a fim de produzir resultados financeiros favoráveis e sustentáveis.

De acordo com dados empíricos, apenas algumas empresas têm sucesso na transformação digital e vão além das etapas iniciais da mudança. Expectativas irrealistas, falta de apoio financeiro, foco restrito em tecnologias, governança deficiente e subestimação das barreiras culturais são exemplos de falhas que ocorrem ao longo da transformação digital, especialmente em organizações que estabeleceram seus modelos de negócio em um ambiente pré-Internet.

Diante de tal contexto, esta pesquisa visa examinar as definições, os desafios e explicar a transformação digital à luz de um modelo baseado na teoria das capacidades dinâmicas.

Dada a complexidade do tema, esta tese foi organizada em três artigos inter-relacionados que utilizaram como abordagens metodológicas a revisão sistemática de literatura, a Design Science Research (DSR) e estudos de caso múltiplos, respectivamente.

Os resultados apresentados evidenciam que a transformação digital é um fenômeno que pode ser explicado a partir de gatilhos, barreiras, estruturas habilitadoras e impactos gerados nas organizações. Elementos como a revisão da proposta de valor que a organização oferece, o entendimento dos diferentes tipos de modelos de receita suportados pela adoção de tecnologias digitais, os silos fortificados pelas estruturas que se encontram avessas à mudança, o apoio do corpo executivo e a governança dos dados, exemplificam parte dos componentes listados neste trabalho para compreender a transformação digital.

Além dos elementos que circundam a organização, esta pesquisa constatou através dos estudos de caso e das opiniões de pessoas especialistas, que práticas que mantenham a organização conectada com o ambiente externo, o uso de dados para o desenvolvimento das estratégias futuras, a difusão de uma mentalidade digital, a agilidade ao guiar a estratégia, a capacidade de criar produtos digitais, a flexibilização do modelo de negócio considerando parcerias, a navegação em ecossistemas de inovação, a flexibilização das estruturas internas e o aumento da maturidade digital, representam capacidades que, quando desenvolvidas internamente, farão com que as organizações gerem vantagem competitiva durante a transformação digital.

Palavras-chave: Transformação Digital; Capacidades Dinâmicas; Sistemas de Informação; Organizações Incumbentes.

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ABBREVIATIONS

BM	Business Model
CDO	Chief Digital Officer
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CUH	Coimbra University Hospital
COVID-19	Coronavirus disease of 2019
DSR	Design Science Research
DT	Digital Transformation
DTS	Digital Transformation Strategy
GDPR	General Data Protection Regulation
HDT	Head of Digital Transformation
IP	Intellectual Property
IoT	Internet of Things
IS	Information System
IT	Information Technology
LMS	Learning Management System
MBA	Master of Business Administration
Ph.D.	Doctor of Philosophy
R&D	Research and Development
RBV	Resource-Based View
SLR	Systematic Literature Review

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1 INTRODUCTION

1.1 Motivation

With the emergence and maturity of digital technologies (e.g., social networks, mobile telephony, big data, and artificial intelligence), organizations in every segment are pursuing a range of initiatives to leverage their benefits in their business models (Vial, 2019). We have seen the rise of digital products and services during the last two decades, changing business models and creating new markets (Lucas & Goh, 2009). Companies, such as Uber, Spotify, Netflix, YouTube, Google, Facebook, and others spurred a disruption by adopting digital technologies to create new customer experiences.

Given the increased competition promoted by globalization and the importance of a customer-centric approach, organizations have sought to become digital ahead of others to survive and gain a competitive advantage (Singh & Hess, 2017). The downfall of long-established and successful organizations, such as Blockbuster, Nokia, and Kodak confirms that market conditions are continually changing, and businesses need adaptable capabilities to keep competitive and sustainable (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013).

Organizations are discovering that becoming a digital leader is not merely a matter of technical knowledge; it is about creating a flexible structure capable of identifying market changes and reacting quickly with the most competitive solution (HBR, 2017). They should exploit opportunities and protect themselves against threats by the constant and proactive transformation. This scenario enabled the emergence of a new strategic thinking called Digital Transformation (DT).

DT refers to an initiative whereby organizations continuously engage in digital innovation to develop or improve products, services, and business models to gain or keep their competitive advantage (Nadkarni & Prügl, 2020; Vial, 2019). The term "*transformation*" describes organizations' capability to succeed in a complex business scenario by adopting new technologies, such as social media, mobile, big data, analytics, cloud, and Internet of Things in their routines (Vial, 2019; Singh & Hess, 2017).

A survey conducted by Fitzgerald, Kruschwitz, Bonnet, and Welch (2013) with 1559 executives shows that 78% of the respondents believe that achieving digital transformation will become crucial to their organizations in the following years. Despite being a relevant topic in executives'

agenda, Wade and Shan (2020) observed that only one out of eight DT initiatives could be considered successful by the people involved. The authors noted that factors, such as unrealistic expectations, lack of financial support, limited focus on digital technologies, poor governance, and underestimation of cultural barriers increase the chances of failure in DT.

In order to succeed in their DT initiatives, organizations must build a wide range of capabilities, which will vary in importance depending on their business context and specific needs (Sebastian, Ross, Beath, Mocker, Moloney, & Fonstad, 2017). Since organizations seek to develop new products and services, they will need to implement deeper changes in their Information Systems (IS) and operational model to support new value propositions (Gimpel et al., 2018). In addition to new services, products, and digital channels, distinct forms of value creation empowered by digital technologies will demand changes in organizations' purpose and identity (Wessel, Baiyere, Ologeanu-Taddei, Cha, & Blegind-Jensen, 2021). The implementation of these changes modifies how organizations recognize their strategy, structures, business model, customer experience, digital technologies adoption, and firm performance (Vial, 2019).

Given the diversity of perspectives to explain Digital Transformation, it is unsurprising that the topic has gained more visibility in IS research in recent years. By searching the term "*digital transformation*" on the Association for Information Systems database, it is possible to identify an accelerated academic production growth. In 2020, 575 academic studies were published in conferences – 317 more in comparison with 2016, when there were 258 papers.

Notwithstanding the increasing attention DT has gained, it is still an emerging field, and more academic studies are required to consolidate definitions, propose new models supported by theories, and demonstrate the phenomenon empirically (Wessel et al., 2021; Vial, 2019; Warner & Wäger, 2019; Gimpel et al., 2018).

1.2 Research Gaps and General Goal

DT combines several topics, such as strategy, technology, and organizational change that have a strong tradition in the Information System's research domain. While organizations, governments, and society shed light on the topic, uncertainties regarding whether DT is a new phenomenon or simply a market label arise. To improve the general understanding of the subject, Nadkarni and Prügl (2020) and Vial (2019) defined *DT* as a business-centric change that uses IT as a critical asset. In essence, DT is more than the automation of processes; it

requires in-depth cultural changes to transform structures, roles, skills, technology usage, and the value proposed to customers (Nadkarni & Prügl, 2020; Vial, 2019).

Additionally, Wessel et al. (2021) noticed that differently from an IT-enabled organizational transformation, DT activities leverage digital technology in (re)defining an organization's value proposition instead of supporting it. They also highlighted that such activities promote a new organizational identity in lieu of a simple enhancement of it. In other words, DT means more than changing processes from analog to digital, denoting the use of digital technologies leading organizations to become digital businesses.

Vial (2019), Nadkarni and Prügl (2020), and Wessel et al. (2021) made substantial contributions by conceptualizing, framing, and characterizing Digital Transformation as a distinct phenomenon in the general IS discussion. However, there is still an opportunity to deeply explore definitions and challenges and describe the phenomenon through the lens of academic frameworks.

Although there are practical investigations, like those conducted by Fitzgerald et al. (2013) and Westerman, Calm ejane, Bonnet, Ferraris, and McAfee (2011), there is still a deficit in academic results connecting DT with a consolidated theory. In this sense, Vial (2019) and Warner & Wager (2019) suggested the dynamic capabilities as a theoretical foundation to explore the unique capabilities firms are building to promote the ongoing DT. In view of the foregoing, new research describing how firms design mechanisms that enable them to continuously adapt considering the accelerated changes emerge as a field to be explored academically (Warner and Wager, 2019; Vial, 2019).

Finally, incumbent organizations have been dealing with challenges to take advantage of the opportunities promoted by DT. Chanias, Myers, and Hess (2019) reported them as companies belonging to traditional industries, such as education, retail, automotive, or financial services, which were financially successful in the pre-digital economy. Despite the past of glory, incumbents' value has diminished by the market revolution promoted by digital-native companies.

To close the previously discussed gap, we divided this research into three related papers with the following research questions each:

1. How do we analyze digital transformation in light of definitions, challenges, and frameworks?
2. What are the dynamic capabilities that incumbent firms need to develop for digital transformation?
3. How do dynamic capabilities are essential to higher education institutions' digital transformation?

Considering the contextual conditions, diversity, and chronological characteristics, it is easy to note how relevant and complex DT is. From that perspective, the general purpose of this study is to conduct a deep analysis of definitions, challenges and explain DT by proposing a dynamic capability framework.

By describing the phenomenon considering the relevant existing knowledge, we aim to contribute to the Information System research field by giving new insights into two intertwined areas: business transformation (e.g., describing elements that encompass DT beyond digital technologies) and the emerging digital transformation field (e.g., providing a framework based on dynamic capabilities microfoundations).

Additionally, supported by previous research on Information Systems and Strategic Management, our framework offers new theoretical insights into the elements and capabilities incumbent organizations need to consider when undergoing DT.

1.3 Chapters

We divided this study into five chapters. In the first chapter, we present the research motivation and its purpose.

To answer the research questions, we organized this study in three complementary chapters structured as papers. Table 1.1 shows each of the chapters mentioned above detailing their titles, research questions, specific goals, and the methodological approach.

Title	Research Questions	Specific Research Goals	Methodology
Understanding Digital Transformation in Light of Definitions, Challenges and Frameworks: A Systematic Literature Review	What are the definitions of digital transformation? What are the challenges of digital transformation? What are the frameworks proposed by academia to analyze the digital transformation process in organizations?	<ul style="list-style-type: none"> - Define digital transformation. - Identify the main challenges regarding digital transformation. - Identify academic frameworks that explore digital transformation. 	Systematic Literature Review
Digital Transformation and Dynamic Capabilities: A Framework Proposal	What are the dynamic capabilities that incumbent firms need to develop for digital transformation?	<ul style="list-style-type: none"> - Identify the digital transformation triggers of in incumbent firms. - Identify the internal enablers that support digital transformation in incumbent firms. - Identify the internal barriers that hinder digital transformation in incumbent firms. - Identify the expected outcomes of digital transformation in incumbent firms. - Identify the strategic renewal caused by digital transformation in incumbent firms. - Describe the dynamic capabilities microfoundations required for digital transformation in incumbent firms. 	Design Science Research Demonstration in an empirical case (Coimbra University Hospital) and a survey with experts
Reshaping Education Institutions in Times of Digital Transformation: Findings from a Dynamic Capabilities Model	How do dynamic capabilities are essential to higher education institutions' digital transformation?	<ul style="list-style-type: none"> - Demonstrate the digital transformation journey in higher education institutions. - Describe the main dynamic capabilities developed by higher education institutions during digital transformation. 	Case studies with higher education institutions

Table 1.1 - A full overview of the chapters that aim to answer the research questions

In the second chapter, we analyze definitions, challenges, and frameworks regarding digital transformation supported by a systematic literature review of the most prominent academic papers.

In the third chapter, we present a framework that generically describes the triggers, enablers, barriers, dynamic capabilities, expected outcomes, and strategic renewals that encompass digital transformation in incumbent organizations by using a design science research method.

The fourth chapter presents three case studies in higher education institutions (HEIs) undergoing digital transformation through the lens of dynamic capabilities theory. We chose HEIs because, unlike other sectors, such as retail and financial, academic institutions have changed at a slow pace without considering how to streamline processes and enhance student's experience.

In the fifth chapter, we finish this study by discussing its prominent academic and practice contributions. Finally, we address some limitations and how these create opportunities for future research.

For a thorough understanding, we recommend reading all the chapters in a sequence. However, we have written the content so that each chapter is relatively independent.

2 UNDERSTANDING DIGITAL TRANSFORMATION IN LIGHT OF DEFINITIONS, CHALLENGES AND FRAMEWORKS: A SYSTEMATIC LITERATURE REVIEW¹

Abstract

Digital transformation (DT) is a phenomenon that has been changing markets and the way organizations are using technology. Business model innovations, the development of new digital solutions, and the demand for a digitally skilled workforce are examples of challenges that organizations have been facing to sustain and gain competitive advantage. Given the pace at which the digital evolution is influencing industries globally, this research presents a systematic literature review of leading academic publications to explore definitions, challenges, as well as execute an examination of frameworks that support organizations toward digital transformation. A string-based search in four databases and nine journals identified a total of 547 papers, of which 38 primary studies were included for analysis. A total of 20 definitions of digital transformation were found, a group of 9 challenges was identified, and 7 frameworks were reviewed. The results presented in this study are a useful body of knowledge for academics and practitioners who are leading DT inside organizations.

Keywords: Digital Transformation; Challenges; Frameworks; Systematic Literature Review.

¹ Is available a short version of this paper at the proceedings of the 2019 edition of CONF-IRM (International Conference on Information Resources Management) and 2020 edition of EnADI (Encontro de Administração da Informação from Anpad). We submitted a version of this paper to the Journal of Systems and Information Technology.

2.1 Introduction

The post-dotcom decade has seen firms taking advantage of lower price levels of computing as well as global connectivity to modify their business infrastructure to the new digital era (Bharadwaj et al., 2013).

Given the pace at which the digital evolution is influencing industries globally, it is only natural that most CEOs (Chief Executive Officer) feel pressured to find and deploy the right technology as fast as their budget allows. However, many CEOs have discovered that becoming a digital leader is not a matter of technical knowledge; it is about creating a flexible arrangement that identifies the type of essential changes and reacts quickly with smart solutions (HBR, 2017).

Scholars substantially agree that the right Information Technology (IT) and digital capabilities can enhance business performance (Nwankpa & Datta, 2017). These capabilities can enable the configuration and reconfiguration of different organizational resources rapidly and flexibly, helping the organization to sense and respond to changes in its environment (Yousif, Magnusson, & Pessi, 2017).

In order to leverage the possibilities offered by digital technologies and respond to digital disruptions, many established (Please note we will also use the term ‘incumbent’ in this paper) companies have begun to enhance their digital capabilities (Sebastian et al., 2017; Svahn, Mathiassen and Lindgren, 2017) and call this digital transformation.

A digital transformation is an initiative where organizations try to become digitally enable (Vial, 2019; Hess, Matt, Benlian, & Wiesböck, 2016). The term “*transformation*” relates to the ability of organizations to reach business changes by adopting new technologies such as social media, mobile, big data, analytics, cloud, and Internet of Things (Vial, 2019; Sebastian et al., 2017; Singh & Hess, 2017).

Despite its importance, a recent Gartner survey (Gartner, 2018) showed that just a small number of companies have been able to successfully scale their digital transformation initiatives beyond the experimentation and piloting steps.

The excitement for the topic has increased the academic production, but literature on the issue is yet limited (Vial, 2019). By searching the term “*digital transformation*” in the database of the Association for Information Systems, it is possible to recognize an accelerated growth in

academic productions. In 2019, there were 307 published academic studies – 261 more than in 2015, when 46 papers were published.

As Hess et al. (2016) noted, the recent studies in academia have focused on guiding particular perspectives of digital transformation. A holistic approach to digital transformation still needs to be discussed; after all, more companies are setting up digital transformation in their strategic agenda (Gurbaxani & Dunkle, 2019; Gimpel et al., 2018; Kane, Palmer, Phillips, Kiron, & Buckley, 2015).

A way to understand the digital transformation from a broad perspective is through the frameworks that are a guide for refining issues to be investigated as well as for creating measures and building analyses (Imenda, 2014). Gimpel et al. (2018) identified lack of models to support companies in structuring digital transformation initiatives, reason why it is necessary to examine theoretical, analytical, or practical representations of digital transformation for the improvement of the body of knowledge.

While there are practical investigations such as Fitzgerald et al. (2013) and Westerman et al. (2011), there is still a deficit in academic results reporting the value of digital transformation. Additionally, it is a new issue which requires frameworks to describe the connection, actions, and outputs for leading a digital transformation (Gimpel et al., 2018; Hess et al., 2016).

Given the limitations of previous research regarding digital transformation, this paper asserts that there is still an opportunity to deeply examine definitions and challenges, and to explain the phenomena through the lens of academic frameworks.

The purpose of this research is to review recent academic literature to answer the following questions: *(i) what are the definitions of digital transformation? (ii) what are the challenges of executing digital transformation? (iii) what are the frameworks proposed by academia to analyze the digital transformation process in organizations?*

As a general investigation of the characteristics related to digital transformation, this paper reviews and synthesizes what researchers are claiming about the topic with respect to definitions, challenges, and frameworks to shed some light on the research stream. This paper intends to compare the definitions concerning digital transformation, discuss the main challenges, and understand how the frameworks presented by the literature are representing the organizational change. The findings of this research can provide insights, improve the current

body of literature encompassing digital transformation, and contribute to both academics and managers alike.

As a methodological approach, we conducted a Systematic Literature Review (SLR) which is the primary method for synthesizing quality scientific studies based on a methodologically rigorous review of research results, which makes it possible to aggregate all the existing evidence for a research question (Kitchenham et al., 2009).

This paper has five sections. In the first section, we present the research motivations and its purpose. In section two, we report the research methodology used. Section three presents a review of the central academic literature in digital transformation. In section four, we provide conclusions emerged when answering the research questions. Finally, in section five we conclude the study by describing how each of the research purpose were achieved and suggest new research agendas.

2.2 Research Methodology

To answer the research questions, we adopted the Systematic Literature Review (SLR) approach, which is one of the main methods to synthesize quality scientific studies based on methodological rigor (Kitchenham et al., 2009). The required steps to carry out a transparent and reproducible methodological procedure are plan the review, develop the review, and present the review results (Ardito, Messeni Petruzzelli, & Albino, 2015).

While planning the review, we defined the research protocol. We conducted an exploratory literature review to refine the research protocol in order to reduce author's bias in the search. In this stage, we identified keywords and their synonyms, which, together with the Boolean operators, enabled the appropriate expansion and limitation of the search, generating the necessary strings to answer the research questions (Cooper & Schindler, 2011). Table 2.1 shows the keywords defined to collect academic papers.

Research question	Keywords
What are the definitions of digital transformation?	"digital transformation definition"
What are the challenges of executing digital transformation?	"digital transformation challenges"
What are the frameworks proposed by academia to analyze the digital transformation in organizations?	"digital transformation framework"

Table 2.1 - Applied research strings for collecting academic papers

A set of academic papers presented the term "*transformation*" with the terms "*disrupt*" and "*challenge*," and for that reason, we selected the words to compose the final query string (Vial, 2019). The following SQL-like syntax represents the search query: "*((abstract LIKE '%digital%') AND (abstract LIKE '%transform%' OR '%disrupt%' OR '%challenge%' OR '%framework%')) OR ((title LIKE '%digital%') AND (title LIKE '%transform%' OR '%disrupt%' OR '%challenge%'))*."

The EndNote bibliography software (www.endnote.com) was used to organize and categorize papers throughout the literature review process.

The research was carried out without limitation on papers' publication date, and included AISEL, Elsevier (Science Direct), Web of Science, and EBSCO databases. Additionally, the research considered papers written in the eight major journals in Information Systems (European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, Journal of the Association of the AIS, and MIS Quarterly). MIS Quarterly Executive records were incorporated, as the source is a suitable research database that balances practical case studies and academic support. The research was conducted from November 23, 2019 to January 31, 2020.

We carried out an exploratory search in the IEEE and ACM databases. However, the papers found in these repositories were restricted to computer science and, therefore, were not included in this systematic review.

Once the search was concluded, the duplicated files were excluded, resulting in a set of 547 documents that were analyzed.

In the review stage, we established a criteria process for excluding papers. We excluded papers that were not written in English and that were not published in a scientific or practical journal. Also, papers that were not available for download, master's theses and doctoral dissertations, and proceedings of conference papers were not considered for this review as well.

The selection of papers published in journals is in line with the relevance of such source in the production and dissemination of the academic state of the art (Ngai & Wat, 2002). The exclusion criteria generated 132 documents for analysis.

The selection of the studies was performed in multiple stages (Kitchenham et al., 2009). The first stage consisted of filtering studies' titles and abstracts by words such as "digital transformation," "digital transformation strategy," "digital challenge," or "digital disruption," resulting in 88 documents. Next, we carried an in-deep reading of the abstracts and titles, scanning for mentions of definitions, challenges, and frameworks, resulting in 56 articles read by us. Throughout the reading stage, we used quality criteria (Kitchenham et al., 2009) to refine the studies we would use in the analysis. Table 2.2 presents the criteria we employed. For the analysis, we selected studies with more than four "yes" in the criteria table.

Criteria	Score
Does the study present a theoretical and/or practical contribution?	Yes – 1; No – 0
Does the study use digital transformation-related concepts as major constructs?	Yes – 1; No – 0
Does the study use digital transformation-related concepts at the core of the theoretical section?	Yes – 1; No – 0
Are the research goals clearly stated?	Yes – 1; No – 0
Are the proposed techniques clearly described?	Yes – 1; No – 0
Is there a discussion about the study results?	Yes – 1; No – 0

Table 2.2 - Quality criteria for paper selection

Applying the systematic process shown in Figure 2.1, 38 papers were selected for further examination.

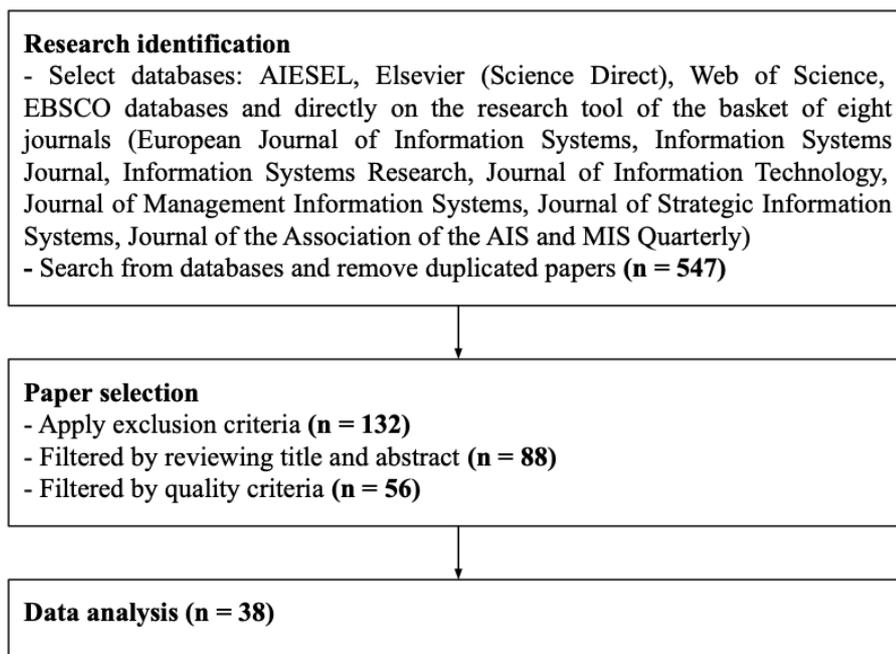


Figure 2.1 - Systematic Literature Review Process

Table 2.3 summarizes the two types of papers reviewed (academic and practitioner), the number of papers with empirical results, and the number of papers presenting a conceptual model.

Type of paper	Description	Empirical results	Conceptual	Total
Academic	Total papers gathered from Business and Management journals.	15	9	24
Practitioner	Total articles obtained from practical journals.	12	2	14
Total		27	11	38

Table 2.3 - Papers characteristics

The analysis of the frequency of articles per journal demonstrated that most papers were published in the MIS Quarterly Executive (Table 2.4 presents the top four journals identified). It is worth emphasizing that the beforementioned journal promotes practice-based research in the IS field and disseminates investigation connected with market trends.

Journal	Count
MIS Quarterly Executive	12
The Journal of Strategic Information Systems	4
Business Horizons	2
Pacific Asia Journal of the Association for Information Systems	2

Table 2.4 - Top four journals

Since the purpose of our systematic literature review is to examine the literature rather than consolidate the findings empirically, we limited our methodology to descriptive and qualitative

analyses. Therefore, we carried out an interpretative synthesis (Dixon-Woods et al., 2006) of the studies selected.

As noted by Dixon et al. (2006:37), interpretative synthesis involves processes similar to primary qualitative research in which the aim is to generate maximum explanatory value concepts. In this approach, the synthesis is achieved by incorporating the concepts recognized in the primary studies into a more subsuming theoretical structure.

The categorization strategy adopted in this study to identify definitions and challenges is similar to the principles applied in content analysis. The categorization focus went beyond the necessary bibliographic information.

The conceptual model presented by Vial (2019) was a starting point for the analysis of definitions and challenges. In the first step, we read the papers individually and developed open codes. We used a worksheet to facilitate the process of registering definitions stated and challenges mentioned. In the second step, we looked for connections between categories found in the previous step to aggregate them into more abstract concepts or classes.

The categorization results suggest twenty digital transformation definitions and nine group of challenges. Particularly for the definitions, we performed a hierarchical clustering procedure to discover connections between them. Agglomerative algorithms begin with n groups and, after a set of interactions, they will find a proper grouping solution (Ammirato et al., 2020). The groups identified were evaluated, and we proposed a new definition for digital transformation.

In the next section, we present the findings according to the classification and interpretations obtained from the research.

2.3 Findings

In this section, we present the findings of the systematic literature review in three subsections: (1) digital transformation definition, (2) digital transformation challenges, and (3) digital transformation frameworks.

2.3.1 Digital Transformation Definitions

The first step of our study consisted of examining the definitions of digital transformation, and we found 20 different definitions, presented in Table 2.5.

Author	Definition	Main takeaways
Schuchmann and Seufert (2015)	<i>“The digital transformation encompasses technology realignment and new business models to improve digital engagement with customers.”</i>	Use of technology as a path to reach customers and offer them a remarkable experience.
Karimi and Walter (2015)	<i>“Deploying digital platforms to create new ways of attracting and engaging audiences, offering digital solutions, and implementing a wide variety of online revenue models.”</i>	Use of technology to rethink a company’s business model and revenue streams.
Matt, Hess, and Benlian (2015)	<i>“A digital transformation strategy is a blueprint that supports companies in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation.”</i>	Change the business routine with the use of digital technologies.
Hess et al. (2016)	<i>“Digital transformation is concerned with the changes digital technologies can bring about in a company’s business model, which results in changed products or organizational structures or in the automation of processes. These changes can be observed in the rising demand for Internet-based media, which has led to changes in entire business models.”</i>	Use of technology to rethink a company’s products, organizational structures, and processes.
Reddy and Reinartz (2017)	<i>“Digital transformation refers to the use of computer and internet technology for a more efficient and effective economic value creation process. In a broader sense, it refers to the changes that new technology has on the whole; on how we operate, interact, and configure, and how wealth is created within this system.”</i>	The organizational capability to be reconfigurable by using digital technologies to create economic value.
Sebastian et al. (2017)	<i>“A digital strategy is a business strategy, inspired by the capabilities of powerful, readily accessible technologies (like SMACIT), intent on delivering unique, integrated business capabilities in ways that are responsive to constantly changing market conditions.”</i>	An organizational strategy that understands technology as a dynamic capability with the intent of delivering business value.
Haffke, Kalgovas, and Benlian, 2017	<i>“Digital transformation encompasses the digitization of sales and communication channels, which provide novel ways to interact and engage with customers, and the digitization of a firm’s offerings (products and services), which replace or augment physical offerings. Digital transformation also describes the triggering of tactical or strategic business moves by data-driven insights and the launch of digital business models that allow new ways to capture value.”</i>	Digital transformation has a link with strategic shifts in the business model, product and service offerings, as a result of the implementation of digital technologies.

Singh and Hess (2017)	<i>“Use of new digital technologies, such as social media, mobile, analytics or embedded devices, in order to enable major business improvements like enhancing customer experience, streamlining operations or creating new business models.”</i>	Use of new technologies to improve business performance, enhance customer experience, create new businesses, and achieve operational excellence. A digital transformation strategy guides the organization in its journey toward digital transformation.
Nwankpa and Dappa (2017)	<i>“Digital business intensity is a measure of the level of strategic organizational investments in emergent and innovative digital technology such as analytics, big data, cloud, social media, and mobile platforms in order to engage customers, connect people, place, and information in a seamless and economically sustainable model of operation.”</i>	Digital technologies and Information and Technology are essential capabilities to promote business development and improve a firm’s performance.
Gimpel et al. (2018)	<i>“Digital transformation refers to organizations’ managed adaptation as they capitalize on digital technologies to change business models, improve existing work routines, explore new revenue streams, and ensure sustainable value creation.”</i>	An organizational approach to use digital technologies to change business model, improve processes, create new revenue streams, and seeks sustainable growth.
Li, Su, Zhang, and Mao (2018)	<i>“Digital transformation highlights the impact of IT on organizational structure, routines, information flow, and organizational capabilities to accommodate and adapt to IT. In this sense, digital transformation emphasizes more the technological root of IT and the alignment between IT and businesses.”</i>	Aligning Information Technology and business strategies allows effective organizational change, strategic use of data, and smart automation.
Wiesboeck and Hess (2019)	<i>“Digital transformation has been defined as the use of new digital technologies, such as mobile, artificial intelligence, cloud, blockchain, and the Internet of things (IoT) technologies, to enable major business improvements to augment customer experience, streamline operations, or create new business models.”</i>	An organizational approach to use digital technologies to change business model, improve processes, create new revenue streams, and seek sustainable growth.
Chanas et al. (2019)	<i>“A Digital Transformation Strategy is supposed to coordinate, prioritize, and implement a pre-digital organization’s transformation efforts and, as a long-term objective, to govern its journey to achieve the desired future state of being digitally transformed. Its scope goes beyond the digitization of resources and involves the transformation of key structural and organizational aspects, the use of advanced information technologies (IT) or aspects of value creation including key products and services, leading to adjusted or completely new business models.”</i>	An organizational strategy that involves the transformation of structures and organizational aspects by using digital technologies as key resource to change the business model and the business value creation.
Warner and Wäger (2019)	<i>“The Digital Transformation is contingent on the strategic renewal of an organization’s business model, collaborative approach, and, eventually, the culture.”</i>	Digital technologies renew organizational strategy, impacting the business model, the culture, and how people collaborate.

Vial (2019)	<i>“Digital transformation is a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies.”</i>	Digitalization is a mix of disruptions, strategy answers, use of digital technologies, which will influence value creation, organization arrangement, and will produce positive or negative impacts.
Verhoef et al. (2019)	<i>“Digital Transformation is a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm.”</i>	Using digital technologies can transform organizational business models allowing a sustainable growth.
Svadberg, Holand, and Breunig (2019)	<i>“Digital transformation is described as a broader process of transforming an organization by affecting the organization’s business processes (for example, products, structures, processes, organizational behaviors), and is thus complemented by changes in business models.”</i>	The process of transforming organization's process and changing its business model.
Guinan, Parise, and Langowitz (2019)	<i>“Digital transformation encompasses an organization's ability to adapt, respond, and position itself for success in the face of rapid technological evolution.”</i>	The capability of being flexible in dealing with business changes and gaining a business advantage.
Gurbaxani and Dunkle (2019)	<i>“The reinvention of a company’s vision and strategy, organizational structure, processes, capabilities, and culture to match the evolving digital business context.”</i>	Reinventing strategy, structure, processes, and company capabilities to respond to the digital context.
Ponsignon, Kleinhans, and Bressolles (2019)	<i>“Digital transformation involves leveraging modern digital technologies to radically transform products and services, processes and people and improve performance.”</i>	Realizing business changes and leveraging digital technologies to achieve performance improvements.

Table 2.5 - Digital transformation definitions

By examining the twenty definitions, we identified ten central words: business, technologies, models, organizational, changes, strategy, processes, products, value, and technology (see Table 2.6). The results highlight that DT comes from a business-centric perspective rather than a technology-centric one.

Word	Frequency
business	19
technologies	11
models	9
organizational	7
changes	6
strategy	5
processes	5
products	5
value	5
technology	4

Table 2.6 - The top ten central words found in DT definitions

By interpreting the dendrogram represented in Figure 2.2, we noticed four groups of related definitions. The first group includes the definition by Chantias et al. (2019) and Haffke et al. (2017), which understands DT as a change that goes beyond process digitization and demands deep transformations of organizational structures, the advanced use of IT, improvement in value creation to adjust or generate an entirely new business model.

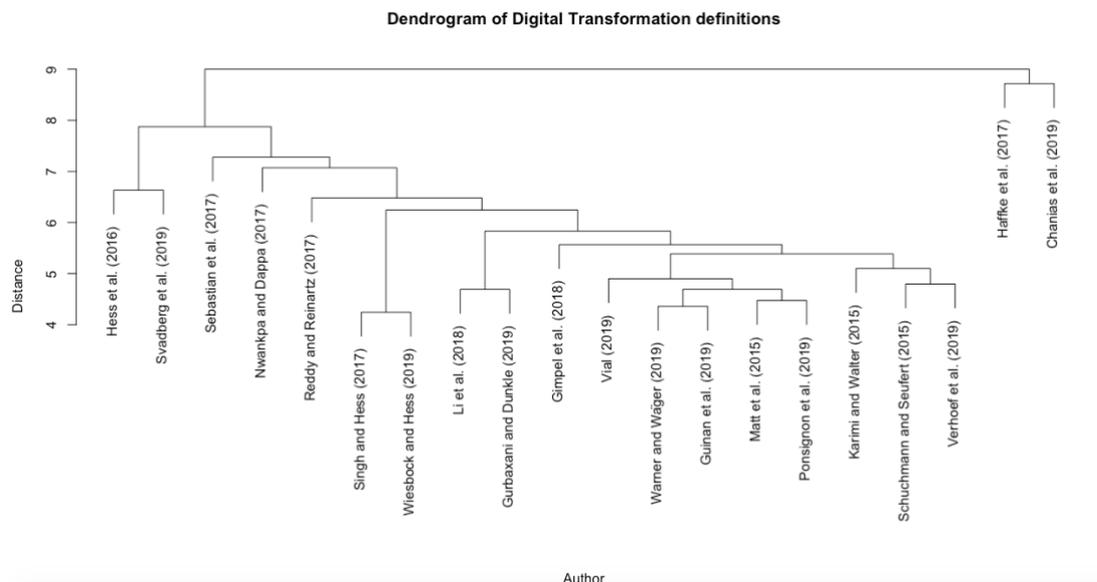


Figure 2.2 - Digital transformation definition similarities

Sebastian et al. (2017) description leads the second group of definitions. The authors explain the digital transformation as an organizational strategy that employs digital technologies capabilities to deliver business capabilities. Offerman, Stettina and Plaat (2017) define business capabilities as a particular skill business has or acquires to accomplish a corporate goal.

Hess et al. (2016) and Svadberg et al. (2019) formed the third group of definitions. The authors define digital transformation as the process of transforming the organization's process and its business model.

Finally, the last large group offers a broader viewpoint of digital transformation by relating the use of technology to rethinking the company business model, new revenue streams, business performance, and customer experience.

After the analysis performed, we propose the following definition for digital transformation: *“Digital transformation is the revolution fostered by digital technologies in organizations strategy and workforce systems, promoting a revamp on pre-established business models, customer interactions and business processes, producing favorable financial results and ensuring business sustainability.”*

Our findings are in line with Vial's (2019:121) understanding of digital transformation, which is *“a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies.”* Business models, customer interactions, and business processes are properties

to be changed by a new combination between digital technologies and strategy. Adding Vial's (2019) definition, we suggest that DT initiatives also produce favorable financial results and ensure business sustainability. After thoroughly reading the papers bearing the definitions, we recognized six different perspectives while defining digital transformation that will be presented below.

2.3.1.1 The Role of Information and Technology in DT

In light of technology disruptions and the dynamic promoted by the market change, organizations expect to rethink their strategies to stay competitive (Ponsignon et al., 2019; Gurbaxani & Dunkle, 2019; Guinan et al., 2019; Chanias et al., 2019; Nwankpa & Datta, 2017).

A collection of definitions reveals DT as a reinvention of the strategy of a company that recognizes technology as a powerful capability with the intent of delivering business value (Warner & Wäger, 2019; Gurbaxani & Dunkle, 2019; Nwankpa & Datta, 2017; Chanias et al., 2019; Singh & Hess, 2017; Matt et al., 2015; Bharadwaj et al., 2013).

Bharadwaj et al. (2013) propose a merging between organizational strategy and IT strategy as a passport to business differentiation. In other words, DT requires aligning IT and business strategies to allow an effective change in business model, flexible IT infrastructure, strategic use of new digital technologies, and smart use of data (Haffke et al., 2017; Nwankpa & Datta, 2017; Bharadwaj et al., 2013).

As opposite to seeing Information Technology as an internal asset, DT requires a more strategic view of technology to rethink a company's products, organizational structures and processes automation (Gimpel et al.; 2018; Hess et al., 2016; Bharadwaj et al., 2013). Organizations need to evolve from traditional Information Systems applications and utilization and scale to more innovative digital technologies such as social media, mobile, and data analytics (Nwankpa & Datta, 2017).

DT is an evolution of IT-enabled transformation that suggests enterprise process optimization, efficiency gains, and a channel boundary in IT artifacts (Vial, 2019).

2.3.1.2 Digital Transformation is about Strategy

By addressing strategy, Matt et al. (2015) suggest the concept of DT strategy (DTS) as "*focus on the transformation of products, processes, and organizational aspects owing to new*

technologies” (p. 339). The authors see DTS as a fundamental concept to integrate the complete coordination, prioritization, and implementation of digitalization.

To complement to the aforementioned, Warner and Wäger (2019) present DTS in a scope of how digital technologies renew organizational strategy impacting the business model, the culture, and how people collaborate.

More comprehensively, Chaniyas et al. (2019) define DTS as an organizational strategy that involves the transformation of structures and organizational aspects by applying digital technologies as an essential enabler to change the business model and the business value creation.

2.3.1.3 Changing Organization Arrangements

In addition to the strategic perspective, some authors highlighted the DT impact on operation arrangements, employee skills, and process changes (Gurbaxani & Dunkle, 2019; Svadberg et al., 2019; Gimpel et al., 2018; Li et al., 2018; Haffke et al., 2017; Hess et al., 2016; Karimi & Walter, 2015).

Rethinking the workplace, understanding digital skills, developing a digital mindset, and building organizational agility are capabilities required for a Digital Transformation (Warner & Wäger, 2019; Gimpel et al., 2018; Karimi & Walter, 2015). Organizations must identify their digital workforce maturity, recruit external digital talent, and leverage digital knowledge inside the firm to readapt in order to be optimal for a new digital strategy (Gurbaxani & Dunkle, 2019; Li et al., 2018).

The connectivity offered by the advanced application of digital technologies has facilitated the development of new institutional arrangements that support cross-service opportunities (Svadberg et al., 2019). DT demands a more flexible, integrated, and business-aligned IT, and the literature highlights cross-functional collaboration as an essential element for DT (Haffke et al., 2017).

2.3.1.4 Changing the Business Model

Business Model (BM) is an additional perspective seen in DT definitions. Some authors highlighted that DT is the adoption of technology to rethink a company’s products, organizational structures, and processes (Vial, 2019; Hess et al., 2016). Others recognized

technology as a way to change elements in BM to enhance business performance, improve customer experience, create new businesses, and achieve operational excellence (Verhoef et al. 2019; Svadberg et al., 2019; Warner & Wäger, 2019; Singh & Hess, 2017; Schuchmann & Seufert, 2015). By compiling the descriptions, we identify that DT has a connection with business model innovations as a result of the implementation of digital technologies (Chanas et al., 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Haffke et al., 2017).

2.3.1.5 Offering a Diverse Customer Experience

While there are various descriptions of DT, some of them advocate for the value of customer experience. In order to clarify that point of view, DT can be explained as the use of technology as a way to reach customers and provide them with a remarkable experience (Wiesboeck & Hess, 2019; Singh & Hess, 2017; Schuchmann & Seufert, 2015). Matt et al. (2015) pointed out that DT offers possibilities to enhance products and services, which means providing a portfolio of experiences during customer journeys.

2.3.1.6 Increasing Firm Performance

The latest aspect noted in the definitions studied is the presence of the firm performance. A radical technological cycle creates capability gaps for incumbent firms in the industry because it introduces new technical knowledge and alternatives, and new ways of improving firm performance (Karimi & Walter, 2015). According to such viewpoint, it is possible to define DT as the process of making business changes and leveraging digital technologies to achieve performance improvements (Ponsignon et al., 2019; Verhoef et al., 2019; Gimpel et al.; 2018).

2.3.2 Digital Transformation Challenges

After reviewing the papers, we identified nine group of challenge to achieve digital transformation (please see Table 2.7 for more details): business model innovation, culture, customer needs, data, IT capability, leadership, organizational structure, people, and strategy.

Category	Challenges	Authors
Business Model Innovation	Respond to the increased competition to eliminate entry barriers and reduce market limits.	Warner and Wäger (2019); Verhoef et al. (2019); Redd and Reinartz (2017); Schuchmann and Seufert (2015); Matt et al. (2015)
	Faster innovation cycles.	Gimpel et al. (2018); Redd and Reinartz (2017); Haffke et al. (2017)
Culture	Resistance to change.	Kane (2019); Eden et al. (2019); Tekic and Koroteev (2019); Warner and Wäger (2019); Vial (2019); Gimpel et al. (2018); Li et al. (2018); Lucas and Goh (2009)
	Willingness to take risks and experiment.	Chanas et al. (2019); Dremel, Herterich, Wulf, Mettler, and Brenner (2017); Haffke et al. (2017)
	Inertia created by path dependence, which reduces innovation.	Kane (2019); Tekic & Koroteev (2019); Vial (2019)
Customer needs	Respond to changing customer needs.	Warner and Wäger (2019); Vial (2019); Ponsignon et al. (2019); Verhoef et al. (2019); Gimpel et al. (2018); Hansen and Sia (2015)
Data	Access, integration, process, and investigate the extensive data volumes.	Adner, Puranam, and Zhu (2019); Gimpel et al. (2018); Bharadwaj et al. (2013)
	Privacy and data protection.	Gimpel et al. (2018); Redd and Reinartz (2017)
IT capability	Integrate new technology into an organization's fragmented legacy IS.	Vial (2019); Gimpel et al. (2018); Nwankpa and Datta (2017); Sebastian et al. (2017); Zhu, Dong, Xu, and Kraemer (2006)
	IT resources adaptability to fast-changing technologies to fully remodel businesses.	Guinan et al. (2019); Gimpel et al. (2018); Haffke et al. (2017)
Leadership	Leadership that does not integrate IT and business.	Vial (2019); Gurbaxani & Dunkle (2019); Tumbas, Berente, and vom Brocke (2018); Tanniru, Khuntia, and Weiner (2018); Singh and Hess (2017); Sia et al. (2016); Hansen, Kraemmergaard, and Mathiassen (2011)
Organizational structure	Break functional silos.	Guinan et al. (2019); Vial (2019); Verhoef et al. (2019); Chanas et al. (2019); Wiesboeck and Hess (2019); Gimpel et al. (2018); Dremel et al. (2017)
	High level of hierarchy.	Warner and Wäger (2019); Dery et al. (2017); Lucas and Goh (2009)
People	Dynamic change of organizational roles, skills.	Eden, Jones, Casey, and Draheim (2019); Tekic and Koroteev (2019); Verhoef et al. (2019); Guinan et al. (2019); Vial (2019); Dremel et al. (2017); Dery, Sebastian, and van der Meulen (2017)
	Compete for talent with new digital entrants.	Verhoef et al. (2019)

Strategy	Misalignment between IT and business strategy.	Guinan et al. (2019); Gurbaxani & Dunkle (2019); Riera and Iijima (2019); Yeow, Soh, and Hansen (2018); Wulf et al. (2017); Matt et al. (2015); Bharadwaj et al. (2013)
	Rigid strategic planning.	Chanas et al. (2019); Warner and Wäger (2019); Ponsignon et al. (2019); Tekic and Korteev (2019)

Table 2.7 - Digital transformation main challenges

The conceptual model presented by Vial (2019: 122) provided a starting point for our understanding of barriers, triggers, and impacts of digital transformation. However, by analyzing the papers in this review, we understood that digital transformation requires an internal approach (cultural, IT capacity, leadership, strategy, and people) and attend to external demands (customers and business model). The following sections will explain in detail the challenges reported by the literature.

2.3.2.1 Business Model Innovation

Understanding the new market logic (Redd & Reinartz, 2017), being flexible (Haffke et al., 2017), being ready for more accelerated innovation cycles (Redd & Reinartz, 2017), remaining aware of disruptive innovations (Warner & Wäger, 2019), and following customer needs (Schuchmann & Seufert, 2015) are hurdles that will impact the company's business model in the digital era.

The organizations that are not able to react to the new business dynamics (Verhoef et al., 2019) will lose market share. DT demands an active contribution of digital technologies in shaping and supporting organizations' strategies (Gimpel et al., 2018). Digital technology should guide innovation in how businesses are run and cause organizations to rethink and, perhaps, reinvent their business models to sustain competitiveness (Matt et al., 2015).

2.3.2.2 Culture

Based on Peter Drucker's statement that "*culture eats strategy at breakfast*", digital transformation will only succeed in a dynamic environment that fosters collaboration and has diminished the resistance to change (Vial, 2019; Lucas & Goh, 2009). Organizational culture has a crucial role in technology-enabled transformations (Warner & Wäger, 2019; Lucas & Goh, 2009).

For incumbents, change is a fundamental challenge, when it relates to peoples' mindset and attitude toward change, and the real place to implement changes, it is inside the company, not in digital assets (Kane, 2019; Tekic & Koroteev, 2019; Eden et al., 2019; Li et al., 2018).

The adoption of new technologies in the organization routine can produce workforce stress, fatigue, and the need to react to unexpected events continually (Vial, 2019; Eden et al., 2019). These circumstances demand a solid cultural foundation that will enable the organization's workforce to deal with the initial sense of turmoil caused by changes.

Frequent changes in employee's behavior and thought patterns will be crucial for the future workplace to support knowledge-intense work. Working in the digital economy requires dynamically bringing collaborative people together in project teams that compete in real-time for high-value tasks all over the world (Gimpel et al., 2018).

The extra cultural challenge is to break the inertia created by path dependence (Vial, 2019). The past success drives firms to maintain the existing relationships with customers and suppliers and follow well-established production processes that are highly optimized, but often rigid (Tekic & Koroteev, 2019).

The CDO (Chief Digital Officer) – a role responsible for changing management and innovation (Tumbas et al., 2018) –, is an agent that could lead the cultural shift in the c-suit level.

Another issue pointed out in culture-related studies was the need for firms to promote a willingness to take risks and experiment (Chantias et al., 2019; Dremel et al., 2017). Inspired by software development practices, organizations can learn quickly through small trials instead of executing extended plans (Dremel et al., 2017; Haffke et al., 2017). DT should promote an environment where failure and error should serve as an input for learning and not as a yardstick for punishment. In other words, it is cheaper and better to develop a mindset that sees failure as an opportunity to improve (Vial, 2019; Gimpel et al., 2018).

2.3.2.3 Customer Needs

The diversity of offerings, the shift of shopping behavior to online channels, the high expectations about service quality, and a more influential role of customers in transactions require organizations to develop the ability to know customer needs and experience (Verhoef et al., 2019). DT requires organizations to use digital technologies to transition from, or expand, the sales of physical products with the sales of services as an integral part of their value

proposition to meet customer needs, by offering innovative solutions as well as gathering data on customers interactions with products and services (Vial, 2019; Hansen & Sia, 2015).

Additionally, the use of digital technologies provides organizations with new ways of learning consumer insights by gathering data on shoppers journeys and across digital touchpoints (Gimpel et al., 2018; Hansen & Sia, 2015). Understanding customer needs by sensing external trends is a capability that allows organizations to promote better solutions (Warner & Wäger, 2019; Hansen & Sia, 2015).

All the circumstances presented earlier will “*bring the customer in*” and will help organizations improve customer satisfaction, increase customer loyalty and sales (Ponsignon et al., 2019; Hansen & Sia, 2015). Making decisions that focus only on processes efficiency and do not consider the customer’s point of view will cause businesses to lose competitiveness. Nowadays, clients require innovative value propositions that leverage digital technologies (Gimpel et al., 2018; Hansen & Sia, 2015).

2.3.2.4 Data

A DT process involves the development of a data-driven culture and the understanding of data as a strategic resource (Adner et al., 2019). A whirlwind of sources such as digital transactions, social media interactions, sensors, and mobile devices generates a significant amount of data. Organizations can be seen as an arrangement of “*data streams.*” However, giving a meaning to this intertwine of records requires a consistent process of integration, curation, and quality management (Gimpel et al., 2018). Big data and analytics should support a faster decision-making process (Bharadwaj et al., 2013).

Another vital challenge involves data ownership (i.e., the rights and control over data). Due to the high volume of data available, organizations should think of governance strategies to ensure their position and legitimacy (Gimpel et al., 2018; Redd & Reinartz, 2017).

2.3.2.5 IT Capability

Some authors addressed how challenging it is to integrate new technology artifacts into an organization's fragmented legacy Information Systems (Vial, 2019; Gimpel et al., 2018; Nwankpa & Datta, 2017; Sebastian et al., 2017; Zhu et al., 2006).

Sebastian et al. (2017) observed that for incumbents, developing an operational backbone (focus on efficiency and operational excellence) is a long, expensive, and transformative journey, but those companies need to promote digital services for the accelerated implementation of digital innovations. The company's ability to simultaneously explore new digital technologies and create a stable infrastructure enables it to execute its chosen digital strategy and, ultimately, deliver customer engagement and digitized solutions.

Adjustments are required when it comes to IT architecture. Organizations will need to maintain rigid information systems that demand a high support cost, usually such information systems are the backbone of operations and can impact negatively the business when they are unavailable, at the same time that add innovative solutions that generate business advantages with their IT assets (Vial, 2019; Gimpel et al., 2018; Zhu et al., 2006).

Increasing the strategic value of IT has challenged IT function's ability to appropriately assist organizations in reaching their innovation goals while sustaining the delivery of their reliable and secure IT services (Haffke et al., 2017). A flexible, lightweight technology infrastructure that supports continuous evolution will enable organizations to learn quickly and test new digital strategies (Haffke et al., 2017).

In DT, IT capability has re-emerged as an essential mechanism through which firms can create pervasive digital connections among activities and entities within the value chain (Nwankpa & Datta, 2017). IT capability describes a firm's ability to assemble and deploy IT-based resources in combination with other firms' resources (Bharadwaj, 2000). An organization's IT capability enables firms to benefit from emerging digital technologies and respond to changing market demands (Nwankpa & Datta, 2017). Organizations with the ability to plan and integrate their IT resources are better positioned to capture customer information, share knowledge, and enhance business processes (Gimpel et al., 2018).

2.3.2.6 Leadership

Without a clear understanding and alignment of the senior executive team, there will hardly be any engagement, political strength, and social capital for DT to happen (Vial, 2019; Gurbaxani & Dunkle, 2019; Tumbas et al., 2018). Building that leadership unit requires synchronous improvement and alignment between IT and business (Tanniru et al., 2018; Sia et al., 2016).

Different leadership roles have emerged to conduct DT (Tumbas et al., 2018; Singh & Hess, 2017; Sia et al., 2016; Hansen et al., 2011). One of them is the CDO, which is committed to develop digital capabilities in relevant domains and successfully use various technologies to generate new revenue, increase operational efficiency, and respond to the warnings and possibilities resulting from digitalization (Tumbas et al., 2018; Singh & Hess, 2017). The CDO plays the role of an integrator supporting the achievement of DT, removing barriers, and promoting close collaboration between business and IT (Tumbas et al., 2018; Singh & Hess, 2017).

2.3.2.7 Organizational Structure

DT will only succeed if an organizational shift occurs. Such a change will require a rupture of the existing silos among the different areas and a flattening of the hierarchy level to produce the necessary collaboration to respond to market changes (Guinan et al., 2019; Vial, 2019; Gimpel et al., 2018; Dremel et al., 2017; Lucas & Goh, 2009). Removing the existing barriers inside the business will enable a better communication flow, a diverse team and will allow the release of flexible arrangements (Warner & Wäger, 2019; Chanias et al., 2019; Guinan et al., 2019).

Wiesboeck and Hess (2019) presented three different ways of eliminating high hierarchy and strong silos. The first strategy is to allocate the tasks relating to an organization's DT efforts to its IT department and put the Chief Information Officer (CIO) in charge of it. A second approach is to create a new operation to organize the DT. As the head of such departments, organizations usually appoint a Head of Digital Transformation (HDT) or even decide to establish the role of CDO. The third way presented is to strictly divide an organization's digital business activities from the core business and institute a dedicated digital business unit with a particular budget and accountability to run the business unit.

Regardless of the organizational chart, businesses should find ways to create flexible configurations (Dery et al., 2017). Hierarchical structures, with a top-down management approach, are not favorable in fast-changing circumstances. This type of structure brings a load of bureaucracy, slowing down response and innovation pace (Verhoef et al., 2019; Dery et al., 2017).

Gimpel et al. (2018) recommended an organizational agility approach, which means using approaches such as agile project management, process flexibility, lean start-up, design thinking,

continuous deployment, and integrated development and operations. Fast-changing customer demands and delivering innovative products challenge well-established methodologies as the digital economy propagates agility as a core value. Companies will need to reconfigure previous methods that rely on predictability, uniformity, and consistency.

2.3.2.8 People

Organizations that are undergoing DT should rethink their roles and workforce skills (Vial, 2019; Eden et al., 2019; Verhoef et al., 2019; Gimpel, 2018; Dremel et al., 2017).

Employees will need to be encouraged to perform roles outside their regular positions and will be bound to cultivate a willingness to take risks, experiment and develop the ability to engage with stakeholders across the business (Guinan et al., 2019; Vial, 2019; Dremel et al., 2017; Dery et al., 2017).

From a human resource management perspective, DT requires the attraction of digital and analytical skilled workers (Verhoef et al., 2019; Dremel et al., 2017). Additionally, incumbents are challenged to attract talent when confronted with digital entrants (Verhoef et al., 2019).

Continued agile development training, collaborative work, digital tools, ways of developing solutions based on customer's perspective, and data analytics will be necessary during the transition period for the build of employees' digital skills (Guinan et al. 2019; Eden et al., 2019; Vial, 2019; Verhoef et al., 2019; Singh & Hess, 2017).

2.3.2.9 Strategy

DT suggests a change in the traditional strategy view to overcome difficulties like business and IT misalignment, and rigid strategic planning (Warner & Wäger, 2019; Bharadwaj et al., 2013). DT is more than embedding digital assets; it is about connecting digital technologies with the organizational strategy (Yeow et al., 2018; Wulf et al., 2017). Changes in the digital age requires businesses to upgrade their strategic mindset for continuous innovation term and quickly fix modifications as well (Yeow et al., 2018; Matt et al., 2015). The development of a DT strategy requires a mix of high-level support and bottom-up strategizing. Considering that formal strategizing tended to be restricted by politics, informal strategizing (bottom-up) became a more fertile source for promoting DT (Chanias et al., 2019).

In order to address the need for alignment between IT and business, organizations have to produce a clear and integrated DT goal statement (Gurbaxani & Dunkle, 2019). Ponsignon et al. (2019) found patterns for digital strategy purposes, such as improving customer experience and engagement, efficiency, decision-making, innovation, or transforming the business model. In another study, Riera and Iijima (2019) presented four categories of business purposes that can be achieved when the proper alignment between IT and business happens: financial, customer, business process, and learning and growth.

Tekic and Kortelev (2019) recognized that business model readiness for digital and mastery of digital technologies, would define the digital transformation initiative strategy.

2.3.3 Digital Transformation Frameworks

The following section provides a summary of the frameworks found in the literature review. Frameworks help to demonstrate an understanding of concepts that are important to the topic in analysis and, in the case of DT, can be useful to guide organizations toward their changes. We carefully examined the studies selected and created a table of aspects that the framework recommends to be transformed by DT, its theoretical background, and the confirmation or not of the empiric validation of the study (please see Table 2.8).

Conceptual framework	What to transform (what needs to be transformed)?	What is the theory's background?	Was the study empirically validated?
Hess et al. (2016)	Adoption of technologies, change in value creation, structural changes, and financial aspects.	Not stated.	Yes
Gimpel et al. (2018)	External perspective (customer and value proposition), internal perspective (operations and organization), data and transformation management.	Grounded theory.	Yes
Loonam, Eaves, Kumar and Parry (2018)	Strategic-centric actions (business model innovation), customer-centric actions (customer needs and expectations), organizational-centric actions (reshaping structure and change management), and technology-centric actions (information systems integration and data insights).	Not stated.	No
Wiesboeck and Hess (2019)	The development and implementation of digital innovations; dealing with the enablers of digital innovations; creating governance structures.	Not stated.	No
Warner and Wäger (2019)	Strategic renewal and changes in business models, collaboration approach, and organizational culture.	Dynamic capabilities.	Yes
Vial (2019)	Use of digital technologies, change in value creation and structural changes.	Not stated.	No
Gurbaxani and Dunkle (2019)	Company strategic vision, investments in DT, culture for innovation, intellectual property assets and know-how, digital capabilities, and use of digital technologies.	Not stated.	Yes

Table 2.8 - Digital transformation frameworks

2.3.3.1 Digital Transformation Framework

Hess et al. (2016) identify that DT combines changes in products, processes, organization structures, and management. In other words, the authors stated that DT demands a severe shift in the activities, processes, capabilities, and structures of organizations so that they can react to market changes in an agile way by using digital technologies as strategic allies.

The framework created by Hess et al. (2016) states four elements for DT: use of technology, changes in value creation, structural changes, and financial aspects. To demonstrate the dimensions presented in the framework, the authors conducted three case study on German media companies.

The use of technology's dimension specifies the strategic role of IT (enabler or supporter) and how proactive and innovative the unit is for the business (innovator, early adopter, or follower). The changes in value creation identify the impacts of DT on the organizational business model and provide a predictive analysis of the challenges and opportunities related to the digital transformation. The structural change dimension is about who will be in charge of the DT, determine whether there should be new digitally enabled services, think about the types of operational settings to consider, and decide if the organization may also need specialized know-how. Finally, the financial aspect dimension explains the organizational financial ability for DT by analyzing the financial pressure and the necessary financial resources.

The framework application has a coverage limitation due to the limited number of cases (three case study), and all of them occurred in media companies. However, the produced insights and the questions presented in each dimension help managers with DT assessments and development of the next steps.

2.3.3.2 Structuring Digital Transformation: A Framework of Action Fields

Gimpel et al. (2018) introduced a framework for understanding and running digital transformation among six action fields which merge external perspective (customer and value proposition), internal perspective (operations and organization), data, and transformation management.

In the Customer dimension, the authors spotlight the importance of sustaining customer relationship (customer management), learning from customer feedback to create smart solutions (customer insights), engaging in multi and omnichannel to cooperate with customers in a further target-oriented approach, and supporting customers via different channels simultaneously (hybrid customer interaction). Another external perspective highlighted in the framework is the Value Proposition; customers ask for innovative value propositions, and digital technologies leverage them, enabling the rise of individualized smart products and services. Finally, digital ecosystems help organizations rapidly propose new products and services to a global base.

While the digital and real worlds continue to blend, companies should rethink their operating models, business processes, and supply networks. According to Gimpel et al. (2018), organizations reach such ubiquitous conditions supported by an integrated IT infrastructure and digital operations that improve the supply networks and manufacturing capabilities. Offering

consistent customer experience combined with smart products and services depends on seamless data processing and systems integration, which the authors have represented in the Operations and Data dimensions.

While improving their IT basis, businesses also benefit from promoting digital technologies that allow them to remodel their businesses fully.

Social media, digital transactions, embedded sensors (e.g., Internet of Things), and mobile devices are new data sources that drive data explosion. The authors mentioned that a key challenge involves data integration. The authors warn that many data-driven applications such as recommendation systems or predictive analytics, in addition to integrated data, require high-quality data.

Another important aspect related to the increasing amount of available data and data-driven business models is data ownership. The business that collects or hosts specific data enjoys the use rights or possession. The authors bolstered that data ownership and privacy (i.e., the rights and control over data) are highly relevant factors in defining competitive positioning and should be elements of an organization's data strategy.

Gimpel et al. (2018) recommended that DT demands organizational agility, which is the use of approaches such as agile project management, process flexibility, lean start-up, design thinking, continuous deployment, and integrated development and operations. Additionally, changes in employee's behavior and thought patterns will be necessary for the future workplace. Work in the digital economy requires digital skills and a digital mindset. The action items aforementioned represent the Organization dimension.

According to the authors, the last dimension (Transformation Management) will help companies to explain how to adjust the as-is toward a digitally enhanced target state.

Even the broad academic background that bears the framework mentioned above holds a lack of sufficient empirical evidence. Additionally, Gimpel et al. (2018) presented the action fields exclusively on the organization's boundaries lacking an assessment of the impact and influence of external variables, which often remain beyond the firm's control (e.g., disruptive digital competitors or disruptive digital technologies).

2.3.3.3 Managerial Actions for Digital Transformation Initiatives

Based on the analysis of a diversity of cases of companies that had faced the DT challenge, Loonam et al. (2018) introduced a framework that suggests DT as an arrangement of four key themes: business model innovation, customer understanding, organization reshaping, and technology integration.

Considering the strategic perspective, the authors observed three key business model innovations which drive DT: producing new digital businesses (connecting the digital and real-world); rebuilding value delivery models (the merging of products and services to obtain a comprehensive customer view) and reexamine value propositions (recognizing unsatisfied customer needs).

The customer-centric perspective sheds light on the importance of producing an outside-in knowledge, engaging customers and digital communities in order to produce better experiences.

The organizational-centric viewpoint realized the value of cultivating a workforce digital culture. Additionally, a successful DT should have a clear perception of the key critical success factors (effective leadership, change management concentration, organizational-wide communication), and focus on the organization rather than the technology to achieve transformation.

Finally, the technology-centric perspective showed the importance of system integration, captured insights from data analytics, and built cross-platforms that reached all customer touchpoints.

The framework proposes a multifariousness perspective on DT, outlining that it has an interconnection between technology, business, organizational structure, and customer. The reviews of the case study presented practical actions for organizations that are facing the digital transformation. However, like most of the other conceptual frameworks considered, it has not been validated with empirical evidence.

2.3.3.4 The Three-ring Framework of Embedding Digital Innovations in Organizations

Wiesboeck and Hess (2019) organize digital innovations in organizations through a framework of three concentric theoretical rings: (1) the development and implementation of digital innovations; (2) the enablers of digital innovations; (3) governance structures.

The innermost ring of the framework introduces the concept of technology-driven development. The rise of new digital technology led to the development of new digital solutions, which triggered the development of different digital business concepts. However, the rise of an original digital business concept may then trigger the follow-up development of additional solutions, which, again, lead to the expansion of new complementing digital business concepts. Additionally, this stream is especially important to understand what causes organizations to implement digital changes (the development of new digital products and services; digital business processes; digital business models).

DT can only happen if organizations have the required combination of enablers for the process. The first enabler considers the general IS infrastructure and it needs to accommodate the changes triggered by digital technologies. Accordingly, organizations need to establish IS foundations that propose sufficient levels of centralization and flexibility. The second enabler is related to the organization structures. Without enough levels of agility, the organization will not be able to exploit the advantages granted by digital technologies. The third enabler is associated with culture. An organization culture defines how employees would accept the many changes induced by digital technologies. The last enabler explains the necessity of dedicated digital capabilities, as such digital capabilities allow organizations to use digital resources for innovation purposes.

Finally, the governance of digital innovations engages on discussions on how to structure DT (e.g., allocate the tasks relating to an organization's digital transformation efforts to its IT department or establish deliberative executive departments and assign them the task to coordinate an organization's digital transformation, or separate an organization's digital business activities from the core business and establish a dedicated digital business unit), the alignment of DT strategies with other organizational or functional strategies, such as IT or general business strategies, and the interplay of existing relational mechanisms as well as the design of novel relational mechanisms that facilitate digital innovations.

The framework proposes a path to study the DT phenomenon comprehensively. The perspectives (also named rings) presented by Wiesboeck and Hess (2019) advance DT's debate, describing new research fields to explain the phenomenon. The major limitation noticed in the framework is that it is purely theoretical without any empirical evidence that tests its hypothesis.

2.3.3.5 Building Dynamic Capabilities for Digital Transformation

Warner and Wäger (2019) proposed and developed a dynamic capability framework to investigate DT in organizations. The authors observed that DT usually rises with the strategic renewal regarding the incumbent's business model and advances in business models, leading to broader shifts in the firm's collaborative approach, which, if performed precisely, will eventually lead to more significant advances in organizational culture.

The framework development is a union of senior consultants' accumulated knowledge and their DT experiences and the application of the model in organizations across different industries.

The starting point of the framework is the external triggers, which include disruptive digital competitors, changing consumer behaviors, and disruptive digital technologies that precede the raising of dynamic capabilities. Supporting the dynamic capabilities development, the authors specify three core enablers (cross-functional teams, fast decision making, and executive support) along with three core barriers (rigid strategic planning, change resistances, and a high level of hierarchy).

Teece (2014) claims that dynamic capabilities consist of sensing, seizing, and transforming. Sensing involves *"identification, development, co-development, and assessment of technological opportunities about customer needs"* (Teece, p. 332). According to the framework proposed by Warner and Wäger (2019), digital sensing consists of digital scouting (scanning for technological trends, screening of digital competitors, sensing customer-centric trends), digital scenario planning (analyzing scouted signals, interpreting future digital scenarios, and formulating digital strategies) and digital mindset crafting (establishing a long-term digital vision, enabling an entrepreneurial mindset, and promotion of a digital mindset).

The second capability is seizing, whereby the organization mobilizes resources to capture the opportunities identified by sensing (Teece, 2014). Warner and Wäger (2019) found that digital seizing consists of rapid prototyping, balancing digital portfolios, and strategic agility.

Ultimately, the third capability is transformation, which produces a sustained revitalization, including asset arrangement and redeployment (Teece, 2007). According to Warner and Wäger's (2019) framework, the digital transformation consists of navigating innovation ecosystems (joining a digital ecosystem, interacting with multiple external partners, and exploiting new ecosystem capabilities), redesigning internal structures (hiring a chief digital

officer, digitalization of business models, and designing team-based structures), and improving digital maturity (identifying digital workforce maturity, external recruiting of digital talent, and leveraging digital knowledge inside the firm).

The use of dynamic capability theory produced robustness to the framework. Additionally, from an academic point of view, it does an excellent job describing “*how-to*” to achieve DT. Nevertheless, like the other conceptual frameworks presented so far, it does not have an extensive empirical evidence to support its feasibility.

2.3.3.6 Building Blocks of the Digital Transformation Process

Vial (2019) presented another conceptual framework that seeks to explain the dynamics of digital transformation within an organization. The theoretical model recommended is the outcome of an extensive literature review.

The framework demonstrates connections that arose through the analysis across eight overarching building blocks describing DT as a manner where digital technologies operate a primary role in the creation as well as the reinforcement of disruptions taking place at the society and industry levels. Those disruptions trigger strategic responses on the part of organizations, which are central in the DT literature stream. The author claims that organizations use digital technologies to change the value creation paths they have previously relied upon to remain competitive. To that end, they must perform fundamental shifts and overcome barriers that limit their transformation effort. Those changes lead to positive results for organizations as well as, in some cases, for people and society, although they can additionally be associated with undesirable outcomes.

Vial’s (2019) framework could be useful for organizations in their quest to understand more broadly the barriers, the challenges, the changes, the expected outcomes, and the influence of technologies on DT. Another framework addition is the recognition of DT as an evolution of IT-enabled transformation. The artifact presented by Vial (2019) reveals the complexity of the environment in which firms operate and the disruptive impacts of digital technologies on individuals, organizations, and society. However, like the other conceptual frameworks reviewed, it does not have an extensive empirical evidence to support its feasibility.

2.3.3.7 Enterprise Digital Transformation

Gurbaxani and Dunkle (2019) proposed the Enterprise Digital Transformation framework that examines organization strategy, culture for innovation, ownership regarding relevant assets, digital capabilities, and use of digital technologies. The authors proposed the model from the assumption that DT is the reinvention of an organization's strategy, capabilities, processes, and culture.

To suggest the six framework components, the authors had the support of a dozen businesses and IT executives.

The strategic vision dimension measured if the company has a clearly defined strategic vision mapped for an understanding of digital needs, a DT strategy, if the senior executive team has a clear understanding of DT capabilities and how they will support business's goals, if the company has a digital leadership to define strategy, and if the digital strategy is clear.

The culture for innovation dimension focused on verifying if the organization owns a culture of risk-taking, if the environment recognizes the diversity of thinking, if the controlled failure produces learning, if the organization compensates innovation, and if the cultural resistance is not an obstacle.

The know-how and Intellectual Property (IP) dimension investigate if the organization is increasingly using software to improve operation performance, customer understanding, product know-how, and supplier interactions. Additionally, it assesses if the organization has sufficient IP assets to implement a strategic vision.

The digital capability dimension measures if the company uses digital expertise, technical talent, and digital skills to execute its strategy.

The strategic alignment dimension measures the company's willingness to fund uncertain digital initiatives, its short-term willingness to cannibalize existing revenue streams, the collaboration between strategic teams, if the organization has provisioned budget/resources to DT, and if the organization has invested in software over past three years.

Finally, the technology asset dimension checks the organization's adoption of technologies such as big data, data mining/analytics, mobile technologies, and cloud computing.

The framework suggests meaningful coverage of different aspects of designing the process of DT and how to measure it. The six dimensions and each of their indicators work in a way that creates a reference for organizations to understand the context as-is and to plan actions to keep advancing towards DT.

2.4 Discussions

In this section, we present a comparison between the frameworks, and we connect them with the challenges identified.

2.4.1 Framework Comparison

We concluded that all frameworks explain the components expected to accomplish digital transformation (for more details, see Table 2.8).

Warner and Wäger (2019) recommended the use of dynamic capability theory as an approach to explain the fundamental changes in the strategy of organizations that are dealing with DT. Considering the transformational nature of DT inside the organization, the resource-based theory offers a theoretical core to support future frameworks.

The frameworks proposed by Vial (2019) and Wiesboeck and Hess (2019) are an excellent basis to understand DT from a full conceptual perspective, in addition to providing sources for future academic studies.

Lastly, the other frameworks are general instruments to understand the stage in which the digital transformation is and provide guidance for planning the next steps required for organizational transformation.

2.4.2 Connections between Challenges and Frameworks

While cataloging the challenges and frameworks presented by the literature, a question arose concerning each framework's potential to meet the DT challenges.

The model proposed by Gimpel et al. (2018) was the only one capable of meeting all DT challenges recognized in the literature review. Some of the studied frameworks did not propose responses to cultural trials, such as the organization being open to taking risks and experiment, the difficulty in breaking the functional silos, the new talent competition, or the high level of hierarchization.

Another group of frameworks (four out of seven) did not discuss the struggle in dealing with privacy and data protection, as well as the difficulty in integrating new technologies into fragmented information systems.

After reviewing the different types of frameworks, we noted the complexity of understanding through the lens of a framework the impact of digital technologies on the innovation of the business model, the defense of a market position, the cultural changes, the rearrangement of the organizational structure, the demand for offering better customer services, the discipline of data management, the evolution of Information Systems assets, the change in leadership style, the hiring of new digital skills and the strategic planning adaptability.

2.5 Conclusion

This paper provides a first step to structure the existing literature landscape regarding digital transformation definitions, its challenges, and frameworks. In summary, the conducted SLR revealed some interesting insights concerning the research questions.

With respect to the definition, DT means organizations capability of using technologies for changing how they create value for customers, reviewing their business model, rethinking their structure, building data governance, transforming data into information, integrating IT resources, developing organizational agility, dealing with internal resistance, and designing new revenue models. It involves implementing digital capabilities to support business model transformations that impacts the whole organization, especially operational processes, resources, internal and external users, asserting that IT must be relevant strategically.

Organizations that are experiencing DT may face challenges like responding to the intensified competition due to the blurring of market boundaries and the removal of entry barriers, meeting customer needs, dealing with faster innovation cycles, struggling against the resistance to change, creating strategies more agile, taking risks, reducing organizational structure complexity, and shaking the inertia created by path dependence. Additionally, there are issues regarding how to ensure data protection, integrate new technology into an organization's fragmented legacy IS, and advance IT resources adaptability with fast-changing digital technologies to fully remodel businesses.

The presented frameworks can be a useful tool for academics and practitioners who are driving DT inside organizations. Gimpel et al. (2018) present essential answers on how to reach DT against the challenges identified in this study.

With respect to the limitations, this study is subject to several of them. First, the extension of the search string, the forward and backward search, and the quality assessment require further examination. Second, we did not add other databases such as “*Google Scholar*” or “*business source complete*” while sampling the documents. Third, the search string could consist of more contextual variables and should subdivide each variable to include relevant topics concerning the research field. Fourth, the selected papers were published in the peer-reviewed journals and written in English only. Papers published in conference proceedings and different languages were excluded. Lastly, we applied a manual process concerning coding the DT definitions and challenges. The use of tools to support the analysis could increase the validity and reliability of the results.

An extension of this study would contribute to demonstrate how the organizations are overcoming the DT challenges presented empirically.

Furthermore, despite being out of this research's scope, identifying the theoretical backgrounds that describe DT's phenomenon would be a significant task. However, we identified during the systematic literature review, as DT is a strategic issue, a group of papers used the dynamic capability theory as a theoretical lens. A thorough investigation of the theoretical backgrounds could give rise to other theoretical viewpoints.

Lastly, as DT is a phenomenon organizations are facing nowadays, it would be quite interesting to realize if it is possible to create a generic framework to understand the digital transformation in organizations.

3 DIGITAL TRANSFORMATION AND DYNAMIC CAPABILITIES: A FRAMEWORK PROPOSAL²

Abstract

This qualitative study presents a set of components that provoke, enable, and retard the building of dynamic capabilities for digital transformation. Digital transformation has been defined as the capacity of organizations to embed digital technologies inside their routine leading a shift on how these organizations create value for their customers, backed by a rethinking of their whole structure and processes, reshaping their business model. Motivated by empirical data and cases which report that just a small number of companies succeed in digital transformation initiatives beyond the experimentation and piloting steps, we propose a framework that generically describes the triggers, enablers, barriers, dynamic capabilities, expected outcomes and strategic renewals that encompass the digital transformation in incumbent organizations. Following a design science research approach, we proposed an artifact that was demonstrated and evaluated by a set of experts. Our findings reveal that digital transformation is an ongoing journey of adapting technology and strategy, evolving the business model, building a culture of collaboration, supporting the development of people, creating smart governance structures, and connecting deeply with the customer.

Keywords: Digital Transformation; Information System Strategy; Dynamic Capabilities; Design Science Research.

² A version of this paper is under publication at the International Journal of Business Information Systems.

3.1 Introduction

The last decade gave rise to a number of challenges in the business world. Organizations have faced growth in uncertainty toward beforehand consolidated business models, and hindering boundaries are coming down (Verhoef et al., 2019). Customers have gained more influence over transactions by Internet empowerment (Warner & Wäger, 2019; Guinan et al., 2019; Singh & Hess, 2017). Digital technologies have modified regulations (Hinings, Gegenhuber, & Greenwood, 2018). Digital skills, talent management and collaboration are becoming the foundation of new organization arrangements (Gurbaxani & Dunkle, 2019). Subsequently, Information and Technology (IT) resources became more than a technology enabler and gained the role of business enabler that allows organizations to maintain or even increase their expected firm performance (Vial, 2019; Nwankpa & Datta, 2017; Bharadwaj et al., 2013).

In order to leverage the possibilities offered by digital technologies and respond to digital disruptions, incumbent organizations have begun to improve their digital capabilities and resources (Sebastian et al., 2017; Svahn et al., 2017) naming this digital transformation (DT).

DT is a change that goes beyond the process digitization and requires profound transformations in organizational structures and business processes, advanced use of IT, and improvement in value creation to adjust or create an entirely new business model (Chanas et al., 2019; Svadberg et al., 2019; Haffke et al., 2017; Hess et al., 2016). Additionally, digital technologies offer new strategy possibilities for incumbent firms (Sebastian et al., 2017). Finally, DT stimulates the use of technology to create new revenue streams, to increase business performance, and to enhance customer experience (Wiesboeck & Hess, 2019; Guinan et al., 2019; Vial, 2019).

The change to the digital age requires the organization to update its strategic mindset much more than its IT infrastructure (Rogers, 2016).

A recent Harvard Business Review survey (HBR, 2019) showed that just a small number of companies succeed in DT initiatives beyond the experimentation and piloting steps. The study found that a lack of top-management support and a mindset that is closed to external options led organizations to DT failure.

Another research by McKinsey (McKinsey, 2016) showed that 70% of DT initiatives do not accomplish their established goals. The study discovered that lack of employee engagement, resistance to change, improper management support, limited collaboration, and a lack of

responsibility are common barriers. Svahn et al. (2017) pointed out that a significant challenge for incumbent organizations is to develop the ability to exploit existing capabilities while building new digital ones without being delayed by created path dependencies.

Even though DT has been increasingly gaining attention, it is still an emerging domain and requires more academic works to consolidate definitions, concepts, and investigation paths (Vial, 2019; Warner & Wäger, 2019; Gimpel et al., 2018).

A way to understand digital transformation is through frameworks that are guidance for refining issues to be investigated as well as for creating measures and building analyses (Imenda, 2014). Gimpel et al. (2018) identified a lack of frameworks that support companies in structuring digital transformation initiatives, reason why examining DT theoretical, analytical, or practical representations is necessary for the advancement of the body of knowledge. Additionally, there is a sparseness of academic works presenting how organizations build dynamic capabilities for digital transformation (Warner & Wäger, 2019; Vial, 2019).

A research gap arises from the previously stated circumstances: set that digital transformation is a frequent topic in organizations' agenda, *what are the dynamic capabilities that incumbent firms need to develop for digital transformation?*

To explore the process of sensing, seizing, and transforming from dynamic capability theory (Teece, 2007), we proposed a review of the framework designed by Warner and Wäger (2019) by gathering new academic references and collecting opinions from practical experts to explain the factors that trigger, enable, and hinder the building of digital transformation dynamic capabilities.

The research aims at presenting new viewpoints on how to describe digital transformation through dynamic capability building framework, improving the current body of literature encompassing digital transformation in incumbent firms and contributing to both academics and managers.

This paper has seven sections. In the first section, we presented the research motivations and its purpose. In the second section, we presented relevant literature on digital transformation and dynamic capabilities. We explained how the Resource-Based View Theory provides a useful lens for the study of digital transformation. In section three, we presented the design science methodology applied to the framework development. In section four, we reported the designing

of the artifact. Subsequently, in section five, we demonstrated the designed framework in an empirical illustration based on an incumbent organization undergoing digital transformation. In section six, we presented the artifact evaluation. In the last section, we concluded this study by providing the main research and practice findings.

3.2 Theoretical Background

This section aims at describing why digital transformation is a multidisciplinary problem supported by strategy, the relevance of dynamic capabilities as a strategic theoretical lens, and the link between the dynamic capabilities microfoundations and digital transformation.

3.2.1 Digital Transformation

The DT has become vital since it is associated with how the business can be sustainable in the digital era (Chanas et al., 2019; Yeow et al., 2018; Karimi & Walter, 2015; Schuchmann & Seufert, 2015; Matt et al., 2015; Lucas & Goh, 2009). Digitally born firms, such as Amazon, Twitter, Facebook, Uber, Airbnb, have created a new style of market competition that has left the survival of incumbent firms under warning (Warner & Wäger, 2019; Sebastian et al., 2017).

That dynamic market shift has brought more attention to DT in IS investigation in the last years. By searching the term “*digital transformation*” on the database of the Association for Information Systems, it is possible to recognize an accelerated growth in academic productions. In 2019, 307 published academic works were published, 261 more than in 2015, when 46 papers were published. By performing the same research string on Google Scholar, we found almost 45,900 results.

A recent study conducted by Vial (2019) pointed out that DT definitions join a group of topics like strategic adoption of digital technologies, strategy, organizational change, business model, customer experience, and firm performance.

A collection of definitions describes DT as a reinvention of company strategy that recognizes technology as a powerful capability intended to deliver business value (Warner & Wäger, 2019; Gurbaxani & Dunkle; 2019; Nwankpa & Datta, 2017; Chanas et al., 2019; Singh & Hess, 2017; Matt et al. 2015; Bharadwaj et al., 2013). Bharadwaj et al. (2013) suggest a merging of organizational strategy with IT strategy as a passport to reach business differentiation. DT requires arranging IT and business strategies to allow an effective business model change, flexible IT infrastructure, strategic use of new digital technologies, and smart use of data

(Haffke et al., 2017; Nwankpa & Datta, 2017; Bharadwaj et al., 2013). DT is an evolution of IT-enabled transformation that proposes a business process optimization for business-enabled transformation that improves IT as a key for business processes and business models transformation (Vial, 2019; Chanias et al., 2019; Matt et al., 2015).

Strategy and the smart use of digital technologies are crucial elements, but not the only ones required by DT. Rethinking workplace, fostering collaboration, understanding digital skills, developing a digital mindset, promoting digital expertise, supporting digital transformation knowledge, managing technical talent for innovation, taking a calculated learning risk, and building organizational agility are internal capabilities required for a successful DT (Gurbaxani & Dunkle, 2019; Warner & Wäger, 2019; Gimpel et al., 2018; Li et al., 2018; Karimi & Walter, 2015). Furthermore, successful DT requires partnerships with a broad range of external partners, creating a smart ecosystem for the creation of better solutions (Svadberg et al., 2019).

All aforementioned definitions rely on business model change to enhance business performance, improve customer experience, create new businesses, and achieve operational excellence (Verhoef et al. 2019; Svadberg et al., 2019; Warner & Wäger, 2019; Singh & Hess, 2017; Schuchmann & Seufert, 2015). DT offers possibilities to enhance products and services, which means producing a portfolio of remarkable experience during customer journeys (Wiesboeck & Hess, 2019; Singh & Hess, 2017; Matt et al., 2015) as well as new ways of achieving firm performance enhancements (Ponsignon et al., 2019; Verhoef et al., 2019; Gimpel et al.; 2018; Karimi & Walter, 2015).

Based on the understanding that DT is a holistic change in how organizations purposefully orchestrate their resources to respond to the outside triggers in order to gain competitive advantage and produce superior performance, we believe the dynamic capability approach provides a valuable theoretical foundation for examining the phenomenon of how incumbent organizations can (re)build new resources.

3.2.2 Resource-Based View and Dynamic Capabilities

The resource-based view (RBV) has been extensively used in the Information System literature to demonstrate how firms can gain a competitive advantage and build superior performance (Wade & Hulland, 2004). The theory postulates that a better firm performance is attributable to resources and skills that are firm-specific, rare, and difficult to imitate by rivals (Barney, Wright, & Ketchen, 2001; Bharadwaj, 2000). Production, updating, and reconfiguration of

resources are among the stimuli required for firm innovations. From this perspective, dynamic capabilities rise as theoretical stream focusing on explaining how firms build, accumulate, transform, manage, acquire, and (re)combine their resources in order to address fast-changing markets (Foss & Stieglitz, 2012; Helfat & Peteraf, 2009; Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997).

Despite starting in the strategy field (Helfat & Peteraf, 2009; Eisenhardt & Martin, 2000; Teece et al., 1997), the investigation of dynamic capabilities represents a research path in IS Management (e.g., Pavlou & El Sawy, 2011), particularly in digital transformation (Vial, 2019). Building and using dynamic capabilities are a vital theoretical lens to answer what enables firms to deal with the technological transformation (Barreto, 2010) and preserve strategic flexibility (Singh, Oberoi, & Ahuja, 2013) in order to sustain competitiveness (Teece, 2014).

A radical technological disruption creates capability gaps for incumbent firms since it introduces new technical knowledge, new ways of performing activities, and new ways of creating value (Warner & Wäger, 2019; Yeow et al., 2018; Karimi & Walter, 2015). DT challenges organizations to develop dynamic capabilities, which allow firms to identify and respond to opportunities by changing the organization, reconfiguring resources, and building digital capabilities, and, therefore, returning to industry changes (Karimi & Walter, 2015) provoking strategic renews (Yeow et al., 2018) that influence firm's business model and culture (Warner & Wäger, 2019).

Teece (2014:330) states that dynamic capabilities can be better understood when compared to ordinary capabilities. While ordinary capabilities have the purpose of promoting technical efficiency in business, dynamic capabilities exist to help firms be congruent with customer needs and technological and business opportunities (Teece, 2014:332). Dynamic capabilities support organizations to produce new forms of competitive advantage in high-complex and continuous changing environments and are capable of explaining differences in firms' adaptation and performance (Teece et al., 1997). Thus, the core purpose of dynamic capabilities is not short-term efficiency, but sustainability over time through "*evolutionary fit*" (Teece, 2007; Teece, 2018). Ordinary capabilities alone are insufficient to undergird sustainable competitive advantage in a robust aggressive business scenario (Teece, 2014; Winter, 2003). The non-execution of a dynamic capability over a more extended term can cause the unique capability performance knowledge to fade into oblivion (Konlechner, Müller, & Güttel, 2018).

Even with the research increase over the years (Warner & Wäger, 2019; Yeow et al., 2018; Karimi & Walter, 2015), scholars have revealed disappointment due to the lack of empirical contribution and the under specification of dynamic capabilities (Schilke, Hu, & Helfat, 2017). In order to address such subjectivity, Teece (2007) shows the necessity of presenting dynamic capabilities in three specific processes: (1) sensing the external environment, (2) seizing opportunities, and (3) reconfiguring the organization's broader resources.

The building of sensing, seizing, and reconfiguring enables any firm to set a future strategy that designs, creates, and improves a defensible business model, leads organizational change, and provides a reliable source for gaining a competitive advantage (Teece, 2018).

3.2.3 Connecting Dynamic Capability Microfoundations with Digital Transformation

Teece (2014) describes sensing as the “[..] *identification, development, co-development, and assessment of technological opportunities about customer needs*” (p. 332). The author states that in order for the firm to develop the sensing capability, the following microfoundations are necessary: (1) processes to direct internal Research and Development (R&D) and select new technologies; (2) processes to identify new markets, changes in customer needs and customer innovations; (3) processes to tap developments in exogenous science and technology; and (4) processes to explore the supply chain and complementary innovations (Teece, 2007).

Sensing is especially critical as DT is ongoing and emergent, and organizations need to identify and recognize the external triggers as well as establish a strategic approach to deal with them (Yeow et al., 2018). Additionally, Warner and Wäger (2019) found specific organizational capabilities to identify customer needs and competitor-based trends as well as keep in touch with informal and formal networks in the world's technology hubs to identify technological trends. Those capabilities highlighted customer-driven innovations that are hard for strategic planners to predict but are essential as incumbent firms need to discover alternatives to steer through uncertainty and obtain insight into new opportunities (Warner & Wäger, 2019).

The second capability set by Teece (2014, 2007) is seizing and it describes the importance of resource orchestration by firms in order to capture the value identified in opportunities. In Teece's seminal work, seizing included the following microfoundations: (1) defining the customer solution and (re)design the business model; (2) managing the selection of enterprise boundaries considering complementary assets; (3) selecting a rapid decision-making process

that attempts to avoid bias and arrogance; (4) building loyalty and commitment between effective communication and leadership (Teece, 2007).

Regarding DT, seizing is a meaningful adjusting capability as it enables the organization to act on the identified opportunities through the designing of new structures and processes, selecting different alternatives based on their potential (e.g., choosing suppliers and platforms that can provide complementary services or products) and setting several implementation approaches (Yeow et al., 2018).

Warner and Wäger (2019) observed that adapting a strategy rapidly, balancing internal and external options in order to scale innovative business models, and building minimum viable products by using digital innovation labs or not are capabilities that allow an organization to determine what specific changes to make across its multiple organizational components in order to capture DT opportunities.

As an essential element of the DT, IT needs to be better tuned in order not to become a barrier to changes in the organizations' business model. The more flexible, integrated, and aligned the IT structure is with the business, the better the governance of the solutions that will sustain and enable the company to be innovative.

Finally, the third capability is the transformation (also named "*reconfiguration*") that covers how firms both formulate new resources and modify the existing ones to keep them strategically aligned with customers, partners, and the business context (Teece, 2014).

According to Teece (2007), the transformation is represented as the following microfoundations: (1) the decentralization to a point close to the decomposability firm structure; (2) the co-specialization management, which means to arrange the resources properly; (3) the knowledge management, which also encompasses the learning and sharing of knowledge; and (4) the governance that symbolizes the ability to keep the firm aligned.

In a broad context of DT, transformation is the organization's capacity to embed existing resources into new ones, creating new competence in resource combination, accessing external data as a complementary resource, and resizing resources, especially those that may not be optimal for a new digital strategy (Yeow et al., 2018).

Looking at incumbent firms' DT, joining a digital ecosystem, interacting with multiple external partners, exploring new possibilities, creating new internal structures, and improving digital workforce maturity are transformation required capabilities (Warner & Wäger, 2019).

Sensing and seizing capabilities support the formulation and identification of opportunities, but organizations should combine IT infrastructure, human IT skills, and IT-enabled intangibles with other firm-specific resources to make a transformation (Karimi & Walter, 2015; Bharadwaj et al., 2013; Wade & Hulland, 2004).

The previously presented microfoundations demonstrated why organizations should always sense and seize in order to respond to technological innovations, customer needs, and competitive landscape (Teece, 2018). Additionally, they need to periodically undergo a transformation to be ready to address new threats and opportunities as they arise (Teece, 2018). These theoretical lenses serve as the starting point for our investigation regarding the dynamic capabilities that incumbent firms need to develop for digital transformation. Our main goal is to theorize an integrated view on building dynamic capabilities in pre-digital organizations considering external triggers, internal barriers, and internal enablers as relevant viewpoints that encompass the digital transformation phenomenon.

3.3 Research Method

This research adopted the design science research (DSR) as a methodological approach. A fundamental characteristic of applying the DSR method is its orientation towards problem-solving, not necessarily the search for the optimal solution, but a satisfactory solution (Gregor & Hevner, 2013; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007; Hevner, March, Park, & Ram, 2004). However, whenever possible, the proposed solutions should be subject to generalization for a particular class of problems, thus allowing other researchers or practitioners to make use of knowledge in other contexts (Gregor & Hevner, 2013).

This study aims at presenting the necessary dynamic capabilities that incumbent firms need for digital transformation. In this sense, we proposed the development of an artifact (frame) that represents a set of constructs (Gregor & Hevner, 2013) that form a vocabulary of a domain of knowledge and constitute a concept used to describe the triggers, barriers, enablers, dynamic capabilities, expected outcomes and strategic renewal from digital transformation.

By applying the process suggested by the seminal works on DSR (Gregor & Hevner, 2013; Peffers et al., 2007; Hevner et al., 2004), we followed the six (6) steps described in Table 3.1.

Step	Description
Awareness of the problem	Systematic literature review on digital transformation, challenges and frameworks which lead us to identify relevant related works in academic and practical publications.
Suggestion	Explain the fundamental changes in the incumbent companies that are undergoing digital transformation by using dynamic capabilities as a theoretical approach.
Development	Design the artifact, in the form of a set of constructs by using dynamic capabilities as a theoretical background.
Demonstration	Demonstration of the designed framework in a real scenario. The results were collected from data extracted from external sources and an interview with the CIO of Coimbra University Hospital.
Evaluation	Evaluate the proposed framework by cross-checking the collected data with the reviewed literature. The evaluation step was carried out through a survey with digital transformation experts.
Conclusion	Submit and publish the results in relevant research sources, including journals and conferences, and presenting the results to experts.

Table 3.1 - DSR phases and tasks performed in this research

3.3.1 Awareness of the Problem

As the foundation for the framework development, we conducted a systematic literature review to collect relevant papers about digital transformation. The SLR is one of the main approaches to synthesize scientific quality studies based on methodological rigor in order to clarify research questions (Kitchenham et al., 2009).

We considered papers published in the eight main journals of Information Systems (European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, Journal of the Association of the AIS and MIS Quarterly). Additionally, we included records from MIS Quarterly Executive since the source is a suitable research database that balances practical case studies and academic support. The research was conducted from November 23, 2019 to January 31, 2020.

A careful look at our initial search query results and prior knowledge of the topic led us to define the following search query, which was adapted to each database but summarized in SQL-like syntax for genericity: “(abstract LIKE '%digital%') AND (abstract LIKE '%transform%'

OR '%disrupt%' OR '%challenge%' OR '%framework%'.” After the research, we excluded the duplicated files resulting in a set of 547 documents for checking.

In the review stage, we set a selection criterion for discarding papers. We excluded the studies that were not written in English and not published in a scientific or practical journal, resulting in a set of 132 studies for quality analysis.

Subsequently, we assessed the studies' titles and abstracts, resulting in 88 documents. Then, we conducted the quality analysis evaluation, which assessed if the study had: a theoretical or practical contribution; some concept of digital transformation; a literature review regarding digital transformation; clarity in the proposed techniques; and a clear discussion of the results and 56 documents were selected. After a more accurate analysis of the remaining studies, we examined a total of 38 papers that guided our understanding of digital transformation definitions, challenges, and frameworks.

Similarly, to the existing research and references presented in Section 3.2, recent academic works confirm the IT-business-centric nature of the digital transformation and the need for empirical work to guide decision-makers through the development of digital transformation capabilities (Warner & Wäger, 2019; Vial, 2019; Hess et al., 2016). Additionally, Warner and Wäger (2019) and Vial (2019) suggested the use of dynamic capabilities as a theoretical approach to explain the fundamental changes in organizations and the study of dynamic capabilities microfoundations as an essential digital transformation research stream.

3.3.2 Suggestion

The digital ecosystems create challenges and opportunities for both new and established firms, specifically regarding the development, establishment, and disruption of business models where the boundary between the business and IT strategy is increasingly blurred (Bharadwaj et al., 2013).

In order for incumbent businesses to take advantage of the opportunities that an increased focus on digitization affords them, they must undertake a digital transformation initiative, often altering the corporate culture to open the organization to new digital opportunities (Fitzgerald et al., 2013).

To achieve the research purpose, we suggested a collection of concepts presented in an artifact that will guide incumbent organizations through the digital transformation.

3.3.3 Development

After a careful evaluation of the academic frameworks of digital transformation (Gurbaxani & Dunkle, 2019; Wiesboeck & Hess, 2019; Warner & Wäger, 2019; Vial, 2019; Loonam et al., 2018; Gimpel et al., 2018; Hess et al., 2016) and considering practical works as well (Westerman et al., 2011), we found out that some of them contributed with foundations for understanding DT from a full conceptual perspective (Vial, 2019; Wiesboeck & Hess, 2019). Others are instruments for understanding the stage in which the digital transformation is as well as a guide for defining the next steps required for organizational transformation (Gurbaxani & Dunkle, 2019; Hess et al., 2016; Gimpel et al., 2018; Loonam et al., 2018; Westerman et al., 2011); however, only Warner and Wäger (2019) suggested the use of dynamic capabilities as a theoretical path to explain the fundamental changes in the organizations that are dealing with DT.

From the identified gaps in the academic frameworks and the under specification of dynamic capabilities (Schilke et al., 2017), we realized the opportunity of theorizing an integrated view on the building of dynamic capabilities in pre-digital organizations. Backed by the sensing, seizing, and transformation process presented by Teece (2007) we updated the framework proved by Warner and Wäger (2019) by utilizing contributions from Verhoef et al. (2019), Wiesboeck and Hess (2019), Vial (2019), Gimpel et al. (2018), and other authors as per the detailed explanations provided in Section 3.4.

3.3.4 Demonstration

In the demonstration stage, the proposed solution must be validated to show it can be used to explain the research problem. In this study, we demonstrated the framework in an empirical case by studying the digital transformation initiative of an incumbent organization.

We selected the Coimbra University Hospital for the analysis. The case selection was based on four criteria: the importance of the study case, the connection between the study case and the research theme, data availability, and respondent impact and knowledge about the studied theme. It is a relevant case involving an incumbent institution handling a digital transformation, which allows access to information. We collected publicly available reports and recent news about Coimbra University Hospital's digital transformation initiative and interviewed its CIO as well. The selection of the interviewee was based on his information capacity related to the problem at issue.

To guide the demonstration, we introduced the framework to the participant and asked him to apply our model to explain the digital transformation. This interactive practice allowed the participant to use the artifact to openly discuss his knowledge of and experiences from the digital transformation. The interview was conducted in April 2020 and lasted 2 hours.

The software used to analyze the open data and the interview transcription was the NVivo.

3.3.5 Evaluation

For the evaluation, we applied the framework presented by Venable, Pries-Heje and Baskerville (2016). The authors proposed a four-step evaluation. First, the evaluation context must be defined. Second, the strategies that better fit the research goals must be defined. The third step consists of choosing the specific methods, and the fourth is the specification of the detailed evaluation process.

The selected sample was defined by its detailed digital transformation knowledge and experience (Mergel, Edelmann, & Haug, 2019). Such approach is in line with the suggestion of producing relevant academic research to practicing professionals (Conboy, Fitzgerald, & Mathiassen, 2012).

We selected twenty (20) experts (please see Table 3.2) who are leading or providing guidance on digital transformation in incumbent organizations. They were identified via known incumbent digital transformation business cases, and involvement in relevant consulting developments in Brazil (Mergel et al., 2019).

To find the experts, we used social media, mainly LinkedIn and WhatsApp, from where résumés and contact information (email and telephone numbers), were collected one by one, whenever possible.

Expert ID	Role	Sector	Years conducting organizational transformation
1	Consultant	Business consultancy	4 and 5 years
2	Consultant	Business consultancy	1 and 2 years
3	Consultant	Business consultancy	5 and 10 years
4	Manager	Finance	5 and 10 years
5	Director	Education	Over 10 years
6	Consultant	Business consultancy	5 and 10 years
7	Consultant	Business consultancy	4 and 5 years
8	Manager	Finance	3 and 4 years
9	Manager	Finance	Over 10 years
10	Manager	Publisher	5 and 10 years
11	Consultant	Business consultancy	5 and 10 years
12	Manager	Telecommunication	Over 10 years
13	Consultant	Business consultancy	5 and 10 years
14	Consultant	Business consultancy	4 and 5 years
15	Director	Finance	5 and 10 years
16	Director	Insurance	5 and 10 years
17	Consultant	Business consultancy	4 and 5 years
18	Director	Retail	Over 10 years
19	Consultant	Business consultancy	Over 10 years
20	Director	Finance	5 and 10 years

Table 3.2 - Role, sector, and years conducting organizational transformation

We invited the participants to watch a five-minute video describing the designed framework. Subsequently, we sent a ten-page material describing the components of the proposed framework. Then, we invited the participants to take a survey on Google Forms. The questionnaire (please see Appendix 1) had a section for each component of the framework where the experts could state their agreement with the construct presented as well as introduce new aspects through open questions. Lastly, the participants replied via audio message the following question: “*what were the main findings the framework offered to understand the digital transformation of an incumbent organization?*”

The questionnaire was prepared in English, but the answers were submitted in Portuguese and then translated into English.

We used NVivo software used to analyze the open-ended responses and the audio transcription. The qualitative data and the survey results were compared to the theoretical basis of each component of the framework, and we inductively identified new constructs.

Finally, the research team conducted the data collection between February and April 2020.

3.4 Designing the Dynamic Capability Framework for Digital Transformation

We selected the constructs introduced by Warner and Wäger (2019) as the starting point for designing our framework.

While conducting the literature review, we noticed in Verhoef et al. (2019), Vial (2019), and Wiesboeck and Hess (2019) the importance of clarifying expectations concerning the results produced by the digital transformation. By integrating the expected outcomes as a new construct, we designed the first version of the framework shown in Figure 3.1 below.

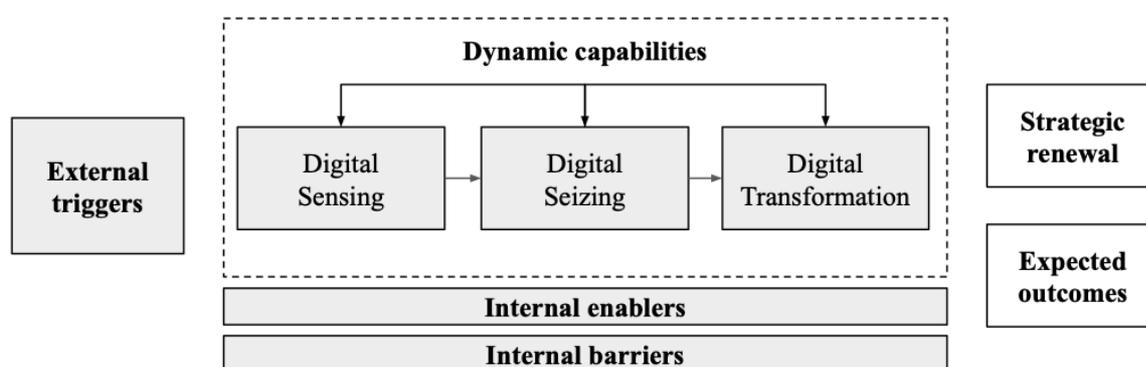


Figure 3.1 - Constructs of the proposed framework based on Warner and Wäger (2019)

3.4.1 External Triggers

The external environment is an essential agent in driving digital transformation (Wiesboeck & Hess, 2019). Digital technologies have changed the competition arrangement, whether by introducing new solutions by existing competitors or by the entry of new players with more innovative solutions (Vial, 2019; Warner & Wäger, 2019).

Additionally, the arrival of new consumers and the growth of sales options through digital channels have forced organizations to customize solutions to meet customer needs (Gimpel et al., 2018; Loonam et al., 2018; Singh & Hess, 2017; Schuchmann & Seufert, 2015).

The advent of disruptive technologies is also a trigger given that specific markets are at risk of being dematerialized (Vial, 2019; Warner & Wäger, 2019; Wiesboeck & Hess, 2019). Uber is an example of how the improvement in Internet connections and smartphone computational capacity enabled the rise of solutions that revolutionized the transport segment.

Finally, previously unknown needs are generating opportunities to develop new products and services with individualized value propositions (Vial, 2019; Gimpel et al., 2018; Loonam et al., 2018; Hansen & Sia, 2015). We can see examples of companies that are fostering the disintermediation of value chains such as insurance and retail.

Table 3.3 presents the initial version of the external triggers that provoke the digital transformation, including the related literature background.

Constructs	References
Competitive landscape	Digital technologies facilitate the (re)combination of existing products and services to generate new forms of digital offerings favoring services over products, lowering barriers to entry, and hindering the sustainability of the competitive advantage of incumbent players (Vial, 2019; Warner & Wäger, 2019; Wiesboeck & Hess, 2019).
Consumer behaviors and expectations are changing	An aggregate number of expectations on service quality and a more influential role of customers over transactions require organizations the ability to know customer wants and habits (Verhoef et al., 2019; Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Loonam et al., 2018; Singh & Hess, 2017; Schuchmann & Seufert, 2015).
Disruptive digital technologies	Disruptive technologies as social media, mobile, big data, analytics, and Internet of Things are decreasing innovation cycles and are providing opportunities and threats to companies (Verhoef et al., 2019; Warner & Wäger, 2019; Vial, 2019; Gimpel et al., 2018; Nwankpa & Dappa, 2017; Hess et al., 2016; Karimi & Walter, 2015).
Rethinking value propositions	The spurring of digital offerings is challenging organizations to identify unmet customer needs, create smart products and services, and introduce innovative and tailored customer value propositions (Vial, 2019; Gimpel et al., 2018; Loonam et al., 2018; Hansen & Sia, 2015).

Table 3.3 - External triggers

3.4.2 Internal Barriers

Considering the nature of the change, organizations will not always be ready for digital transformation (Vial, 2019; Warner & Wäger, 2019; Gimpel et al., 2018). When employees feel threatened by new technologies, they stop promoting changes (Eden et al., 2019; Tekic & Koroteev, 2019). Additionally, the context of uncertainty produces rigid strategic plans and

structures with silos and low collaboration (Vial, 2019; Guinan et al., 2019; Warner & Wäger, 2019; Chantias et al., 2019; Yeow et al., 2018; Gimpel et al., 2018; Dremel et al., 2017; Matt et al., 2015; Lucas & Goh, 2009).

Organizations that were successful in the past take the plunge and make an effort to catch up the same results that brought them to the current state, generating a limited way of thinking (path dependence). Furthermore, the larger the organization, the higher the effort to drive a change.

Such beliefs or internal barriers slow down the transformation process (Vial, 2019). Table 3.4 describes constructs we considered and the references regarding internal barriers.

Constructs	Reference
Rigid strategic planning	Long-term strategic vision, rigid planning, and strategizing policies slow up continuous innovation (Warner & Wäger, 2019; Chantias et al., 2019; Yeow et al., 2018; Matt et al., 2015).
Resistance to change	The well-built workforce mental model and the lack of attitude toward changes create resistance (Warner & Wäger, 2019; Kane, 2019; Tekic & Koroteev, 2019; Gurbaxani & Dunkle, 2019; Eden et al., 2019; Li et al., 2018).
High-level hierarchy and silos	The power relationships created by hierarchical structures and the walls designed by silos reduce the emerging of a collaborative context (Guinan et al., 2019; Vial, 2019; Warner & Wäger, 2019; Gimpel et al., 2018; Dremel et al., 2017; Lucas & Goh, 2009).
The inertia created by path dependencies	The success obtained in the past leads organizations to maintain the existing ties with customers and suppliers and follow highly optimized but often rigid well-established production processes (Tekic & Koroteev, 2019; Vial, 2019).

Table 3.4 - Internal barriers

3.4.3 Internal Enablers

Despite the existence of internal barriers, organizations may have enablers that drive digital transformation (Warner & Wäger, 2019). A multifunctional team produces a diversity of capabilities that will encourage innovation (Tekic & Koroteev, 2019; Chantias et al., 2019; Guinan et al., 2019; Dremel et al., 2017; Sia, Soh, & Weill, 2016). Moreover, such diversity produces the capacity to engage with stakeholders across the business (Tekic & Koroteev, 2019).

In view of the urgency of innovation, making quick decisions at the highest and lowest levels is necessary to foster the capacity of planning and executing (Chantias et al., 2019; Warner & Wäger, 2019).

A transformation does not happen without the support of the organization's executive (Vial, 2019; Warner & Wäger, 2019; Tumbas et al., 2018) and the alignment within a committed senior team (Wiesboeck & Hess, 2019; Gurbaxani & Dunkle, 2019; Dremel et al., 2017).

Finally, digital transformation needs a technological foundation. The intelligent use of data (Reddy & Reinartz, 2019), the absorption of new technological artifacts and the integration of Information Systems are required to enable business changes (Wiesboeck & Hess, 2019; Vial, 2019; Gimpel et al., 2018; Nwankpa & Datta, 2017; Sebastian et al., 2017; Zhu et al., 2006). Table 3.5 describes the constructs considered in this study and the internal enabler references as well.

Constructs	Reference
Cross-functional teams	A group of people with different functional capabilities working for a common iterative goal (Warner & Wäger, 2019; Tekic & Koroteev, 2019; Chanas et al., 2019; Guinan et al., 2019; Dremel et al., 2017; Sia et al., 2016).
Fast decision making	Competing in an unpredictable context demands a fast, traceable, visible, and flexible decision-making approach (Warner & Wäger, 2019; Chanas et al., 2019).
Executive support	A clear understanding and alignment in the senior executive team spread company-wide commitment, intensify the policy strength, and generate the social capital that supports the digital transformation (Vial, 2019; Wiesboeck & Hess, 2019; Gurbaxani & Dunkle, 2019; Warner & Wäger, 2019; Dremel et al., 2017; Tumbas, et al., 2018).
IT capability	To take advantage of digital technologies, organizations have to integrate new resources into an organization's fragmented legacy Information Systems. An organization IT application portfolio, its IT systems, and its general IS infrastructure require the IT resources adaptability to remodel businesses (Wiesboeck & Hess, 2019; Vial, 2019; Gimpel et al., 2018; Nwankpa & Datta, 2017; Sebastian et al., 2017; Zhu et al., 2006).
Data governance	Social media, digital transactions, embedded sensors (e.g., Internet of Things), and mobile devices are new data sources that drive data explosion. Data-driven applications such as recommender systems or predictive analytics, in addition to integrated data, require high-quality data (Gimpel et al., 2018). Before that, data management, data ownership, and privacy (i.e., the rights and data control) are highly relevant factors in defining competitive positioning (Vial, 2019; Reddy & Reinartz, 2019; Gimpel et al., 2018; Dremel et al., 2017).

Table 3.5 - Internal enablers

3.4.4 Dynamic Capabilities

Assuming the strategic nature of digital transformation (Rogers, 2016) and the eminent need to reconfigure organizations' resources (Chanas et al., 2019; Yeow et al., 2018; Karimi & Walter, 2015), we present in this section a microfoundation proposal for the development of sensing, seizing and reconfiguring capabilities referring to the digital transformation of incumbent companies.

Eisenhardt, Furr and Bingham (2010:1263) define microfoundations as: “*the underlying individual-level and group actions that shape strategy, organization, and, more broadly, dynamic capabilities.*” Due to the general nature of dynamic capabilities (Schilke et al., 2017), knowing microfoundations is as a way of explaining how organizations emerge their capacities to produce a competitive advantage (Teece, 2007).

Subsequently, we will present each of the dynamic capabilities proposed during the design. The set-up we used can be found in detail in Warner and Wäger (2019).

3.4.4.1 Digital Sensing

We suggest that Digital Sensing is the organization's ability to map what happens to its direct competition and the new digital substitutes. Also, it considers the importance of building capabilities that help to understand customers' needs from different touchpoints.

Additionally, it encompasses the formulation of digital strategies based on internal and external data, and the interpretation of future scenarios as a way to identify new opportunities.

Finally, it includes establishing a clear vision of the digital strategy that will serve as a guide to change people's mentality.

Table 3.6 represents each Digital Sensing capability considered in this study and how the organization should develop them.

Digital Sensing Capability	References
Digital scouting	Scanning for technological trends, screening of digital competitors, reaching and engaging customers and online communities, and sensing customer journey pain points are ways to help organizations identify outside relevant information for internal teams (Warner & Wäger, 2019; Gimpel et al., 2018; Loonam et al., 2018; Singh & Hess, 2017).
Digital scenario planning	Interpreting future digital scenarios and formulating digital strategies based on internal and external data are actions undertaken by organizations to learn and evaluate potential opportunities for further developments (Warner & Wäger, 2019; Gimpel et al., 2018).
Digital mindset crafting	Establishing a long-term digital vision, allowing an entrepreneurial mindset, advocating a digital mindset, arranging a visionary/innovative skill team to define the right digital strategy are capabilities that enable the internal human-resources to explore new technologies and explore complementary innovations (Warner & Wäger, 2019; Gurbaxani & Dunkle, 2019; Loonam et al., 2018; Dery et al., 2017).

Table 3.6 - Digital Sensing capabilities

Complementing the work developed by Warner and Wäger (2019) and backed by the literature review, we propose two new microfoundations in “*Digital scouting*” which are understanding

the pain points of the customers' journey (Loonam et al., 2018; Gimpel et al., 2018; Singh & Hess, 2017; Schuchmann & Seufert, 2015) and performing relationship and engagement with customers and online communities (Loonam et al., 2018). Such inclusions are in line with Teece (2007) when he cites the importance of identifying changes in customers' needs as a sensing capability.

Regarding the dynamic capability of “*Digital scenario planning*” presented by Warner and Wäger (2019), we altered the “*Analyzing scouted signals*” and “*Formulating digital strategies routines.*” Based on the suggestion of Gimpel et al. (2018), we present a microfoundation that addresses the formulation of digital strategies based on internal and external data as an approach to learn and evaluate potential opportunities. These suggestions corroborate Teece’s statements (2007) when the author stresses the importance of directing R&D and developing processes to explore new markets and new technologies.

Finally, in “*Digital mindset crafting*”, we added a new action regarding the arrangement of a visionary and innovative skill team to define the right digital strategy based on Gurbaxani and Dunkle (2019), Loonam et al. (2018) and Dery et al. (2017). The use of alliances and attention paid by employees in all levels help the organization identify hidden opportunities concerning the use of new technologies.

3.4.4.2 Digital Seizing

When designing Digital Seizing capabilities, we consider a set of microfoundations that can help organizations take advantage of the opportunities identified in Digital Sensing.

In view of the current dynamics of the market, we consider strategic agility fundamental in building organizational agility.

Also, we considered the ability to build prototypes and launch new solutions an approach to increase the organization’s chance to seize the discovered opportunity.

Finally, we stated that determining the required changes in the organization's structures and business model as well as building a portfolio of options that takes into account internal constraints and external alternatives are mechanisms that will help to promote all parties’ commitment to the imminent changes.

Table 3.7 represents each Digital Seizing capability considered in this study and how the organization should develop them.

Digital Seizing Capability	References
Strategic agility	Pacing strategic responses, rapidly reallocating resources, and accepting redirection and changes refer to the organizational agility to select among different options available solutions to capture the identified opportunities (Warner & Wäger, 2019; Yeow et al., 2018; Gimpel et al., 2018).
Rapid prototyping	Creating minimum viable products by using approaches such as digital product management, process flexibility, lean startup, design thinking, continuous deployment, and integrated development, and by using digital innovation labs are capabilities provided by organizations that encourage the rise of new digital assets (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Tanniru et al., 2018).
Balancing digital portfolios	Balancing internal and external options, scaling up innovative business models, and setting an appropriate execution speed refer to organizational actions undertaken to plan, select and design the firm's new structures and processes to respond to the digital transformation (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Loonam et al., 2018; Gimpel et al., 2018; Hess et al., 2016).

Table 3.7 - Digital Seizing capabilities

The only adjustment we proposed to the work presented by Warner and Wäger (2019) concerns the microfoundation “*Considering a lean startup methodology*”. According to Gimpel et al. (2018), other capabilities such as digital product management, process flexibility, lean start-up, design thinking, continuous deployment, and integrated development are required if organizations want to succeed in digital transformation.

The aforementioned resources will support the reduction of the chasm between strategy and execution, favoring the development of solutions in a more agile way.

3.4.4.3 Digital Transformation

Digital Transformation is the last dynamic capability mentioned in this study and it is responsible for reconfiguring the organization resources.

This capability describes the organization ability to conceive new resources and processes, as well as re-adapt existing ones in order to respond to changes. Also, it provides the organization with the ability to use external resources that are complementary to the existing ones in order to open new perspectives for the offering of products and services.

We admit that in order to undergo a transformation, incumbent organizations will need to think about new ways to interact with innovation ecosystems that connect them to new opportunities, redesign their internal structures to make them more agile, create new leadership roles to guide

the transformation in a strategic standpoint, and increase their digital knowledge base to attract new talent.

Table 3.8 shows each Digital Transformation capability considered in this study and how the organization should develop them.

Digital Transformation Capability	References
Navigating innovation ecosystems	Joining a digital ecosystem, interacting with multiple external partners, and exploiting new possibilities of co-creation or coopetition are actions undertaken by organizations to use external resources that are complementary to the existing ones in order to open new perspectives for the offering of products and services (Warner & Wäger, 2019; Schuchmann & Seufert, 2015).
Redesigning internal structures	Defining digital transformation leadership, creating a digital business unit, business model digitizing and designing team-based structures are actions that organizations perform for the conception of new resources and processes to respond to digital transformation (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Tumbas et al., 2018).
Improving digital maturity	Identifying digital workforce maturity, recruiting external digital talent, and leveraging digital knowledge inside the firm are organizational transformation capabilities that (re)adapt the existing resources in order to be optimal for a new digital strategy (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gurbaxani & Dunkle, 2019; Gimpel et al., 2018; Dery et al., 2017).

Table 3.8 - Digital Transformation capabilities

While Warner and Wäger (2019) present the microfoundation “*Hiring a chief digital officer*”, Wiesboeck and Hess (2019) and Gimpel et al. (2018) present a more in-depth discussion about digital transformation governance, shedding light on topics such as the definition of who will be responsible for leading the DT and how the organizational structure will be changed. For this reason, we have evolved the original construct and proposed two new microfoundations: “*Defining digital transformation leadership*” and “*Creating a digital business unit*”.

3.4.5 Strategic Renewal

Given the nature of the strategy, there is an expectation of what strategic renewal will take place in incumbent organizations.

We proposed in our design that organizations can deal with the digital transformation to develop new digital products and services or pursue digital business processes or, lastly, build innovative business models (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Karimi & Walter, 2015). Prosperous digital transformation initiatives produce more extensive changes in the firm's collaborative way (Warner & Wäger, 2019; Guinan et al., 2019;

Wiesboeck & Hess, 2019). Finally, digital transformation will inevitably lead to more significant changes in the organizational culture (Warner & Wäger, 2019; Gurbaxani & Dunkle, 2019; Gimpel et al., 2018; Karimi & Walter, 2015).

3.4.6 Expected Outcomes

A final construct we proposed while designing our framework concerns DT results expected by organizations, and we used Verhoef et al. (2019) as reference.

From this perspective, we stated that DT could offer cost savings from a more efficient deployment of the existing resources. We can cite DT as reference, which focuses on the digitization of processes (Verhoef et al., 2019; Vial, 2019; Ponsignon et al., 2019).

Also, DT can produce business process re-engineering thus enhancing customer experience and producing efficient results. As opposed to only focusing on cost savings, it also includes process improvements which can increase revenue (Verhoef et al., 2019; Vial, 2019; Ponsignon et al., 2019; Svadberg et al., 2019; Sebastian et al., 2017).

Finally, DT can reconfigure the organization revenue and cost structure, giving rise to a new business model driven by digital technologies (Verhoef et al., 2019; Wiesboeck & Hess, 2019; Vial, 2019; Warner & Wäger, 2019; Karimi & Walter, 2015).

3.5 Demonstration

This section describes the “*Demonstration*” step (step 4) in the DSR method with the application of the proposed model in a real situation.

3.5.1 Context

The Coimbra University Hospital (CUH) is a public healthcare complex located in Coimbra, Portugal. It consists of six medical institutions, namely: University Hospital, Pediatric Hospital, Covões Local Hospital, Maternity Dr. Bissaya Barreto, and Sobral Cid Hospital. It is the most important healthcare center in the country, with almost 2,000 beds and 8,500 patients attended per day.

CUH's mission is to provide high quality and differentiated healthcare in a context of training, teaching, scientific knowledge, and innovation. It is a national and international excellence reference.

Since 2017, CUH has been undergoing a digital transformation guided by the following goals: improving digital interaction with users through digital solutions; updating the infrastructures to respond to cybersecurity policies; digitalization and integration of administrative processes (reducing the manual labor); improvement of the local network connectivity; understanding the internal situation vis-à-vis the General Data Protection Regulation (GDPR).

In November 2019, CUH achieved a critical milestone regarding the digital transformation while introducing a unified administrative information system and adopted a multistakeholder clinical process. Such process involved 80% of CUH's employees, a set of training sessions on new technologies, and an upgrade of CUH's internal infrastructure. By including new technologies, CUH expected a reduction in medical and nursing working hours in employee records, an increase in Electronic Health Record registrations, a decrease in energy waste, and an increase in the number of access to CUH's data by healthcare professionals and other National Healthcare System institutions.

3.5.2 Results

Testing the approach in a real empirical case allowed us to identify some relevant issues.

Regarding the external triggers, the competitive landscape is an essential digital transformation driver. Organizations need to understand what is occurring within their market. In the studied case, recommendations from global health organizations, changing consumer behaviors, the introduction of disruptive technology in healthcare (Internet of Things and Big Data), and the rise of a new disease are examples of change drivers.

Concerning the internal enablers, we realized that cross-functional teams are vital to creating solutions that reduce the lack of business complexity. Additionally, without IT capability, it is impossible to consider the appropriation of new digital technologies. The backbone provided by an excellent infrastructure and integrated systems is required to enable the adaptability demanded by digital transformation.

We noticed that internal barriers are potentialized while the organization size increases. The resistance to change, the passivity produced by inertia, the lack of digital skills, and the misalignment promoted by isolated initiatives reduce the velocity of change.

Regarding dynamic capabilities, digital scouting, rapid prototyping, and redesigning internal structures were mentioned as the main microfoundations for sensing, seizing, and

transformation. The interviewed CIO highlighted that becoming digital is a journey to create capabilities to scan for technological trends that could be useful to the business, perform approaches including agile development to deliver solutions faster and redesign the internal structure through educating the workforce digital skill and optimizing the internal resource compositions. He stressed that the IT function should overcome the support image and needs to be a component that promotes the reconfiguration of the organization resources.

We realized in the case at issue that the digital transformation proposes a business model renewal, by improving the value proposition for medical, nursing, and society sectors. The CIO noted that the digital transformation has been forcing a change in how people collaborate across departments, increasing collaboration even though there is a challenge of changing the culture of an organization that is not highly digitalized and has multiple stakeholders to serve.

Finally, as a public service, the hospital expects that the digital transformation brings cost savings from a more efficient deployment of the existing resources. As examples, we noted the unified administrative information system and a document management system that will reduce the use of paper and increase information reliability.

While demonstrating the framework, we noted that it spotlights the triggers, capabilities, challenges, and impacts of a digital transformation.

3.6 Evaluation

This section describes the fifth step of the DSR method and explains the experts evaluation and understanding of the proposed framework.

3.6.1 External Triggers

All the external triggers originated from the literature are also recognized as necessary by at least 9 out of the 20 practitioners working in the digital transformation field, as shown in Table 3.9.

Although the technological disruption had been the least factor mentioned by the respondents, companies need to gain momentum to keep up with digital leaders and start-ups technological mastery and the ability to prioritize innovation; otherwise, they will lose market share (Hess et al., 2016).

External triggers	Total responses	Acceptance percentage
Competitive landscape	19	95%
Consumer behaviors and expectations are changing	17	85%
Rethinking value propositions	15	75%
Disruptive digital technologies	9	45%

Table 3.9 - External triggers evaluation according to the participants

In addition to the external triggers presented in the first version of the framework, the experts also mentioned that internal demand could propel the digital transformation. Being seen as an innovative company (improving company branding and valuation), the challenge of attracting new talent and the organization's out-of-date business model were listed as essential triggers as well.

In other words, digital transformation can be a change that starts with both external and internal demands. Regardless of where the phenomenon is triggered, incumbent organizations need to be vigilant in identifying those changes to be able to adapt quickly.

3.6.2 Internal Barriers

As showed in Table 3.10, out of the four constructs presented to define the internal barriers faced by incumbents in the digital transformation, resistance to change (10) and rigid strategic planning (9) were the least voted ones.

Regarding resistance to change, experts complemented the presented definition, reinforcing that digital transformation is not feasible without cultural changes.

Concerning the rigid strategic planning, experts remarked that in addition to fixed and long-term planning, bureaucracy in budget planning is something that slows down the adaptability demanded by digital transformation.

The inertia created by path dependencies is another significant barrier to digital transformation as stated by an expert: *“The fact that the company has been working in the same way for years creates a false illusion that continuing to operate in the same way will ensure the company remains in the market because the processes have already been widely validated and proved to be useful.”*

Regarding high-level hierarchy and silos, experts described that the political game and the absence of a leadership with a digital openness could also delay the digital transformation, as

noted by Dremel et al. (2017), where traditional organizational structures and hierarchies prevent interdisciplinary collaboration across organizational boundaries.

Internal barriers	Total responses	Acceptance percentage
High-level hierarchy and silos	16	80%
The inertia created by path dependencies	13	65%
Resistance to change	10	50%
Rigid strategic planning	9	45%

Table 3.10 - Internal barriers evaluation according to the participants

In addition to the internal barriers presented in the first version of the framework, we found in the experts answers three new points to consider: risk-averse culture, incentive systems, and strategic misalignment.

A move towards a digital mindset without the possibility of failure challenges incumbent organizations. The innovation expected in a diverse and complex business world will occur with the support of a culture of openness that is willing to take risks and to experiment (Wiesboeck & Hess, 2019; Vial, 2019). Failure while taking a calculated risk is to be learned from and should not be a black mark on one's career (Gurbaxani et al., 2019).

In regard to incentives, the experts highlighted that the liking for individual results and bonuses could lead the organization to oppose the transformation purpose. Additionally, our experts data shows that a self-centered system of performance review enhances silos, distrust, individualism, and hierarchy.

The aforementioned findings are connected with the results presented by Grandori and Furnari (2008). The authors found that innovative organizations combine three different types of internal governance practices, which are market (monetary incentives - performance payment), bureaucratic (authority - rules and plans, labor division), and community (a division of knowledge, values, culture). Systems with exclusively monetary incentives will have an exclusively efficient production, while the combination of monetary, bureaucratic, and community incentives (plural) tends to generate high-performance innovation.

Finally, the lack of strategy alignment to guide the organization eliminates the sense of urgency and fragments a change that should be unified. As explained by one the participating experts: *“Large pre-digital companies work with cost centers and BUs that are often too autonomous so that several isolated initiatives compete for resources, bringing short-term benefits.”*

The business should see digital transformations not as a one-time or a discrete number of individual efforts, but rather as a cumulative effort needed to build organizational capacity to support future transformations (Tanniru et al., 2018).

3.6.3 Internal Enablers

As shown in Table 3.11, when it comes to digital transformation internal enablers, organization data governance was bottom ranked by the experts. Although it was not a characteristic bolstered by the majority of the experts, Gimpel et al. (2018) noted that organizations would bring meaning to the data as a competitive advantage with a governance structure that guarantees quality, availability, and security. As summarized by one of the participants: *“Being metrics oriented is important for decision making, and data governance becomes an important component for driving a transformation.”*

The executive leadership support was mentioned several times by the experts as vital to enabling digital transformation. The opinions reinforced the role of a transparent and efficient communication as well as the sharing of purpose as tasks that must be carried out by the executive team as a way of promoting higher collaboration and alignment during the transformation.

Concerning the importance of cross-functional teams, the experts brought that, in addition to a diverse team, the systemic view of the organization's value chain also becomes a fundamental capability presented in teams for the development of high-impact solutions. This ability to understand the whole organization's ecosystem was also noted by Guinan et al. (2019) when they noticed the importance of having people in cross-functional teams with the capacity to engage with stakeholders across the business as a way of creating solutions to defeat organization silos.

Internal enablers	Total responses	Acceptance percentage
Executive support	19	95%
Fast decision making	12	60%
Cross-functional teams	11	55%
IT capability	10	50%
Data governance	5	25%

Table 3.11 - Internal enablers evaluation according to the participants

In addition to the options presented in the first version of the framework, we found three new possible internal enablers according to the specialists opinions: support from digital leaders, financial resources, and a culture open to change.

Experts noted that the support from digital leaders in different levels of the organization beyond the C-suite layer becomes essential to enable digital transformation. The use of the support from informal leaders expanded the change relevance across the different layers of the organization in a bottom-up approach. As noted by Chaniyas et al. (2019) and Yeow et al. (2018), the development and execution of digital transformation strategies depend on activities either directed by a centralized approach (e.g., top-down driven) or by a decentralized approach (e.g., bottom-up emerging activities).

Available financial resources and an appetite for high-risk investment as well as the ability to continuously invest in innovation initiatives and know how to better deal with uncertainties were placed as necessary elements to sustain a digital transformation.

These findings corroborated the financial dimension presented by Hess et al. (2016), which reports a firm's need to progress in response to a struggling core business as well as its ability to support a digital transformation effort.

Finally, the experts' data highlighted the enabler role of culture while an incumbent firm is undergoing a digital transformation. Culture and people are the drivers that support the movements required for digital transformation. As reported by Wiesboeck and Hess (2019), culture is responsible for an organization's general attitude towards digital technologies, its risk-seeking (or risk-averse) behavior towards new business opportunities, or how it considers innovative ideas. In other words, the digital transformation will happen through the openness and adaptability of people in the organization.

3.6.4 Digital Sensing

All Sensing microfoundations presented in the framework design were recognized by the experts as necessary for the incumbent organizations, as shown in Table 3.12.

Macro Capability	Microfoundations	Total responses	Acceptance percentage
Digital Scouting	Sensing customer journey pain points	18	90%
	Screening of digital competitors	11	55%
	Scanning for technological trends	10	50%
	Reaching and engaging customers and online communities	10	50%
Digital Planning	Formulating digital strategies based on internal and external data	19	95%
	Interpreting future digital scenarios	11	55%
Digital Mindset Crafting	Enabling an entrepreneurial mindset	17	85%
	Advocating a digital mindset	12	60%
	Arranging a visionary/innovative skill team to define the right digital strategy	11	55%
	Establishing a long-term digital vision	7	35%

Table 3.12 - Digital Sensing evaluation according to the participants

The survey results reveal three critical Sensing capabilities: noticing customer journey pain points, formulating digital strategies based on internal and external data, and enabling an entrepreneurial mindset.

The abovementioned items corroborate Teece's (2007) original definition of Sensing by reinforcing the importance of organizations monitoring changes in the market and in customers' needs, as well as using data and creative skilled people to evaluate, assess, and judge the necessary innovations. Additionally, Guinan et al. (2019) noted that companies improving digital transformation should include entrepreneurial processes that enable them to think and act more like startup companies.

An evolution of the Digital scouting capacity suggested by the experts regards the inclusion of universities, research centers, suppliers, and competitors as well as the use of benchmarking routines as approaches to recognize digital opportunities. Previously findings were in agreement with Svadberg et al. (2019). The authors observed that the process of DT is an opportunity to create new entities and connections, change the current paradigms of organizations and individuals.

In addition to interpreting future digital scenarios and formulating digital strategies based on internal and external data, the experts spotlighted the importance of creating scenarios considering the impact on incumbent's business model. One of the participating experts said: *“I do not know exactly where to fit, but there is an item I consider essential: companies need to assess the implications of all these trends and competitors for their current business models.”*

The microfoundation “*Establishing a long-term digital vision*” was bottom ranked by the experts. Since the uncertainty scenario is more critical than having a long-term vision, organizations need to create quick learning capabilities for rapid adaptation. As stated by one of the respondents: “*Digital planning claims that organizations know how to work inductively and use agile methods to validate hypotheses.*”

Such mindset crafting becomes challenging, given the resistance to change and the path dependence created in the incumbent organizations (Eden et al., 2019; Vial, 2019; Li et al., 2018; Lucas & Goh, 2009).

Our results bring out three central issues that incumbents face in traditional industries in building Sensing capabilities. First, organizations need to expand their networks and their capacity to co-create in order to understand the changes demanded by the digital age, abandoning the idea that the traditional form of strategic planning will capture everything that goes on outside the organization. Second, understanding the different available technologies and their impact on the business model is an important capability to filter what will be relevant to guide the digital transformation. Third, the company needs to build a team that has an innovative mindset and knows how to integrate what happens in the digital world into the organization context.

3.6.5 Digital Seizing

Out of all the microfoundations presented in the framework for the Digital Seizing dynamic capability, “*Using a digital innovation lab*” was the least valued by the experts, as shown in Table 3.13. It is interesting to note that this point endorses the idea that seizing the identified opportunities goes beyond attributing such responsibility to innovation structures that are outside the organization routine. Given the challenges of breaking organizational silos (Guinan et al., 2019; Vial, 2019; Verhoef et al., 2019; Chanas et al., 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Dremel et al., 2017) and dealing with the resistance to change (Eden et al., 2019; Tekic & Koroteev, 2019; Warner & Wäger, 2019; Vial, 2019; Gimpel et al., 2018; Li et al., 2018; Lucas & Goh, 2009), having a structure responsible for promoting innovation can reinforce the barriers the organization wants to break by the digital transformation. Even with the challenge of breaking barriers and not assigning the innovation to a single department, one of the experts pointed out that in some organizations they may need an external structure to act as an antibody for these barriers: “*The main point here is to accept an environment of more*

uncertainty and validate hypotheses and projects faster. The company often has such a strong antibody against this type of behavior so that it is necessary to create a separate structure (such as a department) to do, validate, and then incorporate the learning and the new capabilities into the main business.”

Macro Capability	Microfoundations	Total responses	Acceptance percentage
Strategic Agility	Rapidly reallocating resources	15	75%
	Accepting redirection and change	15	75%
	Pacing strategic responses	12	60%
Rapid Prototyping	Creating minimum viable products	18	90%
	Using approaches such as agile project management, process flexibility, lean start-up, design thinking, continuous deployment, and integrated development	16	80%
	Using a digital innovation lab	7	35%
Balancing Digital Portfolios	Scaling up innovative business models	17	85%
	Balancing internal and external options	13	65%
	Setting an appropriate execution speed	12	60%

Table 3.13 - Digital Seizing evaluation according to the participants

Concerning the Strategic agility capability, the experts highlighted the importance of making the strategic planning clear for all the organization levels. Additionally, the evaluations reveal that incumbent firms need to eliminate or mitigate the gap between strategy formulation and execution to exploit opportunities quickly. Finally, the data presents the value of developing decision-making routines based on indicators and metrics that lead organizations to fail fast. As highlighted by one of the respondents: *“Organizations do not need to be afraid of eliminating ideas that did not work. It is necessary to conduct a quantitative analysis and have the courage to give up bad strategies.”*

These findings are consistent with the previous results presented by Chanas et al. (2019). The authors understood that the digital transformation strategy needs to be continually reviewed and reworked by including new learning and insights from ongoing implementation efforts. An example given by the authors was the agile approach to inspecting and adapting the strategic plan based on the short-term results.

In addition to the microfoundations presented for “*Balancing digital portfolios*”, the experts underlined that the investments in digital strategies must be balanced with traditional strategies. Such ability must be accompanied by the organization ability to limit the number of initiatives conducted on the digital transformation journey in order to ensure focus and battle against the misalignment barrier. Finally, expert data showed us that organizations need more flexible budgeting processes in order to reallocate resources quickly.

Based on the Designing contributions made by Yeow et al. (2018), we realized, according to the results, that Rapid prototyping is better explained in three different microfoundations: product development, innovative structures, and agile software development.

Regarding product development, the collected data highlighted the importance of combining design, business, technology, and operations in order to understand customer and market needs.

Organizations will only be ready to provide customer-centric and innovative solutions in the business model when they are able to work as a product and service value chain by using agility as an essential guidance. Such approach ends up incorporating into the organization a vision oriented to hypotheses and rapid tests and a deep interest in the solution delivered to customers. As stated by a participant: “*Organizations that want to take advantage of digital transformation opportunities need to know how to work inductively and use agile methods to validate hypotheses.*”

This finding confirms that digital technology is being embedded in all products and services, and organizations need to focus on creating solutions by an agile approach to respond to market changes (Gimpel et al., 2018).

For Innovative structures, the collected data indicated that new business model innovations will happen when organizations have the capacity of changing structures and internal processes flexibly and organically aiming at decision efficiency. Such flexibility will be possible with a dynamic talent movement and the ability to build teams according to the business challenges. This finding is in agreement with Guinan et al. (2019) when the authors highlighted that to take advantage of digital transformation opportunities, organizations need to promote structures with clear goals, diverse thoughts and the ability to learn.

Finally, the last microfoundation clustered in the experts evaluation regarding “*Rapid prototyping*” was agile software development, which is the capacity of software continuous

deployment and integration. Without the ability to frequently deliver digital products (software), organizations will not take advantage of the opportunities promoted by digital transformation. As noted by Wiesboeck and Hess (2019), IT systems and IS infrastructure need to be able to accommodate the changes triggered by digital technologies.

The expert survey data suggests four essential points regarding the Seizing capabilities required in incumbent organizations undergoing a digital transformation.

First, the ability to understand how to seize opportunities innovatively is a responsibility that goes beyond a centralized structure and should be something proposed for the entire organization.

Second, organizations that want to prototype fast solutions to solve customer problems must have product development structures, which means combining design, technology, business, and operation capabilities. Without such integrated composition, organizations are at risk of continuing to deliver solutions that solve fractions of customer problems.

Third, the digital transformation strategy must be adaptive and able to learn. Organizations need to create a mechanism to execute what they planned in an agile approach. Without the execution capability, the learning flow is not achievable.

Fourth, when everything is a priority, nothing is a priority. A good portfolio of initiatives takes into account actions that helped the organization to remain competitive in the short term, as well as innovations that may produce results in the medium and long term. However, without focus, the organization is at serious risk of not come out of the inertia created by its path dependencies.

3.6.6 Digital Transformation

The results of the expert evaluation shown in Table 3.14 evidenced that all the microfoundations presented in the framework were considered necessary on the transformation journey of an incumbent organization.

Macro Capability	Microfoundations	Total responses	Acceptance percentage
Redesigning Internal Structures	Defining digital transformation leadership	15	75%
	Digitalization of business models	13	65%
	Designing team-based structures	11	55%
	Creating digital business unit	7	35%
Navigating Innovation Ecosystems	Exploiting new possibilities of co-creation or cooperation	16	80%
	Interacting with multiple external partners	13	65%
	Joining a digital ecosystem	11	55%
Improving Digital Maturity	External recruiting of digital talent	15	75%
	Leveraging digital knowledge inside the firm	15	75%
	Identifying digital workforce maturity	14	70%

Table 3.14 - Digital Seizing evaluation according to the participants

Complementing the microfoundations presented in Redesigning Internal Structures, experts emphasized the importance of the organization being able to promote lightweight functions to solve problems, after all, prescriptive and onerous processes may stop the innovation and evolution of new and effective ways to create better solutions.

From the results, we identified the importance of creating teams connected with the customer journey (designing customer-centric structures). This result confirmed the findings that in customer-centered organizations, businesses will provide better solutions (Chanas et al., 2019; Svadberg et al. 2019; Hansen & Kien, 2015).

In addition to Connecting with startups, expert data indicated that the reconfiguration of an organization may require the acquisition of such companies, as cited by a participant : *“Incumbents should consider from minority acquisition in startups that have synergy with the business (so that you have a subjective and privileged view of what is happening and success factors) to acquisition (acquisition and acquire-hiring) to accelerate the optimization of the product offer and adaptation to a new digital model.”*

The results mentioned above tie in well with previous studies where using external structures as complementary to the existing resources in the organization can enhance the value delivered (Yeow et al., 2018).

Despite the lowest acceptance rate of the microfoundation “*Create a digital business unit*” by the experts, the open answer spotlights the importance of a governance structure for digital transformation.

In line with previous studies, our data demonstrated that the transformation initiative could emerge from efforts in the IT department (Wiesboeck & Hess; Haffke et al. 2017), or as a conception of an independent business unit (Wiesboeck & Hess, 2019; Chantias et al., 2019; Yeow et al., 2018; Haffke et al. 2017). Regardless of the previous considerations, a leadership role with social capital and power should be implemented with the support of other C-level managers (e.g., Chief Digital Officer) in order to guide the transformation journey, and the new structure (department, unit, existence function arrangement) need to be able to build lightweight teams with a customer-centricity mindset and business-oriented. The preliminary findings are consistent with Teece (2007) when he presented reconfiguration (transformation) as the capability of adopting loosely coupled structures that embrace innovation sustained by proper alignment.

Regarding “*Navigating innovation ecosystems*”, the evaluation confirms that creating connections with startups can accelerate the development of the transformation mindset within incumbents in addition to generating the possibility to co-create (e.g., opening data and offering APIs to promote collaboration). As pointed out by an expert: “*Large organizations need to be close to startups, or these companies should even consider creating their startups. This kind of approach helps accelerate the development of the transformation mindset.*”

Another finding emphasized by the experts was that establishing connections with global ecosystems from other industries could lead the incumbents to develop business model innovations.

The last finding related to the capability of accessing external resources was the importance of building routines of co-creating solutions with customers and partners. As we mentioned in Sensing and Seizing capabilities, the customer has a central role in the digital transformation strategy, which indicates that creating routines of monitoring customer needs should be considered crucial to open new perspectives for the offer of products and services.

Concerning the macro capability of Digital maturity, the results showed that using external specialists and offering training can enhance the digital knowledge inside the firm. Additionally, talent was the other theme that emerged from the data analysis. The experts

mentioned that incumbent organizations are not able to design routines for talent retention and attraction. Given the existing stability in the business, people management was considered an ordinary instead of a dynamic capability. In order to respond to a digital transformation requirement, incumbent organizations have started a digital talent attractiveness movement, which forces them to compete for new employees against startups. Furthermore, with new routines and new management models, some professionals may not adapt to those changes.

Finally, the results confirm the role of learning and knowledge transfer through rapid organizational learning. Incumbents need to promote short feedback cycles in order to quickly learn which practices continue to work well and which do not.

The collected data suggests three essential points regarding the complexity of reconfiguring incumbents during digital transformation. The first point to highlight concerns the value of creating digital governance to lead collaborative teams on a journey out of the inertia created by the current culture.

Second, in order to undergo a transformation, companies need to be connected to what happens outside. As we noted in the literature review, in the past, incumbent companies dealt with more predictable markets and customers. However, digital transformation presents a different context. To remain innovative, organizations need to establish connections with startups, ecosystems, customers, and partners.

Finally, the digital era brings the challenge of maintaining digital talent and knowledge. Without new management approaches that increase the digital maturity of their workforce, organizations will lose intellectual capital and diminish their ability to create a competitive advantage over the rival(s).

3.6.7 Strategic Renewal

In line with previous studies, we noted in the results shown in Table 3.15 the strategic impact of digital transformation on the business model, the organization's culture, and the way people collaborate.

Regarding the business model, the experts underlined that the digital transformation leads incumbent organizations to reposition the value proposition via innovation in new markets, new services, or new technologies. Additionally, the provoked changes will help organizations defend a market position (acquiring and retaining customers) and open new markets.

Concerning culture, the experts emphasized that digital transformation is able to promote a more diverse, learning-base, and error-acceptance environment.

Finally, the flattening of structures, the decision autonomy, the innovative mindset, and the connection with a broader external partner ecosystem will produce a more collaborative way of working.

Strategic renewal	Total responses	Acceptance percentage
Business model	17	85%
Culture	16	80%
Collaboration	11	55%

Table 3.15 - Strategic renewal

3.6.8 Expected Outcomes

The expert evaluation results shown in Table 3.16 validated the expected outcomes from organizations conducting digital transformation.

We found when organizations provide a better customer experience, revenue will increase. When explaining the expected outcome of incumbent digital transformation, a participant stressed that: *“It is important to explain the impact the transformation has on clients. There is a network movement stating that the customer's opinion can directly impact the company's image and how other people see the organization.”* A similar conclusion was reached by Verhoef et al. (2019), Vial (2019), Ponsignon et al. (2019), Svadberg et al. (2019) and Sebastian et al. (2017) when the authors noted that digital transformation tends to enhance customer experience also producing efficient results.

Regarding the new cost-revenue model (new business models), we found that incumbent organizations foresee that digital transformation will lead the development of new value propositions to respond to threats urged by the disruptive competition from new adjacent industry entrants.

In addition to the expected outcomes presented in the first version of the framework, the experts emphasized that besides the economic results, digital transformation promotes a more motivating environment for employees. This finding strengthens the interest of the organization in developing capabilities to enable talent retention.

Expected outcomes	Total responses	Acceptance percentage
Increased revenues	16	80%
New cost-revenue model (new business models)	15	75%
Operational efficiency	14	70%

Table 3.16 - Expected outcomes

3.7 Conclusion

In this qualitative study, we examined the dynamic capabilities incumbent firms need to develop for digital transformation. We proposed this research to establish elements that can help organizations that are planning or had already started the digital transformation.

By adopting a design science research approach, we extended the dynamic capability framework proposed by Warner and Wagner (2019), updating some constructs based on the current body of digital transformation knowledge. We demonstrated the framework applicability in an empirical case at Coimbra University Hospital. A group of experts evaluated the framework through a survey. The collected data confirms the proposed constructs and also introduced some emerging ones.

3.7.1 Research Contributions

As previously mentioned by Vial (2019), applying dynamic capability and investigating the microfoundations is an essential theoretical stream to explain the ongoing digital transformation initiative in incumbent firms. Supported by previous research on Information System and Strategic Management, our framework provides new theoretical insights into the elements and capabilities incumbent organizations need to consider when undergoing digital transformation.

We reported that digital transformation can be a movement that rises with both external and internal triggers. Regardless of where the phenomenon is triggered, digital transformation is an IT-business-centric change.

Our results highlighted new internal barriers that can slow down the digital transformation process: risk-averse culture, incentive systems, and strategic misalignment. As noted by Wiesboeck and Hess (2019) and Vial (2019), organizations that do not support or bad-judge error cannot learn and cannot be innovative. Moreover, the way organizations define bonus and incentive systems can break the collaborative conditions required by digital transformation. Finally, organizations should focus and keep all efforts aligned to build the capacity to support future transformations (Chaniyas et al., 2019).

Our research presents the support of digital leaders, financial resources, and a culture open to change as critical enablers to support digital transformation. As noted by Chantias et al. (2019) and Yeow et al. (2018), the development and execution of digital transformation strategies depend on the interplay between top-down and bottom-up activities. If fail to promote both movements, digital transformation can freeze. Regarding the financial aspect, we found that digital transformation demands continuous investment.

In line with Warner and Wäger (2019), we found that incumbents need to create an arrangement of dynamic capabilities for digital transformation. Regarding Digital Sensing, our findings corroborate recent researches' results evidencing that organizations need to create a strategy in a lighter way, considering internal and external data (Chantias et al., 2019; Yeow et al., 2018). Moreover, we found that organizations need to continuously understand the impact of digital technologies on the current business model in order to use new technologies productively. Lastly, organizations need to build innovative teams that know how to connect what happens in the digital world to the organization context.

Concerning Digital Seizing, our results highlighted the importance of decentralizing innovation and designing teams in product development structures, which means combining design, technology, business, and operation capabilities (Gimpel et al., 2018). Additionally, corroborating Chantias et al. (2019), we noticed that the digital transformation strategy must be adaptive, able to learn and focused. Without focus, the organization is at severe risk of been stuck by the inertia created by its path dependencies.

Regarding Digital Transformation, as noted by Wiesboeck and Hess (2019), incumbent organizations need leadership to guide the change. Our findings emphasize that without new management approaches to improve their workforce's digital maturity, organizations will lose intellectual capital and diminish their ability to create a competitive advantage.

Finally, our findings showed the importance of providing a better customer experience as a digital transformation expected outcome (Verhoef et al., 2019; Vial, 2019; Ponsignon et al., 2019; Svadberg et al., 2019; Sebastian et al., 2017).

From a holistic perspective, our conclusions can support practitioners who are facing digital transformation. The elements and capabilities reduce the complexity of describing the digital transformation phenomenon.

To help the understanding of digital transformation as the addition of technologies to organizations, incumbents must find capabilities that produce business agility. As we presented throughout this work, creating strategies that promote business model innovation, customer-centered actions, current political game reduction, and collaboration should be in the list of changes of practitioners who want to drive digital transformation within organizations. Furthermore, digital transformation is a never-ending process –new external triggers arise, and culture is always changing –, recalibrating the call for sensing and seizing new opportunities and transforming the structure.

3.7.2 Limitations

As a research limitation, we should mention that even considering the current literature and experts opinion, the presented framework can be evolved as we noted throughout the evaluation.

Another limitation is the transfer of the findings to other contexts. Given the qualitative nature of the data collection, it is not clear if the framework can cover all different types of incumbent organizations that are undergoing a digital transformation.

We need to highlight that the framework was evaluated by a small group of practitioners. We did not consider academic specialists opinions on the topic of digital transformation.

Despite the issues mentioned above, this study represents an essential contribution as we conducted it with people that are leading digital transformation in incumbent organizations.

3.7.3 Future Research

We encourage other researchers to test the transferability and generalizability of our findings, since we worked with a limited sample. Further researches can use quantitative methods to measure the variables proposed by the framework and analyze their effects on organizational growth, performance, and sustainability.

Another essential future work involves presenting the application of the framework to case studies to validate its potential to support to organizations that are experiencing digital transformation.

4 RESHAPING HIGHER EDUCATION INSTITUTIONS IN TIMES OF DIGITAL TRANSFORMATION: FINDINGS FROM A DYNAMIC CAPABILITIES MODEL

Abstract

According to empirical data, just a few companies succeed in digital transformation and go beyond the piloting steps. Unrealistic expectations, lack of financial support, limited focus on digital technologies, poor governance, and underestimation of cultural barriers are examples of digital transformation failures. Unlike other segments, academic institutions have changed at a slow pace without considering how to streamline operations and enhance the student experience. However, COVID-19 (coronavirus disease of 2019) has challenged institutions worldwide to seek innovative solutions in a relatively quick time. Despite the attention given by academia to the issue, there is still a lack of theoretical background to describe the phenomenon. We conducted three case studies in higher education institutions undergoing a digital transformation through the lens of dynamic capabilities to address this gap. We identified dynamic capabilities that can be instrumental in higher education institutions' digital transformation journeys. We also examined triggers, enablers, and barriers to the production of those dynamic capabilities. Additionally, we identified strategic emerging renewals and the outcomes produced from the digital transformation in the institutions analyzed. This research contributed to the existing but limited literature on digital transformation by reinforcing dynamic capability as a theoretical background to analyze the digital transformation and provide new empirical data for future research.

Keywords: Digital Transformation; Digital Technologies; Case Study; Higher Education Institutions.

4.1 Introduction

Generally, organizations environment is changing faster. Digital transformation drives organizations to enhance their engagement with their customers, improve their IT capability to transform business processes, products and services, and survive in a highly digital world.

DT is an organization's capability to embed digital technologies in its routine, promoting a shift in how it creates value supported by a rethinking of its whole structure and processes, thus reshaping its business model (Vial, 2019).

DT requires building data governance, integrating IT resources, developing organizational agility, understanding customers' needs, establishing connections with digital ecosystems, dealing with internal resistance, and designing new revenue models (Nadkarni & Prügl, 2020; Vial, 2019; Gimpel et al., 2018).

Several incumbent organizations have begun to improve their digital capabilities and resources to deal with digital technologies rapid progression (Sebastian et al., 2017; Svahn et al., 2017). However, they are struggling to innovate and adapt at the same pace as start-up companies (Nadkarni & Prügl, 2020).

Some markets, such as the press (Karimi & Walter, 2015), have been transformed and digitized within a brief period. Unlike retail and financial sectors, academic institutions have changed at a slow pace without considering how to streamline processes and enhance student's experience. Nevertheless, COVID-19 has challenged institutions worldwide to seek innovative solutions in a relatively quick time (Tam & El-Azar, 2020).

With the increase in competition for students and funding, higher education institutions need to tackle several challenges, such as migrating from traditional or blended learning to an entirely virtual and online delivery strategy (Crawford et al., 2020).

Such transformation requires a growth in workforce's digital maturity, excellent infrastructure, and evolution of teaching and learning methodologies that will fundamentally modify how institutions operate and how they deliver value to their customers (Crawford et al., 2020; Eggers & Bellman, 2015).

Some universities and schools have developed digital strategies and new kinds of offerings to expand their market. However, those approaches are commonly limited to digitizing the content

of lectures and opening access to education modules, by offering them online, without considering digital trends, customer calls, and revamp of business models (DeVaney, Shimshon, Rascoff, & Maggioncalda, 2020).

The existing research trends usually highlight the relevance of DT in higher education institutions considering its impact on different stakeholders (students, staff, and professors) and processes (Kaplan & Haelein, 2016). There is still a gap in connecting the challenges, triggers, enablers, and generated dynamic capabilities that support higher educational institutions through digital transformation.

Considering the strategic impact of digital technologies, we claim dynamic capability offers a useful theoretical approach to bridge the gap with respect to how higher education institutions can thrive through digital transformation (Vial, 2019; Warner & Wäger, 2019).

The challenge of rearranging the internal resources to maintain a competitive advantage and the demand for firms to incorporate 'old' and 'new' capabilities into their organizational structure are some of the backbones recognized by the theory. Furthermore, the theoretical stream focuses on describing how organizations build, accumulate, transform, manage, acquire, and (re)combine their resources to address fast-changing markets (Foss & Stieglitz, 2012; Helfat & Peteraf, 2009; Eisenhardt & Martin, 2000; Teece et al., 1997).

A few researchers have addressed how organizations build dynamic digital transformation capabilities (Warner & Wäger, 2019; Vial, 2019). To fill the previously mentioned gap, this research aims at answering the following question: *how do dynamic capabilities are essential to higher education institutions' digital transformation?*

The purpose of this study is to describe and analyze how digital transformation occurs in higher educational institutions, check the triggers, enablers, barriers, dynamic capabilities, strategy changes, and expected results, supported by a model that illustrates the phenomenon. So, we conducted three case studies in Brazilian higher education institutions.

By investigating the theme based on case studies, this paper contributes to the literature in different forms. First, we enhance recent research (Sousa-Zomer et al., 2020; Warner & Wager, 2019) by exploring the micro-level components underpinning a firm digital transformation. By producing research in a scenario where the world faces a global pandemic, we analyze and

describe how organizations in a traditional market (higher education) advance. At the same time, the environment demands a complete reframe on how these organizations deliver value.

Second, by exploring the micro-level components, we also contribute to further investigations that expand the understanding of the dynamic capabilities microfoundations (Schilke et al., 2017). The study of dynamic capabilities and how companies develop them, particularly in a digital transformation scenario, enriches both practical and theoretical knowledge of how firms create sustainable advantage (Sousa-Zomer et al., 2020). Finally, considering that triggers, enablers, and barriers are critical while developing capabilities, we describe concrete aspects surrounding digital transformation (Gimpel et al., 2018).

This paper has six sections. In the first section, we presented the research motivation and its purpose. In the second section, we presented relevant literature on digital transformation and the phenomenon in higher education institutions. We explained how dynamic capabilities can help us understand the digital transformation. In section three, we detailed the methodology applied. In section four, we presented the higher education institution case studies. Subsequently, in section five, we presented the common dynamic capabilities identified in the cases studied. The conclusion provides the main research and practice findings.

4.2 Theoretical Background

This section summarizes the relevant background of digital transformation in general and its impact on higher education institutions. Additionally, we describe how dynamic capabilities are an excellent approach to keep firms ahead of the business world's challenges.

4.2.1 Digital Transformation: Triggers, Barriers, Enablers, and Impacts

The crisis provoked by the coronavirus pandemic has required companies to slash costs by reducing headcount and controlling investments to conserve cash. In order to survive and thrive after the crisis, companies need to build capabilities to innovate in their current business.

DT is a change that goes beyond process digitization and requires deep transformation of organizational arrangements, advanced use of IT, and enhancement in value creation to adjust or create a new business model (Chaniias et al., 2019; Svadberg et al., 2019; Haffke et al., 2017; Hess et al., 2016).

Additionally, DT is an organizational strategy that employs digital technology capabilities to rethink new revenue streams, business performance, and customer experience (Sebastian et al., 2017).

Wessel et al. (2021) proposed that DT activities leverage digital technology in (re)defining an organization's value proposition and creating a new organizational identity by changing how organizations build value.

Protecting competitive advantages and creating new opportunities in the digital world are topics that surround the definition presented previously and compose the agenda of incumbent leadership (Gurbaxani & Dunkle; 2019; Sebastian et al., 2017; Hess et al., 2016).

The conceptual framework introduced by Vial (2019: 122) and the thematic map presented by Nadkarni and Prügl (2020) provided a starting point to understand the dynamic connection concerning triggers, barriers, enablers, and impacts that encompass DT.

From an external perspective, DT happens in organizations due to the need to respond to the competitive landscape, changes in consumer behavior and expectations, disruptive technology availability, and the call for rethinking value propositions (Warner & Wäger, 2019; Gimpel et al.; 2018).

Digital technologies have facilitated the (re)combination of existing products and services to generate new forms of digital offerings favoring services over products, diminishing entry barriers and hindering the sustainability of incumbent players' competitive advantage (Wessel et al., 2021; Vial, 2019; Warner & Wäger, 2019; Gimpel et al.; 2018). Consolidated business models struggle to stay competitive against new players in a digital world (Verhoef et al., 2019).

In addition to the competitive landscape, the diversity of solutions, the shopping behavior shift to online channels, the increase in service quality expectations, and a more influential customer role in transactions require organizations to develop the ability to understand customer demands (Nadkarni & Prügl, 2020; Verhoef et al., 2019; Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Loonam et al., 2018; Singh & Hess, 2017; Schuchmann & Seufert, 2015). Customers are increasingly demanding good experiences as more choices of products or services can satisfy them (Singh & Hess, 2017).

Disruptive technologies are another trigger identified. Social media, mobile, big data, analytics, and the Internet of Things are shortening innovation cycles and providing companies with

opportunities and posing threats (Verhoef et al., 2019; Warner & Wäger, 2019; Vial, 2019; Gimpel et al.; 2018; Nwankpa & Datta, 2017; Hess et al., 2016; Karimi & Walter, 2015). Mastering those technology assets is essential for organizations to implement their strategic vision and build digital capabilities to stay competitive against new entrants (Gurbaxani & Dunkle, 2019; Nwankpa & Datta, 2017).

Another DT motivation is the claim for rethinking value propositions. The spurring of digital offerings is challenging organizations to identify unmet customer needs, create smart products and services, and introduce innovative and tailored customer value propositions (Wessel et al., 2021; Vial, 2019; Gimpel et al., 2018; Loonam et al., 2018; Hansen & Sia, 2015). Traditional industries with low entry barriers (e.g., retail, telecom) or that can be mostly digital (e.g., consumer financial services, media, booking, transportation) have faced the challenge of (re)thinking the value offered to their customers (Wessel et al., 2021; Tekic & Koroteev, 2019).

Incumbent firms that navigate through DT deal with significant barriers (Vial, 2019; Warner & Wäger, 2019). The search for a long-term strategic vision, the misalignment between IT and business strategy, rigid planning, and strategizing politics slow up continuous innovation (Warner & Wäger, 2019; Chanias et al., 2019; Yeow et al., 2018; Matt et al., 2015).

Organizational culture has a crucial role in technology-enabled transformations (Nadkarni & Prügl, 2020; Warner & Wäger, 2019; Lucas & Goh, 2009). The well-built workforce mental model and the lack of attitude toward change create resistance and can hinder DT (Warner & Wäger, 2019; Kane, 2019; Tekic & Koroteev, 2019; Gurbaxani & Dunkle, 2019; Eden et al., 2019; Li et al., 2018). The adoption of digital technologies in an organization's routine can produce workforce stress, fatigue, and the need to continually react to unexpected events (Vial, 2019; Eden et al., 2019). Those circumstances require a solid cultural foundation that will enable the organization's workforce to drive the turbulence of change (Eden et al., 2019).

The way an organization is structured and the walls that inhibit collaboration are internal barriers as well. The power relationships created by hierarchical structures and the restrictions produced by silos prevent the emerging of a collaborative context (Guinan et al., 2019; Vial, 2019; Warner & Wäger, 2019; Gimpel et al., 2018; Dremel et al., 2017; Lucas & Goh, 2009). Removing silos and high hierarchy will enable a better communication flow, promote more diverse teams, and allow the release of flexible arrangements, creating a renewed identity (Wessel et al., 2021; Warner & Wäger, 2019; Chanias et al., 2019; Guinan et al., 2019). Middle

management plays a crucial role in driving organizational transformation, leading to a shift in emphasis from planning and controlling to speed and flexibility, welcoming ambiguity and risks (Nadkarni & Prügl, 2020).

The other cultural barrier to be broken down is the passivity created by path dependence (Vial, 2019). The past success guides firms to maintain their existing relationships with customers and suppliers and follow well-established production processes that are highly optimized but often rigid (Tekic & Koroteev, 2019). The fear of taking risks and penalties for failures cause people to remain in their comfort zone (Chanas et al., 2019; Dremel et al., 2017). It is crucial to unfold the friction and fragility occurring throughout the transformation process as it clearly shows that changing activities require adjustments to an organization's work practices, which, if not performed, may hinder the whole transformation plan (Wessel et al., 2021).

According to our literature review, there are some enablers in order for DT to move forward. A previous research found that cross-functional teams, fast-decision making, and executive support are relevant as DT pushes forward (Warner & Wäger, 2019). Another group of authors complement such perspective, including strengthening IT capability (Wiesboeck & Hess, 2019; Vial, 2019; Gimpel et al., 2018; Nwankpa & Datta, 2017; Sebastian et al., 2017; Zhu et al., 2006). Ultimately, to take advantage of digital technologies, organizations must integrate new resources into their fragmented legacy Information Systems (IS) to rebuild their businesses.

Social media, digital transactions, embedded sensors (e.g., Internet of Things), and mobile devices are new data sources that drive data explosion. Data-driven applications, such as recommender systems or predictive analytics, in addition to integrated data, require high-quality data (Gimpel et al., 2018). Additionally, data management, data ownership, and privacy (i.e., the rights and control over data) are highly relevant factors in defining competitive positioning (Vial, 2019; Gimpel et al., 2018).

Without the data governance enabler, organizations will not be able to transform the records of transactions, customers, and processes into resources to enable them to make better decisions and generate a competitive advantage.

Organizations that are pursuing DT need to aim at changes in their business models, the way people collaborate, and their culture (Wiesboeck & Hess, 2019; Warner & Wäger, 2019; Vial, 2019; Gurbaxani & Dunkle, 2019; Karimi & Walter, 2015).

In regard to the economic perspective, organizations that are conducting DT expect to produce cost savings from a more efficient deployment of existing resources (Verhoef et al., 2019; Vial, 2019), increase revenues from business process re-engineering (Verhoef et al., 2019; Vial, 2019), and produce a new cost-revenue model (Verhoef et al., 2019; Wiesboeck & Hess, 2019; Vial, 2019; Warner & Wäger, 2019).

In the past twenty years, a number of markets have been permanently changed by technology: the press, book publishing, services in general, and many more. Similarly, higher education faces unique challenges driven by rapid changes. In the next section, we will discuss the DT phenomenon considering the educational context.

4.2.2 Digital Transformation in Higher Education Institutions

The world is evolving at a fast pace and is rapidly going digital. As artificial intelligence is replacing manual processes, digital devices affect the way we communicate, entertain, interact with each other, and learn.

Digital transformation has reached higher education institutions (HEI) as well, and with the digital age advancing quicker than ever, HEIs need to set themselves up for the scalable capabilities required to remain competitive.

The onsite instruction has become blended, which means combining traditional teaching with digital objects. Additionally, HEIs have been incorporating online courses into academic offerings at undergraduate and graduate levels (Almaraz-Menendez, Maz-Machado, & Lopez-Esteban, 2016).

Students have also changed. Today's HEI scholars were born in the mid 90's and consequently belong to the so-called millennial generation. They grew up with the Internet and interacted naturally with digital devices, thus demanding a new learning approach (Bond, Marín, Dolch, Bedenlier, & Zawacki-Richter, 2018).

In this scenario, teachers should innovate their schooling by using digital technologies to cooperate, interact, and co-create knowledge with different stakeholders (Bond et al., 2018). HEI managers recognize in DT a chance to improve processes, re-evaluate offers, and ensure digital adoption in business as they tackle the challenge of dealing with financial, technology, and infrastructure constraints (Benavides, Arias, Serna, Bedoya, & Burgos, 2020).

As DT is a continuous journey, the hurdle faced by traditional HEIs is to operate the current business (branding, educational ranking position) while evolving for the future, to avoid becoming “*the dinosaurs of the education area*” (Kaplan & Haelein, 2016).

The higher education DT is a strategy that intends to redefine educational services and products and reformulate operational routines (Sandkuhl & Lehmann, 2017). According to Sandkuhl and Lehmann (2017) HEIs can execute such strategy by adopting three different approaches:

1. The service-first transformation, which it intends to create new educational products and transform existing products into digital ones (e.g., an HEI that decides to internationalize its content should adopt this approach to transform its onsite content into a digital offer).
2. The operation-first transformation, which it aims at developing new digital processes, activities and operations, and modify the existing ones, based on the digitization of all value creation and supporting services (e.g., automation of the registration process for programs and courses).
3. The service and operation combination is a systemic inter-relation of the two previous approaches (e.g., an HEI that decides to offer a digital program of a Master of Business Administration for a new target group by using a side admission process).

As DT is a shift that goes beyond technology, Benavides et al. (2020) noted that an HEI should manage a set of systemic dimensions to succeed in the transformation journey, such as teaching, infrastructure, curriculum, administration, research, business process, human resources, extension, digital transformation governance, information, and marketing. This means that DT in HEI has become more than thinking about using tech-devices in the classroom or digitizing content, thus asserting HEI strategic thinking about the matter as digitalization has opened a wide range of possibilities to interact with customers, innovate and survive from a crisis like COVID-19 (Crawford et al., 2020).

DT in HEIs creates a number of benefits, namely: cost savings from administration process efficiency, improvements in data quality and reliability, advancements in teacher-student interactions, enhancements to content quality and access, streamlining enrollments and other touchpoints with students, as well as connecting HEI's knowledge production to a global network of researchers (Benavides et al., 2020). Like any change, HEIs expect DT to improve customer experience, competitiveness, profitability, and agility (Clark, 2018), assisted by

technology, process rethinking, innovative curricula, diverse teaching approaches, and digital marketing (Benavides et al., 2020).

To drive the transformation and reduce complexity, several authors noted that HEI's DT requires an adequately designed strategy, including a framework in which all essential actors perform an influential function in molding the institution to thrive in the digital age (Benavides et al., 2020; Crawford et al., 2020; Clark, 2018). An HEI requires the agility to reallocate resources rapidly and build new capabilities.

In terms of strategies for human resources development, HEIs must provide all stakeholders with pedagogical and technical guidance on how to use technology creatively (Bozhko, Maksimkin, Baryshev, Voronin, & Kondratyeva 2016). Competence and digital transformation centers that give lectures and support, and promote how students, researchers, senior leaders, and support staff experience, learn and work in a digital society are crucial enablers of HEIs DT toward building a competent digital workforce (Sandhu, 2018).

To reach the DT benefits, HEIs must consider the technology layer (Benavides et al., 2020). From a globally integrated platform that enforces standardization and integration of new technologies, HEIs will reduce IT-related risks and increase their organizational agility and decision-making capability (Olsen & Trelsgård, 2016).

Transformation does not happen without the support of the organization executive team. A clear understanding and alignment in the senior executive team promotes a company-wide commitment, intensifies the policy strength, generates the social capital that supports DT, and minimizes potential barriers (Benavides et al., 2020).

As previously mentioned, DT in HEIs requires rethinking, restructuring, and reinventing resources that will enable them to gain a competitive advantage and create superior performance. In other words, DT should be HEIs integral and holistic transformation, affecting how they sense opportunities, seize and transform their resources.

Based on the understanding that DT is a ubiquitous shift in how organizations purposefully arrange their resources to respond to the outside triggers, we believe that the dynamic capability theory provides valuable background for examining HEIs transformation. Research on the dynamic capabilities for digital transformation is still at a nascent stage (Sousa-Zomer et al., 2020; Warner & Wäger, 2019; Vial, 2019).

4.2.3 A Dynamic Capability Model to Analyze Digital Transformation

Barney (1991) stated that a company internal resources and capabilities are strategy and performance determinants. He considered that firms must organize themselves to take advantage of their resources and capabilities to remain competitive and realize their potential (Barney, 1991).

The highly dynamic context which firms deal with requires dynamic capabilities as well (Teece, 2007). Coined by Teece et al. (1997), the dynamic capability theory focuses on explaining how firms build, accumulate, transform, manage, acquire, and (re)combine their resources to address fast-changing markets. Additionally, it corroborates product development and knowledge management literature, evolutionary economics, Schumpeterian thinking, organizational learning literature, leadership work and alliances, and business history (Foss & Stieglitz, 2012).

Digital transformation requires organizations to produce dynamic capabilities as such organizations need to organize and communicate newly obtained knowledge and develop missing resources besides integrating them into their routine to stay innovative and competitive (Warner & Wäger, 2019; Yeow et al. 2018; Nwankpa & Datta, 2017; Karimi & Walter, 2015). As a result, capabilities are not interchangeable and easily replicable commodities; however, these capabilities must interact with the organizational processes and procedures effectively.

Winter (2003) reported it is a mistake linking dynamic capabilities and generalized effectiveness ideas, which uses general formulas to thrive. For the author, existing capabilities are insufficient to undergird a sustainable competitive advantage in a changing business scenario. More recently, Sousa-Zomer et al. (2020) found that new dynamic capabilities are necessary to compete in a fast-paced digital landscape.

Even with the research growth over the years (Sousa-Zomer et al., 2020; Warner & Wäger, 2019; Yeow et al., 2018; Karimi & Walter, 2015), very little has been empirically produced combining dynamic capabilities and digital transformation. Additionally, there is some criticism about the theory's robustness (Schilke et al., 2017) as there is some complexity in making it objective (Vial, 2019).

To explain the theory more tangibly, Teece (2007) presents dynamic capabilities considering three capacities: sensing, seizing, and transforming. Each element includes skills, processes,

procedures, organizational structures, decision rules, and distinct disciplines, also called microfoundations.

Teece's (2014) sensing involves “*identification, development, co-development, and assessment of technological opportunities about customer needs*” (p. 332). Sensing is not limited to technological opportunities but encompasses other environmental changes or internal decisions (Yeow et al., 2018). It is an act of inquiry, creation, learning, and interpretation. Organizations embrace digital technologies, such as Big data, analytics, and mobile technologies to explore new markets and technologies, monitor customer needs, and be aware of sector updates (Gimpel et al., 2018).

The second capability is seizing, whereby the organization investigates the recognized opportunities (Teece, 2014). Seizing moves the organization beyond by understanding new business possibilities and deciding what specific changes to make across its multiple organizational elements to seize those opportunities (Teece, 2007, 2014). Strategic agility, prototype building, designing a portfolio of options that consider internal constraints and external alternatives, and seeking flexibility in structure and business model are capabilities that increase an organization's chance to seize the perceived opportunities (Warner & Wäger, 2019).

The third capability is transforming, which means ongoing refresh of organization resources, including asset alignment, co-alignment, realignment, and redeployment (Teece, 2007). Transforming promotes organization growth and profitability by improving, combining, and reconfiguring its capacities. This capability describes an organization's ability to conceive new resources and processes and re-adapt the existing ones to respond to changes.

To transform, organizations will need to consider new ways to interact with innovation ecosystems, redesign their internal structures to make them more agile, create new leadership roles to guide the transformation from a strategic standpoint, and increase workplace digital knowledge (Warner & Wäger, 2019).

To explore the phenomenon and the microfoundations that embrace digital transformation, we will use as a theoretical background the framework presented in Figure 4.1.

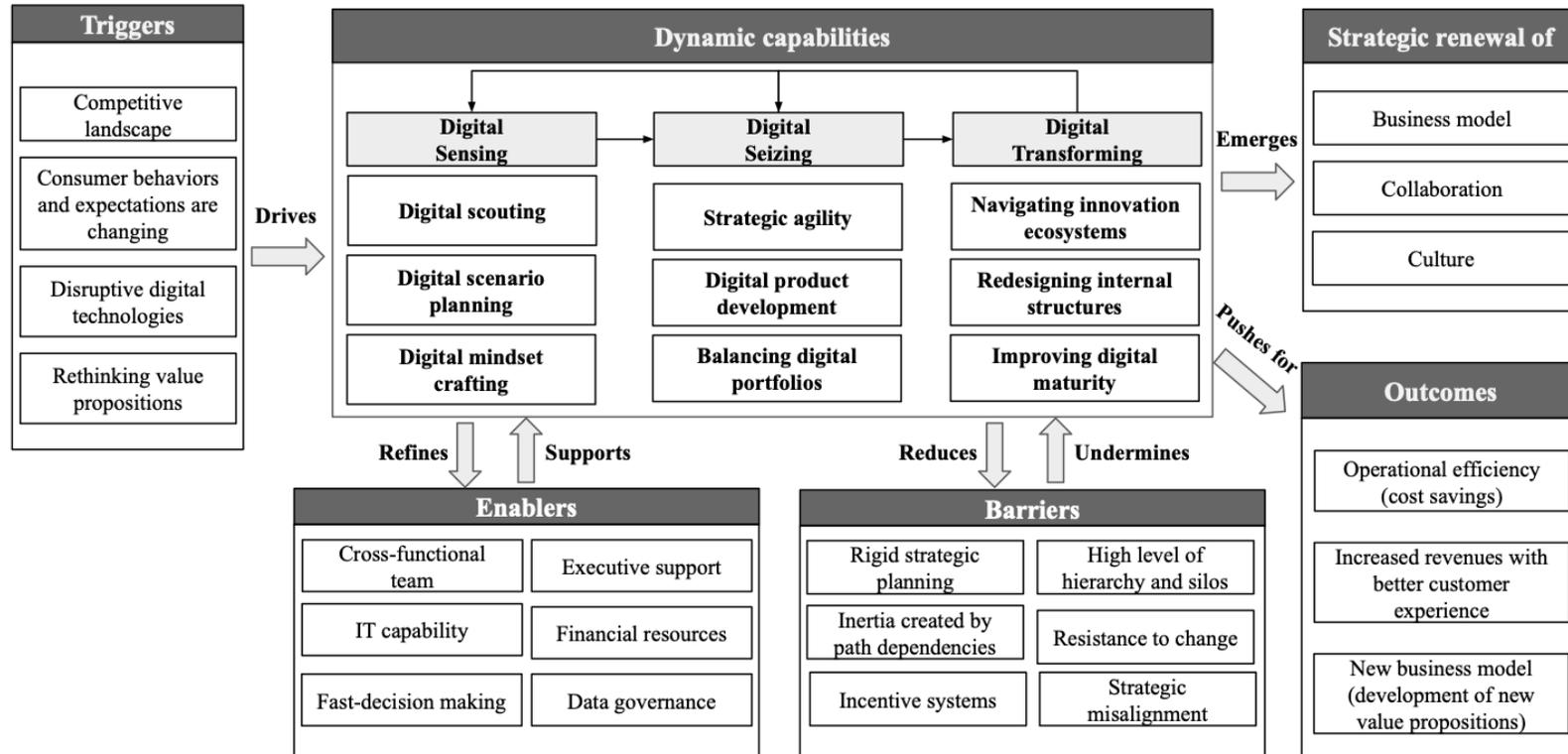


Figure 4.1 - Theoretical model

The proposed model is an extension of Warner and Wäger (2019). The process model's outer boxes represent general elements of transformation processes, and the inner boxes represent the micro-levels. The dimensions show a broad view of the triggers, enablers, and barriers toward producing dynamic capabilities. Additionally, the model proposes emerging strategic renewals and the expected outcomes of the digital transformation.

The theoretical model presented, and the literature described in the previous section are the starting point for our research. Our primary goal is to recognize the dynamic capabilities resulting from a digital transformation in higher education institutions considering the triggers, enablers, barriers, strategic renewals, and outcomes.

4.3 Research Method

We applied a qualitative approach to our research development since we investigated how digital transformation happens and the underlying phenomenon (Yin, 2014). We analyzed individual higher education institutions that are conducting a digital transformation initiatives.

As noted by Conboy et al. (2012), a qualitative investigation in the Information System field is helpful since it encourages the development of a deep understanding of the managerial and organizational issues associated with innovations raised by technology in the business environment.

Due to the insufficient empirical knowledge of digital transformation (Vial, 2019) and the lack of an analytical model for studying the phenomenon (Gimpel et al., 2018), a qualitative case-study method was considered the most appropriate one for this investigation.

We classify our study as exploratory–descriptive. It is exploratory because it seeks to explain the digital transformation in higher education institutions, and descriptive because it aims to report organizations' dynamic capabilities in a challenging scenario (advance of the COVID-19 crisis).

We designed our multiple case study investigation based on the theoretical model introduced in the literature review (Levy, 2008), since theory-guided case studies provide more structured descriptions of the materials, thus improving internal validity and generalizability (Eisenhardt, 1989).

4.3.1 Case Selection

A critical condition for our study was to find higher education institutions that had recently started a digital transformation. We chose three private institutions located in Brazil that met this requirement.

We applied the theoretical sampling method (Eisenhardt & Graebner, 2007) to select the cases. The Brazilian private higher education industry is especially revelatory for studying digital transformation from a practice-relational viewpoint. By 2019, private institutions represented eighty-eight percent of all Brazilian HEIs (Brasil, 2018). Between 2000 and 2018, the amount of private HEIs raised by approximately sixty-nine per year (Brasil, 2018). In 2018, public HEIs offered 835,569 undergraduate seats, while private HEIs had over twelve million open slots (Brasil, 2018).

We selected private higher education institutions that had begun a digital transformation journey and mix digital and onsite educational offers. Despite their similarities, the size, reach, and age contribute for this research by providing different perspectives regarding the digital transformation. Table 4.1 presents our purposeful sample and uses pseudonyms to keep the confidentiality of each participating institution.

Generic Name	Founded	Company size (employees)	Students (undergraduate and graduate)	Number of undergraduate offers	Number of graduate offers	Does the institution have digital offers?	Does the institution have a Master's or Ph.D. (Doctor of Philosophy) program?
Tech University	1990s	501-1000	10000	14	37	Yes	No
Business University	1980s	501-1000	5000	1	129	Yes	Yes
Advertising University	1950s	1001-5000	15000	8	38	Yes	Yes

Table 4.1 - Case studies selected

4.3.2 Data Collection

To collect the data, we used semi-structured interviews, document analysis, and unstructured conversations.

We conducted online semi-structured individual interviews from June 2020 to September 2020 with the leadership of the selected higher education institutions. We chose respondents with the purpose of collecting complementary views of the digital transformation considering technology and education. Table 4.2 presents a profile of each interviewee as well as a code created to identify them.

Code	Institution	Position	Leadership experience	Education
BU-IT	Business University	Chief Operations and Technology Officer	20 years	MSc
BU-PED	Business University	Dean	23 years	PhD
ADV-IT	Advertisement University	Chief Information Officer	15 years	MBA
ADV-PED	Advertisement University	Learning Technology Specialist	9 years	MBA
TECH-IT	Tech University	Chief Information Officer	11 years	MBA
TECH-PED	Tech University	Academic Director and Head of Corporate Innovation	15 years	MBA

Table 4.2 - Interviewee's profile

Interviews were recorded, transcribed, and analyzed. Interviews ranged from 75 minutes to two hours and were all digitally recorded. We made extensive notes during the conversations.

To guide the conversation, we applied the questionnaire available in Appendix 2. A group of experts assessed the instrument before its application, and we had a pre-test interview with a senior digital transformation consultant to assess the data collection approach. The questionnaire has a section for each component of the theoretical model presented in Section 4.2.

We developed the research questions in English, but the interview data was collected in Portuguese and translated into English.

In addition to the interviews, we also gathered data about the institutions using relevant data sources, such as their website, LinkedIn profiles, YouTube videos, media news, and available reports. Additional conversations with the interviewees through WhatsApp messages and audios enabled a deeper understanding of each case's specific issues.

4.3.3 Data Analysis

Our data analysis focused on identifying elements and capabilities associated with digital transformation. To explore the phenomenon's microfoundations, we conducted a within-case analysis and an analysis between cases (Eisenhardt & Graebner, 2007).

In the linear analysis proposed by Yin (2014), we described each case by presenting a brief history of the institution, the recognized triggers that drove the digital transformation, the available enablers, the barriers that are hindering the change, the capabilities developed, the strategic impact, and the outcomes.

We transcribed and examined the interviews by performing a qualitative content analysis, focused on the narrative and describing the meaning of information. The purpose was to analyze the evident and the latent content and contextual information to capture each case's meanings and create a narrative summary (Drisko & Maschi, 2016).

We applied the coding technique to obtain the most significant portions of the interview transcripts, group similar data units, and condense the data into readily analyzable units. A code is a short phrase generated by the researcher that assigns meaning to each piece of data for later pattern detection (Miles, Huberman, & Saldaña, 2020).

We used NVivo software to analyze the answers and code the elements. The theoretical model provided a provisional list of codes. However, during the data analysis, we were opened to identify new emergent codes (Miles et al., 2020).

To ensure the construct validity of our research, we used a range of key informants whose distinct roles and functional levels enabled us to gain insights from different perspectives (Eisenhardt & Graebner, 2007). Access to additional data sources, such as websites, YouTube videos, and interactions with informants by voice messages allowed us to triangulate information thus reducing single-source bias (Eisenhardt, 1989).

After preparing each case's description based on the collected data, we explored and understood the patterns that emerged from the cases, focusing on the conceptual model's initial constructs. We identified similarities, differences, and new ideas among the results obtained from the different analyzed institutions.

4.4 Findings

4.4.1 Business University

The Business University was founded in 1980, and its purpose was to produce research, consultancy, and education in all management areas.

As a higher education organization, the institution offers undergraduate, graduate, master's, and international extension courses, onsite or online.

In 2018, the institution started a digital transformation initiative aiming at offering digital solutions that meet students' needs and creating an innovative education ecosystem. The BU-IT highlighted that: *“The institution must always think about consumer’s preferences and desires. We need faster and more agile deliveries that allow us to launch new products and revitalize these services and products, which are the reasons for our digital transformation.”*

As part of the digital transformation, the institution has been investing in a more effective digital presence by reformulating its digital channels (e.g., website, blog), creating content on social media, and developing a digital marketing strategy.

In 2020, the institution launched graduate and MBA programs in partnership with an educational startup. The strategic goal is to combine the institution's experience and notoriety in business education with the startup's agility and innovative digital learning experience.

4.4.1.1 Business University- Triggers

The institution identified that offering an education that is not time and space restricted is critical to meet students' demands. The pandemic has accelerated the digital transformation, as mentioned by the BU-IT: *“COVID-19 drove us crazy, as we had to implement changes to our entire administrative and educational operation in a few days, something that would take many years. We already had a strategic plan to migrate to a more online learning environment, but before COVID-19, we did not have a clear stimulus for that.”*

The nature of the rapidly changing business landscape was highlighted by BU-PED as follows: *“With the pandemic, the traditional educational market has changed brutally. Abruptly, the pandemic scenario forced us to migrate from traditional modalities (undergraduate, master's, graduate, and MBA) to the digital format.”*

The institution realized that businesses that did not offer education as their core value proposition, such as e-commerce platforms, took advantage of the pandemic and digital media to provide specialized training to customers thus creating a new competitive scenario.

4.4.1.2 Business University - Enablers

With respect to the enablers, the institution's executive board holds an influential position in supporting digital transformation. Particularly, the BU-IT and BU-PED are responsible for ensuring the organization identifies the most critical actions to transform the value proposition for products and services and student experience. The Chief Financial Officer (CFO) and the President have made a financial commitment to support technology implementation investment.

The board has frequently examined the decision-making process to reduce tension and bureaucracy. The BU-IT summarized the board diversity and supportiveness as follows: *“Our President has a solid background in the innovation field with a vibrant history. Our CFO has a young mind, focused on market trends, and despite being from the administrative-financial department, he is the first one to support the digital transformation. Our academic director is also a champion of everything he observes in the market; he examines several opportunities using his national and international network.”*

For this institution, IT is a critical enabler and promptly embraced digital transformation. Since 2014, the school has invested in technologies, such as cloud hosting, mobile apps, workflow automation, thus enabling it to set a robust communication and integration system within and across organizational boundaries. Moreover, IT has been a key partner in supporting business goals and objectives, providing the flexibility that empowers the institution to rethink its educational proposition.

The pandemic showed that cross-functional teams guided by a common goal are essential to create solutions that reduce business complexity, foster motivation and quality, and promote faster releases. The BU-PED considered collaboration crucial to the success of the institution's digital transformation: *“The existing clarity about why we are changing our institution has been vital to the digital transformation. We have empowered finance, technology, and pedagogical departments to redesign processes so they can better meet students' needs.”*

4.4.1.3 Business University - Barriers

The institution's culture is a barrier to digital transformation, according to respondents. The BU-IT said that *“even with a holistic digital transformation plan supported by and aligned with a group of essential stakeholders, the culture and the people seem to be change resistance factors.”*

Changing the Learning Management System (LMS) and the Administrative System was one of the first tasks of the digital transformation initiative. The IT division picked a set of solutions to the critical issues listed by the educators and the administration staff, but the stakeholders became resistant during the implementation. The BU-PED said: *“Professors, employees and coordinators are resistant to the use of technology tools.”*

The institution recognized that introducing new technologies represents a significant threat to workers' sense of security, stability, and purpose. The institution revealed a set of reasons for people's resistance:

- Fear of the unknown;
- Lack of communication;
- Threat to expertise or status;
- No clear benefits or value;
- Effort required to learn;
- Lack of skills to use digital technologies.

Professors did not see the LMS platform as something useful for instruction activities. Students struggled to realize how the digital channels could improve their learning and streamline workflows, such as enrollments and billing. Finally, the new systems changed all the back-office routine, demanding new knowledge that produced some friction.

The pandemic crisis put an end to all technology attrition as professors, students, and the back-office staff migrated their routines to a home-office reality.

To address the new scenario, the entire pedagogical staff trained students and professors to handle online classes. Many departments, such as finance, sales, marketing, and customer service had to work with cloud-based systems.

4.4.1.4 Business University - Digital Sensing

The institution has been scanning for technological trends by building connections with other higher education institutions and attending international conferences.

Given the accelerated evolution of educational technologies, the BU-IT has a formal benchmarking routine with partners and competitors. That sort of capability has helped the institution to determine if the solution must be developed in-house or outsourced. Additionally, the BU-PED has attended international conferences and visited communities related to digital transformation in the educational sector. Such capability has raised the institution's awareness of market trends.

The digital marketing strategy and analytics tools have supported the institution in gathering the insights necessary to identify, segment, and define its target audience. The BU-IT shared a crucial decision to open a new subsidiary based on the analysis of the internal data on customer's profile: *"The ability to analyze data was crucial to our decision to open a new institution's subsidiary. We talked about the expansion in several internal agendas, but we did not converge toward a clear decision. Following a review of our historical database and our current base and considering our alumni and current students residential and business location, we realized we were considering a new branch in a location totally out of their reality. After a geolocation analysis, we made a decision on the address of our new subsidiary."*

With respect to sensing customers' pain points, the institution has a formal process where students continuously evaluate the courses and institutions. That capability enables the pedagogical coordinators and the institution management team to recognize improvement opportunities based on students' direct feedback.

To address students' demands for better experiences, the institution has sensed how innovative companies implement digital capabilities in diverse markets, such as financial services and e-commerce. The BU-PED illustrates the relevance of monitoring external digital solutions trends as follows: *"When a person uses the bank app and sees that he/she can do everything electronically, he/she wants to have the same experience in school. Everything has to be more comfortable for the students. That is why the institution needs to be attentive and provide students with more electronic, agile, and easier processes."*

To reduce the change barriers, the institution has advocated a digital mindset by arranging an innovative skill team to refine its digital strategy. The long-term plan for digital transformation is often reviewed to consider pedagogical, marketing, and technological trends.

4.4.1.5 Business University - Digital Seizing

The Business University has been working on rapidly reallocating resources and frequently aligning its strategy to capture the sensed opportunities.

The pandemic demanded a complete change in the institution's strategy, with the need to eliminate the gap between strategy formulation and execution to exploit opportunities quickly.

After sensing the coronavirus fast spread, the institution rapidly migrated to online classes as it was the most effective tool to retain students and maintain access to education.

The institution called off the remaining in-class lectures for the year, urging its educators and employees to migrate any remaining lessons and activities to the online environment. The BU-IT stated that *“institutions without a lightweight process, strategic adaptability, and a flexible IT fought to migrate to online classes when the pandemic started and provided vacation instead.”*

The online migration of all the institution's programs was enabled by its IT-backbone and the close collaboration of its pedagogical coordinators with the IT department.

Another capability stated by the respondents with respect to seizing is the value of balancing internal and external opportunities while responding to the digital transformation. Since 2018, the institution has begun to migrate its offers to the digital environment to scale up its business models, thus expanding its market share.

Different from offering live classes digitally, the institution has examined alternatives to distance learning or asynchronous education. The institution decided to validate a full-digital instructional model partnering with Coursera. According to the BU-PED, *“it was an initiative that provided us with an initial understanding of how we can create a digital educational value proposition.”* From the lessons learned from the Coursera partnership in 2019, the institution decided to produce digital programs for its graduate and MBA courses. With the assistance and expertise of an educational startup, the institution created offers to a different customer segment, which is geographically dispersed and has time or resource constraints to attend

college on specific dates, due to their work or family duties. The proposed classes blend self-paced learning and online synchronous activities.

The BU-PED stated that without exploiting the startup's partnership, the institution would not be able to migrate to digital learning: *“We realized that migrating to digital learning would require a significant investment. We knew that our competitors and new market entrants were increasing their market capillarity with digital offers. If we did not combine our intellectual capital and knowledge with some expert business, we would lose that opportunity. Based on that scenario, why not seek speed to reach new cities with our educational capability through an education startup? So, we joined an Educational Tech that has accelerated our digital learning capacity. They have the technological know-how to develop digital learning and we give back our pedagogical expertise.”*

Finally, the interviews showed that prototyping solutions to answer customer problems are essential, which means combining design, technology, business, and pedagogical capabilities. That approach includes a vision oriented to hypotheses and rapid tests and a deep interest in students' feedback. As stated by the BU-IT: *“We can only take advantage of digital transformation opportunities by using agile methods to validate hypotheses faster.”*

4.4.1.6 Business University - Digital Transforming

The pandemic context forced the institution to redesign its internal structures and use digital technologies' full potential. The interviews highlighted the importance of the institution being able to promote lightweight functions to solve problems. After all, prescriptive and onerous processes may stop the change required to deal with the digital transformation.

To succeed, the institution restructured its academic and administrative governance model to have a close collaboration between the IT and the business areas. Such capability strengthened the importance of building teams connected with the customer journey.

Since the beginning, the BU-IT has been accountable for the digital transformation. The institution had its critical process automated thus enhancing traditional services with digital ones (e.g., enrollments, payments) and simplifying the routines involved in educational service delivery (e.g., learning management system, online broadcasting tools).

The interviews showed the value of deploying new co-creation possibilities and interacting with multiple external partners as essential capabilities through the transformation journey. The BU-

PED mentioned that *“the proximity of the startup ecosystem and the interactions with rivals have helped accelerate the development of the transformation mindset .”*

The partnership with the education startup revealed new market opportunities. Before the joint-venture, the institution did not have a country-wide representation. *“The alliance between our institution and the startup, each one with its expertise, drove us forward through the digital transformation by scaling the business model to national limits and generating the possibility of scaling revenues exponentially.”* (BU-IT)

The institution does not have a specific department conducting the digital transformation and did not create a particular structure to support students and professors while using digital technologies.

Even with digital platforms ready, the institution highlighted some challenges regarding their use. The lack of digital skills and competence in the technology and communication fields limited online class migration during the beginning of the pandemic. The BU-IT mentioned that the digital transformation required both technical and pedagogical guidance. Considering the pressure imposed by COVID-19, the BU-PED declared the importance of enhancing professors' digital literacy: *“our current scenario requires professors who are able to use technology and accept this too, as there will be resistance to digital teaching-learning. Professors who accept this change will persist. Those who are unable to work with technology in the future will be outdated.”*

The lack of new management approaches that increase the digital maturity of the institution's workforce will diminish its ability to create a competitive advantage as the pandemic has changed the educational market's technology perception.

4.4.1.7 Business University - Strategic Impact and Outcomes

The digital transformation has changed the institution's business model, the way it collaborates, and its culture.

Before the digital transformation, the institution's offers were constrained by a physical location. With the digital transformation, the institution produced a new revenue source by digitizing graduate courses.

Before the digital transformation, the institution had a limited internal collaboration due to the silo mentality among its departments and the historical focus on in-house solution development. However, the threat imposed by the disruptive competition encouraged the institution to openly cooperate with rivals and startups to co-create and co-deliver new offerings. In addition to, internally, the institution has combined a multidisciplinary workforce to improve students' experience. The BU-PED emphasized that this collaborative approach would be instrumental in keeping the institution's flexibility and resilience: *“The classroom was the only thing a 16th-century person would recognize in the 21st century. The digital transformation was already occurring. We need to be more flexible and agile, and that occurs when we connect our strengths with different stakeholders inside and outside the educational ecosystem.”*

With respect to the cultural aspect, before the digital transformation, the institution had a traditional and formal school culture with a strong focus on regular classes. With all changes promoted by the digital transformation, the institution has included technology as an ally in the learning-teaching process. The BU-IT explains that COVID-19 produced a before and an after digital educational world: *“Face-to-face education will never be the same. It is useless to think that the educational environment will be the same, even after the vaccine. It will not come back. Students and professors have already tried digital learning, got used to it, and want a different classroom condition. As a 21st-century education institution, we will have to hold face-to-face classes, online classes, and asynchronous instruction.”*

In regard to the economic outcomes, after the digital transformation, the institution's revenues have grown with the digital offerings. The number of students increased exponentially without rising costs as the digital platform allowed the institution to scale organically.

Even with significant infrastructure investments since the beginning of the digital transformation, the technology backbone supported the institution's operation during the pandemic thus generating operational efficiency in administrative processes and ensuring the migration of all remaining lessons to the online environment.

4.4.2 Advertisement University

The Advertisement University was founded in 1951 by advertisers and entrepreneurs to create a business school with a market focus. The institution motto is *“teach who does,”* strengthening the educational methodology connection with practical experiences. The institution has

branches in three Brazilian states and offers onsite, digital, and hybrid learning for undergraduate, graduate, master of business administration (MBA), master, and Ph.D. students.

Since 2011, the IT department has divided its work into two streams. Part of the team maintains the IT infrastructure (e.g., data centers, classroom devices, network, smart blackboards) and manages the institution's information systems (e.g., Enterprise Resource Planning packages, Data Analytics solution) and databases. A second group builds and implements learning platforms to meet modern educational standards and methods.

The digital transformation began in 2015 under the title "*digital journey*" through a partnership between the pedagogical innovation and the IT departments. The purpose was to amplify the technology adoption across the institution and connect IT with strategic initiatives. The ADV-PED described the journey as follows: "*We started the digital transformation about five years ago. It covers technology from the development of any strategic initiatives to the execution. We started to participate in classroom design projects and development of course programs. Whenever there is a new project, a new course, a new educational offer, the IT team is previously engaged in finding the most effective way to bring technology to the existing problem.*"

The first purpose of the digital transformation was to train teachers with the critical goal of enhancing their digital skills and competence to produce better teaching considering the digital era.

The digital transformation is fundamentally dedicated to offering better experiences to students as well. According to the ADV-IT, "*students expect to have the opportunity to study, without the barriers of time and space. Therefore, we must provide flexible curricula, digital learning, digital educational content, tailored courses and experiences, innovation in teaching and research, , and restructuring of work processes.*"

For the institution board, the digital transformation has been an opportunity to optimize process management across the University. Additionally, it has ensured the effective management of data transformation and digital adoption in business. Finally, it has enabled decisions to be made based on quality data.

4.4.2.1 Advertisement University- Triggers

The participants mentioned the increasing demand to improve the learning and teaching process and provide better service quality as significant digital transformation triggers. The ADV-IT said, *“students are increasingly demanding an improvement in the basics of their experience, with features such as digitization of administrative processes, unrestricted 24-hour access to all information, and services using multiple platforms or digital curriculum.”*

In addition to the changes demanded by the critical educational stakeholders (students and professors), the pandemic accelerated the opportunities promoted by the adoption of digital technologies. Despite being part of a traditional market, the institution identified video conferencing technologies and social media as significant backbones to establish its online instruction strategy. The ADV-PED summarized the urgency of change as follows: *“we accomplished in three months what would normally take us three years.”*

4.4.2.2 Advertisement University - Enablers

A cross-functional team, executive support, technology infrastructure, financial support, and digitally literate students were the critical enablers presented in the Advertisement University.

With respect to the multidisciplinary team, since the beginning of the digital transformation, the institution has promoted the development of flexible structures that combine the expertise and skills of different professionals to assess, plan and manage the development of high-impact solutions. As explained by the ADV-IT: *“a very nice thing about our institution is the collaborative work. We are always working with a multidisciplinary team. Suppose we are working on a mission of technology adoption. For that kind of task force, we bring someone with a pedagogical background, and someone specialized in technology.”* The ADV-PED complements such enabler with a case: *“We have an initiative called the distance learning of your dreams. We started by thinking about all the improvements required in the distance learning. We built a multidisciplinary team with experts in finance, pedagogy, and IT to explore all the improvements we could implement in our online programs. It was fascinating because this project produced improvements in all of our educational offerings.”*

A transformation does not happen without the help of an organization's executive board. In the Advertisement University, the management team gave all the support to the whole team engaged in digital transformation initiatives to make mistakes, experiment, and change plans

after feedback cycles. The ADV-IT summed that enabler as follows: *“Our executive team’s mindset is that a macro plan must support every started initiative. After a short feedback loop, we should reflect on the results, record our learnings, and analyze if we are on track with our goals. If we are out of our plans, we are not afraid of changing. That kind of capability gives much agility to our business.”*

The institution recognizes technology infrastructure as an enabler and a vital digital transformation helper, especially during COVID-19. Migrating from traditional or blended learning to an entirely virtual and online delivery strategy did not happen overnight. It was associated with the available technology, which was relatively mature, and students and professors availability.

Since 2015, the IT department has been investing in the extension and enhancements of the existing technical infrastructure and platforms to ensure future readiness. Throughout 2019, the IT, with the support of the pedagogical center, trained professors on how to use video-audio conferencing tools for teaching and operate the learning management system (Canvas) for knowledge sharing and content development. The ADV-IT explained the DT enabler as follows: *“When the pandemic crisis began, our institution needed a week to migrate its operation to a fully digital one. That only happened because we have a solid IT infrastructure. In 2019, we selected platforms, such as Canvas and Zoom based on technical, functional, and usability criteria. Professors engaged with us in the selection process. First, we examined platforms’ availability, security, usability, and scalability. These characteristics allowed professors and students to handle classes during the pandemic with the least possible damage. The selection of tools based on well-designed criteria in association with the business areas was our great differential for this transition time.”*

Since the beginning of the digital transformation, the institution’s board has given funds for the change. The University’s management team recognized that persevering in the digital transformation was inevitable to guarantee its future viability and protect its competitive position. The DT has required large investments to eliminate the past and adopt new technologies. Due to the high speed of digital technology changes and the fast-changing students’ and business’ goals and requirements, the Advertisement University did not set the budget and potential value of digital initiatives a year or so in advance. The institution’s management team has been giving funds continuously to better implement the necessary technologies.

Unlike other schools, Advertisement University's professors and students have financial resources to maintain a minimal technological infrastructure with Internet and good computers, allowing streamlined online classes execution during pandemic times.

4.4.2.3 Advertisement University - Barriers

In regard to the barriers, the Advertisement University presented two factors that have hindered the digital transformation: lack of professor engagement and the tension between being innovative and operating the current institution's business model.

The interviewees mentioned the professors' comfort zone created by path dependencies as a blocker. The human side of innovation is the most challenging aspect because it is about people's deep-seated needs for security and natural resistance to change. Most of the professors are not digital natives; they have digital skill deficiencies, in addition to dealing with students who are highly motivated to use digital tools for learning. The ADV-IT explained in the following quotes: *“If I were to quote [a barrier], it would be professors not being digital natives. They have to go through a digital literacy process, which is essential to avoid embarrassing situations during the classes.”*; *“Part of the teaching staff is concerned about using new technology in the classroom because they are not from this digital world era, which is completely the opposite when we talk about students.”*

Although the institution considers the digital transformation both beneficial and necessary, there are old organizational dynamics in conflict with the new ones, causing significant tensions, such as resource competition, inertia, conflicting views, resistance to change, and frustration. The ADV-PED summarized the barrier as per the following quote: *“For me, the most significant barrier is being able to handle things concomitantly, that is, keeping the operation running as well as promoting transformation. The digital transformation collides with the university's dynamics, and sometimes we do not have enough time, funds, team, or resources, which ends up paralyzing the implementation of all initiatives. In this scenario, we lose innovative opportunities and suspend cultural change initiatives for lack of capacity.”*

The pandemic crisis reduced the barriers introduced before. Professors had to migrate instruction to the digital ecosystem, and all the institution's resources were designated to promote a customer-centric mentality to design an attractive digital offering for students.

4.4.2.4 Advertisement University - Digital Sensing

The Advertisement University's identified sensing capabilities were screening of digital competitors, scanning for technological trends by academic researches, reaching and engaging with professors and students, and advocating a digital mindset to explore new technologies and complementary innovations.

Given the accelerated advancement of educational technologies, the ADV-IT and his team have a formal benchmarking routine with partners and competitors. They hold periodic meetings with technology suppliers, representatives, and competitors. Additionally, they attend conferences and events organized by international working groups.

The cooperation with working groups was significant for the institution as it allows a benchmarking with top international references. The Advertisement University was *“able to exchange ideas through these groups and organizations, collect information on new opportunities, new requests, and new business models that students and professors would probably mention shortly”* (ADV-IT).

In the educational industry, it is widely common to have a single supplier serving many universities. Therefore, information related to new approaches or new opportunities may be captured and benchmarked through the interaction with suppliers.

The institution also performed sensing through academic research conducted by a pedagogical innovation center, which allows the institution to identify new opportunities and threats regarding the use of technology in the classroom based on papers, theses, and dissertations produced internally and worldwide. The ADV-PED described that capability as follows: *“We have a pedagogical lab dedicated to producing research and supervising researchers on digital literacy, online learning, and digital offer. The products generate oriented decisions on the acquisition of technology, software updates, professors' continuous training programs, and physical infrastructure modernization.”*

In addition to working closely with the pedagogical department to find alternatives to provide flexible curricula, digital learning, digital educational content, innovative teaching and research, tailored courses and experiences, and restructure working processes, the IT department also works with the Marketing department to collect students' expectations. To illustrate this capability, the ADV-PED shared a project, whose primary goal was to improve

user's experience: *“As an advertisement school, we listen to our users a lot. Recently, we started a user experience project. We hired a consultant who had a series of interviews with students and professors to understand their journey and pain points. From that standpoint, we were able to take a deep dive into the survey's results and seek improvement opportunities.”*

Lastly, a multidisciplinary working group that combines IT, pedagogy, marketing, and business operation delivers an innovative mindset that understands how to integrate what happens in the digital world into the organization context. The ADV-IT mentioned that while sensing market opportunities, this group explores sources outside the educational boundaries *“seeking opportunities in other business areas that may be eventually used in Education to help us with our solutions.”*

4.4.2.5 Advertisement University - Digital Seizing

Based on the sensed opportunities, the Advertisement University has been rapidly shifting its strategy to exploit new results, iterating new learning solutions considering short feedback loop cycles in order to validate hypotheses, thinking of its solutions as digital products instead of a simple process digitalization, and balancing a digital portfolio by creating specific business models that link digital and onsite offerings.

The coronavirus pandemic wiped out the institution's strategy. The ADV-IT said: *“Coronavirus accelerated many changes because we had no choice.”* The institution only thrived on the crisis because of its capacity of being adaptive and able to learn both top-down and bottom-up.

With a decentralized approach, the Advertisement University empowered teams to get together to address a specific task and then disband, thus creating a mechanism of delivering the new route (strategy) in an agile way. The ADV-PED explained the rapid readjustment of strategy as follows: *“When the pandemic rose, we took urgent calls centered on keeping people protected and essential business functions running. Weekly, the management team selected the sensed opportunities we should prioritize. According to the expertise expected to develop each possible solution, a steering committee formed by the IT, pedagogy, and business areas appointed temporary teams composed of workers from other business units to develop the solution implementation plan, present it to the management team in order to create the product.”*

To validate the solutions as fast as possible with customers, the Advertisement University shortened its feedback loop cycle. The ADV-IT said that *“without such approach, we are at risk of delivering solutions that solve fractions of students’ and professors’ problems.”*

From the development of a minimum viable solution, the University started to expose it to potential customers. The ADV-PED said that *“frequent feedback and user tests have accelerated the adoption of digital technologies. Thinking small has helped us avoid the mindset of delivering complex solutions that do not solve customers’ pain points.”* This capability has been feasible because the Advertisement University has a flexible IT structure, adequate content production resources, and know-how to implement innovative pedagogical methodologies.

Since the beginning of the digital transformation, the Advertisement University knew that transforming its business model is not about process optimization or building new technologies. Innovation has to reshape the institution’s core business logic and be noticeable by others. Based on that, all the technological initiatives created in the University aimed at enhancing professors' and students' experiences. For that purpose, the institution has endeavored to provide products - technology-enabled offerings used by customers and employees - instead of simply implementing a technology. The ADV-IT stated that *“since the beginning of our digital transformation, we have used the following mantra: digital solutions are different from digitizing a problem. In our institution, for every new project, we keep away from the analogical bias. Rather than just considering automation, we rethink the process as a whole, looking at the journey and customers' experience. That is, designing a product that will be used by someone in the digital ecosystem.”*

To scale the learning offering, the Advertisement University based its business model on distance learning, hybrid offers, and lifelong learning curricula. The institution has been offering fully online short-term programs and graduate courses. Unlike the competitors, the institution proposes a distance learning education where students can attend all live classes and interact with teachers in real-time. If students prefer, they can also attend onsite classes later, at their convenience.

In addition to the distance learning education offerings, the institution has exploited the hybrid education model that combines the best in-school and remote learning with digital engagement. The ADV-PED stated that *“hybrid learning has been the way we enhance and accelerate*

learning by providing student-centered approaches to meet diverse learners' needs. Classes and content for reading are offered on online platforms remotely. In face-to-face conferences, we have practical activities, presentations, and group discussions.”

With an emphasis on students' diversity expectations, constructivist approaches, and student-centered learning, the institution has produced lifelong learning programs to keep students engaged with the institution in the long-term. The ADV-PED shared an example of how the institution has adjusted its portfolios for a lifelong learning strategy: *“The university's pedagogical team has recently been working on how to provide students with total flexibility to build their curriculum. To exemplify, we started to prototype a graduate model where the student brings a project to the university, and we will recommend the subjects required to deliver the project. At the end of the course, the student will have the project delivered and a graduate certificate. This type of approach will make the student seek our institution at different times in their life.”*

4.4.2.6 Advertisement University - Digital Transforming

The participants mentioned that interacting with multiple external partners, leveraging digital knowledge inside the institution, and designing team-based structures were fundamental capabilities to succeed in the digital transformation.

Creating capacities that keep the Advertisement University connected with incumbent organizations, startups, and rivals have enabled it to design customer-centric offerings, that prepare high-quality professionals for the market challenges.

The ADV-PED mentioned that *“our course coordinators and professors are constantly bringing the market trends into the daily school basis. IT specialists, education experts, and professors have weekly interactions to identify the lack of skills perceived by companies. Based on those insights, we embrace a sort of input that will let us rethink our curricula, aligning them with the external context demands.”*

In addition to professors' knowledge, the Advertisement University has systematically kept in touch with companies to collect feedback about its curricula. The ADV-PED mentioned that *“during the development of a new curriculum or updating a current one, we benchmark a group of companies. The core question is: if we provide a professional with those skills, will an organization hire him/her?”*

To better connect its students with startups and digital-native companies, the Advertisement University continuously performs pitches with startup accelerators and promotes internal hackathons. The ADV-IT mentioned that *“this kind of approach helps accelerate the development of new businesses based on our students' ideas. Besides that, we inspire an entrepreneur and an innovative mindset in the whole institution, thus changing our professors and employees.”*

The benchmarking with competitors has helped with the development of the transformation mindset. The ADV-IT mentioned that *“collaboration with our rivals has promoted much learning as we discover good practices while choosing new digital technologies and we anticipate structural gaps in our organizational capacity based on lessons learned by other institutions. In other words, we avoid many mistakes by cooperating with other educational players, thus increasing the confidence of our internal decisions by using external data, besides keeping us updated on the market trends.”*

One of the foundations for the Advertisement University's digital transformation plan was leveraging professor, student, and employee digital knowledge. Since the beginning, the institution has promoted explicit training to enhance critical thinking and generate a set of competencies expected for success in the digital age.

The partnership between the IT and pedagogy departments has offered weekly courses on how the institution stakeholders can effectively adopt digital technologies, as the ADV-PED described: *“We have already trained people on a series of themes, such as digital literacy, data security, and productivity. With respect to the productivity, we presented techniques and methodologies that use digital technologies as support; for instance, we described how the audience could use a web conference to create interaction dynamics with the participants. This strategy enhances digital literacy across the University.”*

The participants mentioned the key stakeholders' digital knowledge as crucial during the methodological educational adjustment required by COVID-19. Employees kept performing their activities by using cloud-based systems and communicating via instant message applications. Students and professors had access to and were able to use digital platforms and tools for distance learning. Also, the institution lent equipment to students and professors who could not afford it. Even with some negative aspects concerning online lessons, the institution's

methodologies and distance learning techniques were crucial while adapting classes appropriately to the online philosophy.

Advertisement University does not have a specific department conducting the digital transformation; it is a partnership between the IT and pedagogy departments. Despite not having centralized governance, the institution built a process to execute its initiatives through temporary customer-centered and business-oriented cross-functional teams. The cross-functional teams have full autonomy to complete a project from discovery to delivery. A multidisciplinary committee tracks each project evolution on a weekly basis and presents the results to the respective sponsor. The ADV-IT mentioned that the flexibility promoted by mission-oriented-teams capability *“has ensured we are providing fit for purpose learning, creating a lean institution, and improving our students’ learning experience.”*

4.4.2.7 Advertisement University - Strategic Impact and Outcomes

In regard to the business model, before the digital transformation, the Advertisement University’s value proposition was constrained by traditional educational arrangements. With the digital transformation, the institution built educational offerings supported by service digitalization logic, that is, digitizing graduate programs and short-term courses, producing a hybrid teaching product as well. The institution's scope shifted from a regional to a national level.

In addition to producing a new revenue stream empowered by digital technologies, the Advertisement University implemented innovations in its onsite teaching, bringing new technologies to the classroom, creating a more interactive and attractive classroom space for students, revamping its curricula with digital innovations, thus improving professors' and students' digital fluency.

Before the digital transformation, the Advertisement University had limited initiatives supporting internal and external knowledge sharing. However, the *“digital journey”* started in 2015 settled a partnership between the IT and pedagogy departments encouraging the creation of relevant knowledge of market trends, digital technologies, and education practices. Additionally, the institution built a pedagogical lab focused on producing research and supervising researchers on digital literacy, online learning, and digital offerings. Finally, the institution started a multidisciplinary-team process that maximizes the sharing of best practices

among members from different business units, increasing diversity and producing multiple-perspective solutions.

With respect to the cultural perspective, before the digital transformation, the institution had a traditional and formal school culture with a strong focus on marketing and brand management. Through the digital transformation, the institution noted that its media DNA linked to the digital learning capability is a significant culture engine to transform the institution into an educational digital innovator. Despite dealing with the resistance to change created by its workforce mental model, the first five years of digital transformation revealed that the Advertisement University created an organizational culture that:

- Fosters the co-creation of new products with ecosystem players;
- Embraces uncertainty by a trial-and-error mindset;
- Builds a cohesive and diverse workforce;
- Promotes structures that ensure the ongoing culture refreshment.

In regard to the economic outcomes, after the digital transformation, the institution's revenues have grown with digital courses. Additionally, the Advertisement University improved its operational performance, reducing administrative costs with the use of digital technologies.

Despite the pandemic scenario, the institution had a low decrease in tuition rates, in part because students did not undergo severe disruptions to their health, finances, and family situations that directly impacted their education goals. Moreover, since the emergence of the COVID-19 crisis, the institution offered all the capabilities to support high-quality online instruction.

4.4.3 Tech University

The Tech University was founded in 1995 by a group of technology entrepreneurs. Since its establishment, the institution has been recognized as an innovative school by the educational segment. The university promotes an educational project that combines computer labs, social areas, and a close relationship with companies.

The Tech University offers undergraduate, graduate, and short-term programs in technology, business, and design fields. The institution operates mainly in Greater São Paulo, the largest and most influential metropolitan region in Brazil, with more than 20 million inhabitants, distributed in 39 municipalities in an intense technological evolution process.

In comparison with other similar higher educational institutions, the Tech University is considered a later adopter of digital learning. The institution's first online course was released in 2016. Since then, the Tech University has offered distance undergraduate and graduate courses with partial onsite activities and fully digital short-term programs.

The institution established a department in 2012 to produce digital offerings. The late adoption of this modality was due to managers considering the market's standard for digital learning not appropriate to the University's quality educational baseline. Hence, they decided to develop the institution's courses after conducting a market research and benchmarking distance learning best practices. The TECH-PED explained that the institution *“visited several colleges in Brazil to learn everything we should not do in digital learning.”*

The digital transformation began in 2013 when the Tech University hired a Chief Digital Officer (CDO) to be accountable for the governance of initiatives to improve every aspect of the University's business administrative processes, giving more efficient and responsive support to students in their academic journey, from choosing a course to becoming a member of the alumni community.

Despite knowing the importance of a governance structure responsible for managing digital innovations projects, after the exit of the CDO, a committee composed of technology, business, and pedagogy departments took the responsibility for keeping the digital transformation.

As part of the digital transformation, the institution has invested in increasing educational offerings that mix digital elements with quality instruction. Unlike other institutions, the Tech University recognizes that learning is changing, and digital learning is not an inferior education option. Instead, the TECH-PED mentioned that the institution has *“insisted that digital education innovations are not just technological shifts but academic, curricular, organizational, and structural changes. In this regard, in our digital transformation, we consider digital resources associated with face-to-face interactions the key to enable new roles for professors and students, creating adaptable and motivating ways of learning, being more autonomous and collaborative.”*

4.4.3.1 Tech University- Triggers

In 2012, the Tech University's CEO sensed the University's need to offer new educational offerings that would bring learning objects to students via a digital channel. The institution's

board saw the disruptive role of digital technologies in education. The institution realized that without technology support, it was impossible to break with the established model to improve it. The Tech University recognized that mobile, virtual reality, artificial intelligence, and collaboration platforms would revolutionize the educational system. The TECH-PED said, *“one of the triggers of the digital transformation was technology change. The educational segment is still anchored to the last century and fails to address the digital age's requirements. Every change enabled by digital technologies we can bring to our institution to disrupt the way we create value, interact with our community, and improve our business is welcome and we are seeking out.”*

In addition to the impact of digital technologies on the educational segment, the Tech University has seen students demand tailor-made training programs, no more predefined syllabuses, real projects with companies, and trial and error learning instead of formal exams. The TECH-IT mentioned that *“the digital transformation has supported our institution to look at our students based on a customer journey — from the application, selection process, interview, enrollment to the course completion —, that is, the whole learning lifecycle. How does this journey enchant our students? How can we maintain students' passion during their learning experience? How to keep that flame burning? How do we offer a hassle-free digital experience? If our institution does not look for that, our students will seek that in other universities.”*

Since the beginning of the digital transformation, the Tech University has dealt with the increasing competition with the new tertiary education providers, cheap or free distance learning offerings, open educational resources, social media, and informal learning (e.g., free YouTube videos). The TECH-PED said that *“the cumulative effect of all the changes happening in our competition landscape is the distribution of learning across a variety of locations apart from the classroom, crossing the temporal and physical boundaries of the University. In that sense, if we do not respond with high-valuable offers to our students and community, we lose our competitive advantage.”*

Lastly, an extra external trigger that has completely changed the educational context was the COVID-19 pandemic. The TECH-IT stated: *“before COVID-19, we had one department responsible for digital learning and another for onsite offerings. When the pandemic started, that silo fell apart, and that trigger was responsible for that. The COVID-19 pandemic led us to shut down, and we migrated all of our operations to an online environment. Everyone did their best to get comfortable teaching and learning by using video conferencing apps like Zoom*

and Canvas. It was necessary to use all the available digital learning know-how and tech infrastructure, and in one week, we were able to migrate to a full-remote model.”

4.4.3.2 Tech University - Enablers

In regard to the enablers, the Tech University presented three factors that have helped the digital transformation: IT capabilities, executive support, and cross-functional team.

Since the beginning of the digital transformation, the IT department had the mission to design an internal IT-architecture that combines rigid information systems, that demand a high maintenance cost and require high availability to not impact the business, with creative solutions that create business advantage, such as digital enrollment, learning management systems, digital classes, and data analytics. The TECH-IT mentioned that *“our Chief Executive Officer (CEO) acknowledged that IT would be an enabler to build long-term business agility. Without an IT backbone capable of building systems and infrastructure that can be promptly reconfigured, scaled, deconstructed, and rebuilt, we know we could not produce new products and services for our students.”* From that guideline and support, the institution has created solutions to eliminate the inefficiencies from manual processes and create a better learning experience. The Tech University invested in creating an internal IT department with higher agility, flexibility, and responsiveness towards business demands. *“Outsourcing was not an option,”* said TECH-IT.

The Tech University's management team has supported and inspired the whole organization to join the digital transformation. The TECH-PED explained that *“Since the beginning of our digital transformation, our CEO is fully boarded on the journey. The idea of bottom-up change is desirable, but in our context, we knew that such change would happen if it were top-down. As our institution has a technological DNA, our team of directors has supported all digital initiatives aiming at improving our students' experience.”*

Unlike other educational schools, former executives from different segments, such as marketing agencies and industries composed the institution's board. Such diversity has produced innovations as the institution's leadership is not anchored to educational dogmas. An example of that enabler is the change made by the University in its final exams, from a regular text to a project presentation. The TECH-PED explained, *“At first, the idea seemed crazy. One of our directors, who does not have an Educational background, claimed our value proposition required a more practical approach to the final examinations. After some reflections, we*

realized that, according to the education segment belief, every final exam has to follow a formal script. From this conclusion, our executive team submitted a change proposal to the regulatory organization, and we were authorized to make the transition.”

The COVID-19 reinforced the relevance of a cross-functional team. Without that enabler, it would not be possible to relocate all the institution's operations to a digital environment. The TECH-PED explained that *“In the beginning of the pandemic, we used our characteristic of teamwork to create multidisciplinary teams with members from business, design, technology, and education areas. The idea was to empower these teams so that our operation could migrate as soon as possible to digital, causing the least possible disruption to our professors and students. After two weeks of work, these teams were able to put 100% of our operation online.”*

In the context of rapidly changing requirements, teams must continuously find unusual ways to address challenges faced by them. The TECH-IT said that *“Tech University benefits from having a diverse workforce. The existing organizational chart does not limit us. We do not bureaucratize structures since everyone has the principle of thinking about better solutions for our students.”*

4.4.3.3 Tech University - Barriers

With respect to the barriers, the Tech University referred to resistance to change and prioritization as factors restricting the digital transformation.

The TECH-PED mentioned that *“since 2015, the results from an in-house survey revealed that Tech University’s professors favor traditional classrooms full of presential students instead of virtual education. Our experience tells that professors with the highest resistance to digital learning have the least digital instruction mastery. Since most of our professors are not digital natives, breaking that resistance has been a challenge. Another identified aspect is that our professors are autonomous when they enter the classroom. They prepare their syllabus, produce slides, and hand out assignments. In other words, every aspect of teaching is under their control. Some of them think their autonomy is reduced in an online environment.”*

In addition to professors, administrative workers have also been resistant. With the increasing number of business process automation performed since the beginning of the digital transformation, the TECH-IT mentioned that *“some of Tech University’s back-office workers*

are concerned about the fear of not knowing what to do and losing their position since part of their work is fully digitized.”

The Tech University’s management recognizes that people can become complacent about doing what they already do, especially with a successful track record. To overcome that hurdle, the institution provided its staff with arguments to embrace the change supported by an environment where it is safe to challenge the *status quo* and accept mistakes. The University expects to develop the next generation of skills for the digital era considering all internal potential.

Although the Tech University recognizes the relevance of digital transformation, the complexity of balancing strategic initiatives with operational routine has limited its capacity to explore new opportunities and enhance the existing resources. The TECH-IT explained that barrier as follows: *“We have many ideas to employ digital technologies in Tech University’s business models, but sometimes there is a lack of clarity about what is most valuable. As we do not have a department responsible for driving the digital transformation, we have difficulty connecting work in progress initiatives with our overall strategy, which leads us to struggle to discard irrelevant work.”*

4.4.3.4 Tech University - Digital Sensing

The Tech University has created sensing capabilities to scan for technological trends and identify opportunities to meet customer’s needs.

The Corporate Innovation department explores new business opportunities and threats through cooperation with several universities and educational suppliers, including international partnerships: *“In general, we map business trends through forums that discuss the future of education. We attend conferences and meetings organized by education associations and are in constant touch with educational innovation directors. Besides that, our Innovation team explores many articles and publications that could enable business change”* (TECH-PED).

Twice a year, the TECH-PED and his team travel to the United States to attend conferences and events organized by international working groups. The international cooperation with working groups from foreign higher educational institutions and solution suppliers has been instrumental in Tech University’s digital transformation. Through these groups and organizations, the institution is *“able to collect information about new opportunities and new requests students*

are likely to make soon, enabling Tech University to anticipate potential market changes as well as being proactive in bringing innovations” (TECH-PED).

Scanning for technological trends also happens through direct knowledge exchange between Tech University's IT Department and competitors. Every three months, the TECH-IT attends a meeting with IT directors from other universities in Brazil. During those meetings, managers share their main achievements, technology challenges and benchmark each other.

Since the beginning of the digital transformation, the Tech University knew that enhancing customer journey would be a competitive advantage. To sense customer journey pain points, the institution has developed a business intelligence data processing that regularly examines students, professors, and employees opinions to check what they expected the University to do about their concerns. The TECH-IT mentioned a case that illustrates the capability relevance: *“About five years ago, we created a retention department formed by psychologists. From students' historical data, we created a coefficient that determines possible students' churn. From a particular score, based on student's absence, the psychologists contact him/her to understand what is happening and bond with him/her.”*

Every week, the management team receives key performance indicators that consider a business overview to identify growth opportunities. The TECH-PED said that *“Tech University's strategy process enhanced when we started to collect data from our key stakeholders. We are now trying to create a predictive model with the help of technology that combines data collected from digital partners and customer relationships.”*

4.4.3.5 Tech University - Digital Seizing

The Tech University has discovered that strategic agility, building capabilities for rapid prototyping, and balancing digital portfolios have provided it with the opportunity to accelerate digital transformation.

Every week, Tech University's management team reviews the organization strategy. Supported by inputs from strategy consultancies, the institution forecasts changes considering the long-term implications of their short-term strategic choices to ensure business's viability and enhance the long-term winning prospects.

The Tech University has used agile project management, process flexibility, lean start-up, design thinking, and continuous software deployment to support strategic agility. The TECH-

PED explained: *“To quickly validate the strategies we have designed in recent years, we developed a team capable of combining skills in design thinking, user experience, marketing and technology that can quickly develop solutions centered on students' needs.”*

During COVID-19, the Tech University made decisions focused on people’s safety and keeping essential business functions running, by implementing changes to its organizational strategies. The institution adopted digital channels as its primary source of operation. The capability of putting things into practice fast was essential to keeping the operational model alive. The TECH-IT described such capability as follows: *“In two weeks, we completely revamped our operational model. If we did not have a solid knowledge of disciplines, such as design, marketing, technology, we would not even dare to think about migrating to digital so fast.”*

Since 2016, the Tech University has been working on scaling up innovative business models. A partnership among Innovation, Digital Learning, and IT departments has examined how distance learning and similar digital technologies (small private online courses, massive online courses, and social media) have the potential to reshape learning and corporate education industries.

The Tech University has invested in technology acquisitions and digital infrastructures for rapid scaling. The short-term courses were the first experiment to create a self-paced learning product with exponential profit potential. Since its release, the Tech University has advanced in new undergraduate and graduate digital offerings. To illustrate how the institution is seeking business model innovation, the TECH-PED explained an initiative that considers reskilling as an educational market opportunity: *“Possibly, we will see reskilling demands arise. For instance, telemarketing attendant is a job that will be replaced by artificial intelligence technologies. Brazil has one and a half million telemarketers. What are they going to do? What is the next step? By partnering with Telecom companies, we can create a reskilling program in a 2-year technical degree with a low production cost and large scale conducted by digital platforms. After the course, we will have transformed and qualified a workforce ready for the digital era.”*

4.4.3.6 Tech University - Digital Transforming

The Tech University has built its ability to create new resources and processes and re-adapt the existing ones during digital transformation by interacting with external partners, designing team-based structures, and leveraging digital knowledge.

The institution has cooperated with multiple partners to open new perspectives to offer better educational products and services. Once a month, the Tech University's CEO holds a meeting with private educational institutions' leadership. *“Each participant has 15 minutes to talk about pain, opportunities. The exchanged knowledge produced insights to develop business model innovations”* (TECH-IT).

The most significant and relevant global technology players, such as Microsoft, Salesforce, and Google support the university's academic projects by providing students and professors with exclusive access to software, certifications, and other services, keeping them updated on technology's innovation.

The Tech University is frequently exploiting new co-creation possibilities with incumbent organizations through hackathons, and interactions in its internal labs where students, professors, and incumbent employees develop, prototype, test, and accelerate disruptive innovative initiatives. *“Our labs represent an opportunity of solving market problems with a tailor-made workforce. Our students can create innovative solutions for big companies, improving their market attractiveness. Our professors can use real problems to promote project-based learning. Our partners (companies) can bring their challenges and use our high-technology infrastructure as a free-branch without their traditional internal constraints”* (TECH-PED).

The transformative capabilities previously mentioned have enabled the Tech University to design customer-centric offers that prepare high-quality specialized professionals to meet market demands.

However, the CDO left the Tech University during the digital transformation and, without a formal structure responsible for the change, a governance structure emerged, empowering team-based arrangements. The TECH-IT mentioned that *“despite the challenge of not having a person orchestrating the digital transformation since the CDO's departure, we explored options to define each officer's responsibilities and roles. While we bring different perspectives to the table, we can create goals relevant to everyone in the company, from top to bottom and side to side.”*

To guide digital initiatives, the university has established lightweight functions to solve problems. After all, prescriptive and onerous processes may stop the innovation and evolution of new and effective ways to create better solutions. Skills available in Pedagogy, Digital

Learning, Administration, IT, and Innovation departments have supported multidisciplinary teams connected with the customer journey and providing better solutions. The TECH-PED emphasized the importance of interdisciplinary teams: *“With the CDO's departure, we decided to change the team organization model. Our departments were isolated in the past, moving work from one side to another without a unified goal. The lead time of initiatives was too high, leading us to lose market opportunities. The current team's design has helped show that everyone has the same goal, reducing handoff between teams and increasing collaboration.”*

Computers, mobile devices, and social media are shaping the ways students think and behave. Being aware that teaching methods fail to attract learners today, the Tech University has invested in bringing external specialists and offering training to enhance professors' teaching skills.

With a partnership among Pedagogy, Digital Learning, IT, and Innovation departments, the Tech University created an internal university to establish a digital learning journey for all institution' employees. The TECH-IT explained the group of skills expected to be developed by each employee: *“From our local university, every professional in the institution has the opportunity to learn about digital transformation in the business context, the importance of innovation, soft skills, leadership, the relevance of entrepreneurship, emotional intelligence, and the use of digital tools. That initiative will be critical to keeping our workforce updated on the new century skill demands.”* During the COVID-19 pandemic, the knowledge and capabilities produced internally supported the significant ramp-up in the use of digital tools demanded by Tech University's key actors.

4.4.3.7 Tech University - Strategic Impact and Outcomes

Digital transformation has accelerated the way Tech University renews its business model by incorporating digitalization logic. The institution has used digital technologies to improve its value proposition creating new learning products that meet learners' demands, focusing on developing 21st-century skills and considering the diverse learning profiles. By adopting digital technologies, the Tech University has shifted its business model to offer programs that meet tomorrow's industry demands.

Even with undergraduate and graduate digital syllabus, the Tech University is against the production of low-quality digital offerings. Therefore, all the business model changes promoted by digital technologies have improved student's experience from better learning outcomes. The

TECH-PED explained that: *“Digital transformation has improved the way we offer higher quality education to our students. We do not intend to offer cheaper courses because it hurts our brand's value and value proposition. Therefore, what we have done since the beginning is to incorporate technology into our educational routine to create inclusive learning. In other words, we are building educational objects that enable our students to learn in a self-paced way. We know this is impossible without technology.”*

Before the digital transformation, the Tech University had limited internal collaboration because of the silo mentality between departments. However, in the last two years, the institution refreshed collaboration with cross-working teams removing work silos and facilitating company-wide knowledge sharing. The TECH-IT stated that digital technologies have been an ally for collaboration improvement: *“Instant communication tools and our internal social network have been instrumental in ensuring smooth interaction between the multidisciplinary workgroups responsible for the digital initiatives we have been implementing. It is noticeable how much the digital transformation has made people work closely with the main goal of always delivering a better solution to our students.”*

With respect to the cultural perspective, Tech University digital transformation has bolstered the importance of building a customer-centricity mindset from top to bottom and across the organization. The Tech University acknowledges that the sustainable competitive advantage based on a customer-centric approach will help complete particular transactions with the first-time students and ensure repeated acquisitions among the alumni in a world of lifelong learners. The TECH-PED mentioned that *“creating a customer-centric mindset requires that all of our employees are in tune with our students' requests, with focus on designing better journeys. The last years taught us that building that culture is an effort that should be relevant to everyone in our institution, requiring changes in behaviors across the organization. The innovation team had to develop new types of learning products considering market trends. The acquisition team had to develop new marketing strategies to make our offerings attractive, regardless of whether they are digital or not. Back-office teams had to adjust their processes to be more aligned with students' issues. Professors had to rethink their classes, respecting the new profile of learners.”* The initial seven years of digital transformation revealed that the Tech University prompted an internal culture that:

- Challenges the *status quo*;
- Encourages the co-creation of new products with ecosystem players;

- Applies a test and learning mindset;
- Promotes structures that ensure ongoing culture refreshment.

In regard to the economic outcomes, the Tech University's revenues have had a two-digit percentage growth per year in the last four years. Operational improvements generated by automation and innovative digital learning offerings have increased retention rates, promoted better employment rates, and increased students' salaries.

4.5 Discussion

In this section, which is sensitized by an extension of Warner and Wäger (2019) dynamic capabilities model and based on a cross-case analysis of the findings, the replicated practices of dynamic capabilities are refined into theoretical themes, that is, microfoundations identified in higher education institutions that have been undergoing digital transformation (please, see Table 4.3).

Dynamic Capabilities	Microfoundation	Definition
Digital Sensing	Digital Scouting	Identifying external relevant opportunities concerning digital technologies and education innovation by scanning for technological trends, screening of digital competitors, sensing customer journey pain points, and reaching and engaging with universities, research centers, suppliers, and competitors, as well as the use of benchmarking (Warner & Wäger, 2019; Gimpel et al., 2018; Singh & Hess, 2017).
	Digital Scenario Planning	Evaluating potential opportunities for digital strategies employing internal and external data (Warner & Wäger, 2019; Gimpel et al., 2018).
	Digital Mindset Crafting	Exploring new technologies and complementary innovations, advocating a digital mindset (Warner & Wäger, 2019; Gurbaxani & Dunkle, 2019; Loonam et al., 2018; Dery et al., 2017).
Digital Seizing	Strategic Agility	Rapidly reallocating resources to select, among different options available, solutions to capture the identified opportunities (Warner & Wäger, 2019; Yeow et al., 2018; Gimpel et al., 2018).
	Digital Product Development	Combining design, technology, business, and operation capabilities to rapidly validate hypotheses (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018).
	Balancing Digital Portfolios	Scaling up innovative business models to respond to digital transformation (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Loonam et al., 2018; Gimpel et al., 2018; Hess et al., 2016).

Digital Transforming	Navigating through Innovation Ecosystems	Joining a digital ecosystem and interacting with multiple external partners to open new perspectives for educational offerings (Warner & Wäger, 2019; Schuchmann & Seufert, 2015).
	Redesigning internal structures	Designing team-based structures to build new resources and processes to respond to digital transformation (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gimpel et al., 2018; Tumbas et al., 2018).
	Improving digital maturity	Leveraging digital knowledge inside the higher education institution to (re)adapt the existing resources in order to be optimal for a new digital strategy (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gurbaxani & Dunkle, 2019; Gimpel et al., 2018; Dery et al., 2017).

Table 4.3 - Microfoundations of dynamic capabilities active in the three cases during digital transformation journey

4.5.1 Digital Sensing

Our study found out that external sources are essential to the recognition of educational innovation opportunities by HEIs. All the institutions subject matter of this study developed capabilities to sense learning transformations and identify digital trends by following up students' and professors' demands, engaging with universities, research centers, suppliers, and competitors and making use of benchmarking.

Our findings resonate with contemporary research that details the importance of understanding customers' needs to develop a better experience (Gimpel et al., 2018; Singh & Hess, 2017). The rise of technology appropriation and new learners' profiles pushes HEIs to design learning offerings considering diverse students' profiles (Benavides et al., 2020).

COVID-19 marks an inflection point as students, educators, and society leaders alike scrutinize higher education's value proposition through the new lens of traditional classroom versus multiple digital delivery approaches. By an amplified external network, HEIs would map new platforms and technologies to excel the simple “*remote learning*” via live video conferencing tools to provide students with alternatives to obtain transferable university credits upon a subscription model.

Being connected to networks in the world's technology hubs is essential to identifying technological trends (Warner & Wäger, 2019). Digital transformation provides the opportunity to create interfaces that expand the organization's boundary (Svadberg et al., 2019). Corroborating Teece (2007) and Yeow et al. (2018), we found that by sensing capabilities, HEIs can collect information about new opportunities and new demands that the educational market

would mention in the future to predict market changes and be proactive in producing innovations.

Our study highlights that benchmarking competitors can help HEIs evaluate available digital technology benefits, their implementation hurdles, and lessons learned that would accelerate the decision of its adoption. Additionally, the sharing of knowledge and experience with external working groups enables HEIs to understand new opportunities, new demands, and new educational business models.

In an era of data abundance (Bharadwaj et al., 2013), the studied cases emphasize that internal and external data would support a better digital strategy (Gimpel et., 2018). Data is a relevant DT asset in HEIs as it enhances the internal process of strategy formulation and implementation (Benavides et al., 2020). Monitoring students, professors, and businesses data will make it easy for HEIs to assess their business and think about the necessary innovations to build, for instance, shorter-form micro-credentials that can stretch into a more extensive lifelong curriculum.

Sensing innovation opportunities should not be restricted to the R&D department in a digital age. Organizations should enable an entrepreneurial mindset and promote a digital mindset across their workforce (Warner & Wäger, 2019). The studied cases stated that Pedagogy, Technology, and Back-office are skills that spur an innovative mindset that will allow HEIs to know how to embed digital technologies in the institution processes and business. With that capability, HEIs can transform existing products into digital ones and digitize current processes, activities, and operations considering internal resources (Sandkuhl & Lehmann, 2017).

4.5.2 Digital Seizing

Corroborating Chantias et al. (2019) and Warner and Wäger (2019), our findings contribute to strategic agility research since our data unveiled that the digital transformation strategy must be adaptive and able to learn how to seize digital trends.

DT demands massive investments to adopt new technologies (Benavides et al., 2020). We found that executive support and financial commitment to technology investments are enablers for HEIs to select, adjust, and innovate their business model.

COVID-19 pandemic caused HEIs to reduce the gap between strategy definition and execution. With the strategic agility capability, HEIs examined their strategy quickly. Without a rapid

resource reallocation, they would have lost the ability to innovate and stay competitive (Olsen & Trelsgård, 2016).

Over the years, the HEIs subject matter of this study developed a capacity of building teams with digital product development skills, such as design, technology, and business capabilities to rapidly validate hypotheses (Yeow et al., 2018; Gimpel et al., 2018). With the growing demand for digital learning, our study highlighted that HEIs should promote customer-oriented multidisciplinary teams to produce better solutions for the academic community. Additionally, our data shows that in a digital context, HEIs must embrace uncertainty by a trial-and-error mindset and build a cohesive and diverse workforce as a way of overcoming the fear of taking risks and failure penalties that make people get stuck in their comfort zone (Chaniyas et al., 2019; Dremel et al., 2017).

Wiesboeck and Hess (2019) stated that IT systems and IS infrastructure need to accommodate the changes triggered by digital technologies. Our findings show that without a technology backbone, HEIs will not be ready to seize the opportunities promoted by digital transformation.

In comparison with other industries, the higher education sector delayed in shifting to a broader digitally driven business model. Corroborating Warner and Wäger (2019) and Wiesboeck and Hess (2019), our findings revealed that HEIs could design innovative business models by using digital technologies.

A variety of powerful new platforms based on cloud computing and smart data models have emerged with the potential to reshape the learning and corporate education industries. Massive online course platforms, such as Coursera collect billions of course data points to create grade assignments automatically and recommend new learning paths considering learners' interests. In this study, the studied HEIs have looked for alternatives to refresh their business model to create learning products that take into account technological advances and workforce skills' shrinking shelf-life.

4.5.3 Digital Transforming

Following Teece's (2007) view, our study noted that sensing and seizing digital transformation opportunities rely heavily on the organization's capabilities of creating new resources or modifying the existing ones to keep its resources in close strategic alignment with customers, partners, and the broader business environment.

We highlight that for innovating in educational offerings, HEIs should navigate through innovation ecosystems. We observed that collaborating with an international network, incumbent companies, startups, and rivals had enabled the studied universities to design customer-centric offerings that prepare high-quality professionals prepared to tackle the market challenges. In line with Warner and Wäger (2019) and Schuchmann and Seufert (2015), our study shows that partnerships and collaboration with other organizations help innovate considering new perspectives.

We also noted that centralized decision-making, rigid organizational structures and one-size-fits-all decisions shut down the creation of new resources. Any organization that is so grounded in formal structures and silos cannot self-evolve.

Corroborating Warner and Wäger (2019), Wiesboeck and Hess (2019), Gimpel et al. (2018), and Tumbas et al. (2018), we found that HEIs should orchestrate different skills in team-based structures to build fit for purpose learning offerings. Regardless of defining a governance structure that leads digital transformation, we found that a straight connection alignment between C-level managers is critical to keep the digital transformation goal precise and clear.

Finally, leveraging digital knowledge inside organizations is essential to (re)adapt the current resources to be optimal for a new digital strategy (Warner & Wäger, 2019; Wiesboeck & Hess, 2019; Gurbaxani & Dunkle, 2019; Gimpel et al., 2018; Dery et al., 2017). Our study supports the before mentioned conclusion. Additionally, we noted that previous digital knowledge from students, employees, and professors was crucial during the educational adjustment required by COVID-19. Employees kept on performing their activities by using cloud-based systems and communicating via instant message solutions. Students and professors had access to and were able to use digital platforms and tools for distance learning. Without their workforce's digital maturity, HEIs would lose intellectual capital and reduce their ability to create a competitive advantage over rivals. Arrangements and practices that support employees in learning, unlearning and relearning digital technologies, and new skills are the keys to reshaping the future of work.

4.6 Conclusion

Organizations should see digital transformation not as a one-time plan but as a cumulative force necessary to build organizational capacity to support future changes (Tanniru et al., 2018).

By adopting the DC perspective, we showed how three higher education institutions managed their digital transformation journeys, highlighting how they sensed market opportunities and threats, seized them and reconfigured their internal assets accordingly.

4.6.1 Research Contributions

Our qualitative research offers several contributions to the digital transformation study field. Our results are in line with recent research that began defining digital transformation and connecting it with theories such as resource based-view (Vial, 2019; Warner & Wäger, 2019; Gimpel et al., 2018). First, our findings reinforced that digital transformation is an IT-business-centric change instead of a bare organization digitalization demanding radical changes in processes, structures, and people (Nadkarni & Prügl, 2020).

Second, our study reinforces dynamic capability as a theoretical background to analyze digital transformation (Warner & Wäger, 2019). Our research confirmed a set of dynamic capabilities microfoundations (see Table 4.3) required to compete in a fast-paced digital landscape (Sousa-Zomer et al., 2020). Our findings empirically demonstrate the application of the dynamic capability theory, thus increasing its robustness (Schilke et al., 2017).

Third, our findings corroborate recent research results that showed the importance of creating a strategy in a lighter way for seizing new digital trends (Chanas et al., 2019; Yeow et al., 2018). Our data shows that experimentation, a fail-fast mindset and a learning culture are common ways of thriving in the digital era.

Fourth, technology is fundamental, but people are essential to digital transformation. Technological disruption has generally led to automation and the elimination of outdated jobs. A DT journey that fails to promote a goal that is relevant to everyone in the organization, from top to bottom and side to side, usually generates workforce stress and fatigue (Vial, 2019; Eden et al., 2019). Our study highlights that investing in an organization's workforce reskills and upskills is crucial to make digital technologies useful.

Finally, DT must promote a customer-centric mentality to design an engaging digital offering (Verhoef et al., 2019; Vial, 2019; Svadberg et al., 2019; Sebastian et al., 2017). Our findings highlight that customers are increasingly demanding good experiences as more choices of products or services can satisfy them. Organizations need to create capabilities that enable them to monitor their users and seek customer journey enhancements.

4.6.2 Practice Contributions

First, our conclusions can support HEIs' leaders who are facing digital transformation. The theoretical model reduces the complexity of representing digital transformation.

Second, we encourage organizations to see a digital transformation beyond digital technologies adoptions, linking them with organizational needs. Understanding “*why*” the organization is adopting a specific digital technology and the expected business outcome will align the organizational context with technology purpose.

Third, we found that business agility and flexible team-arrangements are necessary to seize business opportunities. Organizations need cross-functional teams to deliver small batches in short periods to validate business hypotheses, reduce risks, and respond quickly to market changes.

Finally, DT demands a full engagement of leadership teams. We found that leadership roles are critical to guiding the transformation from a strategic standpoint, fostering the co-creation of new products with ecosystem players, embracing uncertainty by a trial-and-error mindset, and promoting structures that ensure ongoing cultural refreshment.

4.6.3 Limitations and Further Research

This research has limitations. One of the research's main limitations is the number of higher education institutions examined in the study's empirical part.

An additional limitation involves the types of higher educational institutions. In our research, we did not collect data from public institutions. Additionally, identifying microfoundations in the three cases is a small basis for conclusions about other HEIs, thus restricting the generalization of the results.

Further research, incorporating more case studies of sort-like institutions, is recommended to enhance analytical validity for comparable organizations.

Another limitation is the transfer of the findings to other contexts. Given the qualitative nature of the data collection, it is not clear if the digital capability framework can cover different incumbent organizations undergoing digital transformation.

Despite the issues mentioned above, this study represents an essential contribution. We conducted it in a context opportunely impacted by a global pandemic (COVID) that has changed the way HEIs offer education. We also developed a broad perspective considering the digital transformation triggers, enablers, change barriers, dynamic capabilities developed, strategic impact and outcomes.

We encourage other researchers to create a quantitative instrument to evaluate the dynamic capability framework components and analyze their impacts on organizational performance and sustainability.

5 CONCLUSIONS

This study theorized digital transformation considering different perspectives. First, we explored a vast literature review that enabled us to find definitions, challenges, and frameworks. Then, we proposed a dynamic capability framework that explains the digital transformation in incumbent organizations. Finally, we presented three case studies of organizations that are undergoing the journey of DT.

In this section, we explore the prominent academic and practice contributions of this study. To this end, we first present the triggers, enablers, barriers, and impacts regarding DT, and propose a conceptual map. Afterward, we use the dynamic capability theory to understand and show the benefits brought by DT. Then, we explain what the practical implications will be for this study. Finally, we address some limitations and how these create opportunities for future research.

5.1 Research Contributions

Aligned with recent research that started to theorize digital transformation as a strategic change enabled by digital technology (Nadkarni and Prügl, 2020; Vial, 2019), we found core themes explaining the phenomenon (see Figure 5.1).

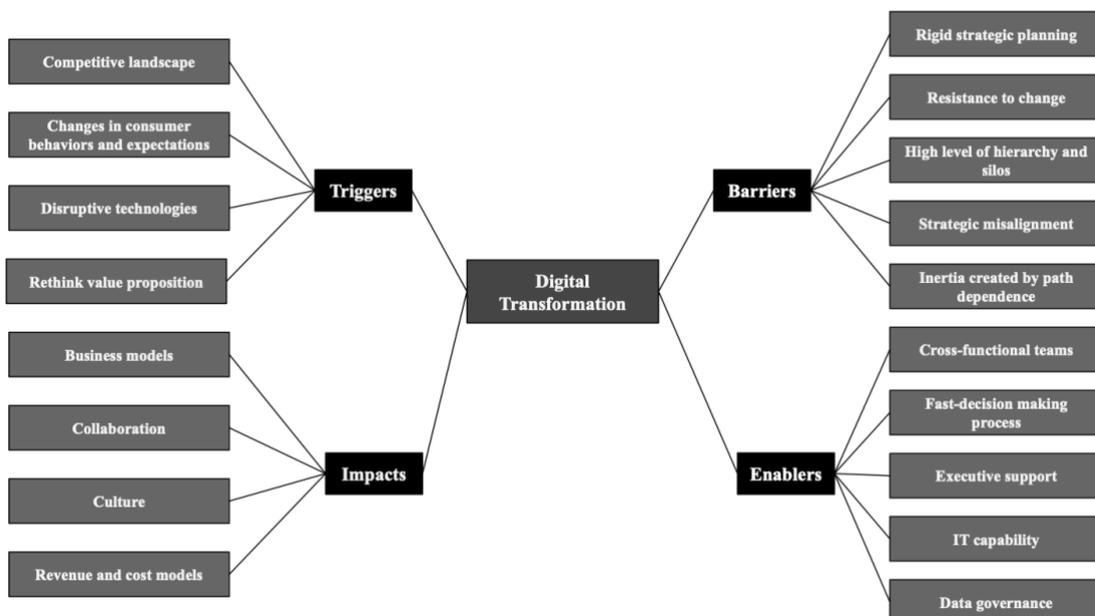


Figure 5.1 - Digital transformation core themes emerging from this study

The traditional competitive landscape has changed. We found that digital technologies have enabled organizations to generate new forms of digital offerings, reducing entry barriers, and confronting the sustainability of incumbent players' competitive advantage (Vial, 2019; Warner and Wäger, 2019; Gimpel et al.; 2018). In the cases studied, we noted that businesses outside the education industry took advantage of the pandemic and digital media availability to provide specialized training to customers, thus creating a new competitive scenario. Incumbent organizations cannot get stuck in their past of glory if they aim to build business sustainability.

The digital age empowered customers, making them key influencers, and triggered the requirement for organizations to build a customer-centric strategy instead of keeping the mass-market model (Verhoef et al., 2019; Warner and Wäger, 2019; Wiesbock and Hess, 2019; Gimpel et al., 2018; Loonam et al., 2018; Singh and Hess, 2017; Schuchmann and Seufert, 2015). Based on experts' opinions and the case studies, we discovered that DT requires organizations to prioritize nurturing customer relationships, learning from their feedback to enhance solutions offered, and seeking the usage of digital technologies to leverage new value propositions. Therefore, organizations that do not engage with consumers will have their abilities to make their offerings flexible and aligned with external needs reduced. In a global market with an increasing rate of new offerings, not listening to the customer puts a business at a high risk of losing its value.

We found out that disruptive technologies can trigger DT. Social media, mobile, big data, analytics, and the Internet of Things are shortening innovation cycles, providing opportunities and posing threats to organizations (Verhoef et al., 2019; Warner and Wäger, 2019; Vial, 2019; Gimpel et al., 2018; Nwankpa and Datta, 2017; Hess et al., 2016; Karimi and Walter, 2015). The higher education institutions we studied revealed that digital technologies were critical to rethinking their learning offering, particularly in pandemic times where it was necessary to use all the available digital learning know-how and tech infrastructure to migrate to a full-remote model. The main question regarding digital technologies is not whether organizations must consider them or not, but how to tie them to an articulated organizational demand beyond a technology adoption per se (Bharadwaj et al., 2013).

One of the studied institutions was considering using artificial intelligence (AI) to predict student's behavior. The focus was not to use a "*cool*" technology but to decrease the churn rate. Such strategy will keep digital technologies tied to specific business outcomes, justifying all DT program efforts.

The last trigger presented in the conceptual map is how DT requires organizations to rethink their value proposition. Our findings recognized that businesses are dealing with a dematerialization of products and services. The spurring of digital offerings is challenging organizations to identify unmet customer needs, create smart products and services, and introduce customer innovative and tailored value propositions (Vial, 2019; Gimpel et al., 2018; Loonam et al., 2018; Hansen and Sia, 2015). The private education segment studied in chapter 4 had to deal with offerings that challenge the traditional market paradigm. Ideas, such as micro-learning, self-paced education, asynchronous instructions, and building knowledge through real business cases defeat private universities' business model. Incumbent organizations must understand DT as a journey that digitizes current value propositions and offers paths to innovate new ones; otherwise, they will lose their landmark value.

In addition to the previously presented triggers, we found out that incumbent firms that navigate through DT could deal with significant barriers that hinder the change as well as benefit from enablers that streamline the transformation (Vial, 2019; Warner and Wäger, 2019).

Our conceptual map showed that long-term strategic vision, the misalignment between IT and business strategy, rigid planning, and strategizing politics slow up continuous innovation (Warner and Wäger, 2019; Chanas et al., 2019; Yeow et al., 2018; Matt et al., 2015). Our results evidenced that the DT strategy must be adaptive and able to learn. Organizations need to design a mechanism to execute their plans through a continuous feedback loop and review their decision-making strategy as soon as possible. Without the execution capability, the learning flow is interrupted, reducing an organization's ability to quickly respond to internal and external triggers.

Our findings highlighted a shift in IT roles as digital disruption changes business models, reduces innovation cycles, and demands real-time customer interactions. IT services are becoming the primary mode by which many companies engage customers and create and capture value (Gimpel et al., 2018). We found out that the more flexible, integrated, and aligned the IT department is with the business, the better the governance of the solutions that sustain and enable the company to be innovative. Furthermore, to take advantage of digital technologies, organizations must integrate new resources into their fragmented legacy Information Systems. The cases studied reinforced that the backbone provided by an excellent infrastructure and integrated systems was essential to enable the adaptability demanded by DT, particularly during the COVID-19 pandemic.

The vision of being a digital leader must be manifested inside an organization's executive board (Tumbas et al., 2018). Whether by creating a new position as Chief Digital Officer or reframing the Chief Information Officer's role, the organization management team should support the building of a fast-paced feedback environment, experimental minding, and customer-centeredness. Our research showed that executive support had empowered the organizations' capability to relearn and reinvent their value proposition constantly.

Additionally, we found out that underestimating cultural barriers can hinder DT (Nadkarni and Prügl, 2020; Warner and Wäger, 2019; Lucas and Goh, 2009). The well-built workforce mental model and the lack of attitude toward changes create resistance and impact DT progress (Warner and Wäger, 2019; Kane, 2019; Tekic and Koroteev, 2019; Gurbaxani and Dunkle, 2019; Eden et al., 2019; Li et al., 2018). DT can generate a sense of threat in the current workforce. To avoid that, organizations must set business goals relevant to everyone in the organization, creating an environment that embraces diversity and multiple skills.

The power relationships created by hierarchical structures and the restrictions produced by silos reduce the emerging of a collaborative context (Guinan et al., 2019; Vial, 2019; Warner and Wäger, 2019; Gimpel et al., 2018; Dremel et al., 2017; Lucas and Goh, 2009). Our results indicate that the removal of silos will promote a better communication flow and faster decision-making. Furthermore, creating light-weight processes and multidisciplinary team structures will provide agile arrangements that will enable organizations to quickly respond to market changes.

The fear of taking risks and the penalty for failures make people get stuck in their comfort zone (Chanias et al., 2019; Dremel et al., 2017). Our results showed that organizations should look for a culture that embraces uncertainty by a trial-and-error mindset. Instead of judging the error, organizations should learn from them as soon as possible to adjust their strategy.

The fear of failing reduces the appetite for innovation, keeping organizations stuck in the inertia created by their path dependencies. The success achieved in the past leads firms to maintain their existing relationships with customers and suppliers and follow well-established production processes that are highly optimized but often outdated in relation to the speed required by the market (Tekic and Koroteev, 2019).

Data-driven applications, such as recommender systems or predictive analytics, in addition to integrated data, require high-quality data (Gimpel et al., 2018). To achieve a data-supported

competitive advantage, organizations need to establish a strategy for data management, data ownership, and privacy (i.e., the rights and control over data) (Vial, 2019; Gimpel et al., 2018). Our findings corroborate previous research, as we noted that without data governance, the institutions presented in chapter 4 would not be able to transform the records of transactions, students, and business processes into resources that enabled them to make better decisions, for instance, defining where to open a new subsidiary or modeling a new learning offer considering data trends.

Corroborating Warner and Wäger (2019), we also proposed in the conceptual map that DT: impacts an organization's business model; modifies the way it collaborates; refreshes its culture; changes its revenue and cost model. Table 5.1 outlines how DT affected each of the elements mentioned in the cases studied.

Higher Education Institution	Business Model	Collaboration	Culture	Revenue and Cost Model
Tech University	The institution used digital technologies to improve its value proposition by creating new learning products that meet learners' demands, focusing on developing 21st-century skills, and considering the diverse learning profiles.	The institution refreshed collaboration with cross-working teams by removing work silos and facilitating company-wide knowledge sharing.	The institution bolstered the importance of building a customer-centric mindset from top to bottom and across the organization.	The institution's revenues grew with digital courses. Operational improvements generated by automation and innovative digital learning offerings increased retention rates, promoted better employment rates, and increased students' salaries.
Business University	The institution produced a new revenue source by digitizing graduate courses.	The institution started to openly cooperate with rivals and startups to co-create and co-deliver new offerings.	The institution diminished the traditional and formal school culture with a strong focus on regular classes.	The number of students increased exponentially without rising costs as the digital platform enabled the institution to scale organically.
Advertising University	The institution built educational offerings supported by service digitalization logic, that is, digitizing graduate programs and short-term courses, producing a hybrid teaching product as well	The digital transformation established a partnership between the IT and pedagogy departments, encouraging the creation of relevant knowledge of market trends, digital technologies, and education practices.	The institution fostered the co-creation of new products with ecosystem players, embraced uncertainty by a trial-and-error mindset, built a cohesive and diverse workforce and promoted structures that ensure the ongoing culture refreshment.	The institution's revenues grew with digital courses. Additionally, it improved its operational performance, reducing administrative costs with the use of digital technologies.

Table 5.1 - An overview of the digital transformation in the three cases studied

The conceptual map resulting from our research findings provides an opportunity to master the several subjects associated with DT, supporting part of this study's goal as it emerged from an in-depth examination of definitions and challenges regarding DT. The triggers, barriers, enablers, and impacts outline academic topics for further research.

Supported by previous research (Sousa-Zomer, Neely, & Martinez, 2020; Warner and Wäger, 2019; Yeow et al., 2018), we also presented in this study a framework with new theoretical insights toward the elements and dynamic capabilities that incumbent organizations should consider during DT. The framework presented in Figure 5.2 summarizes an overview of our findings.

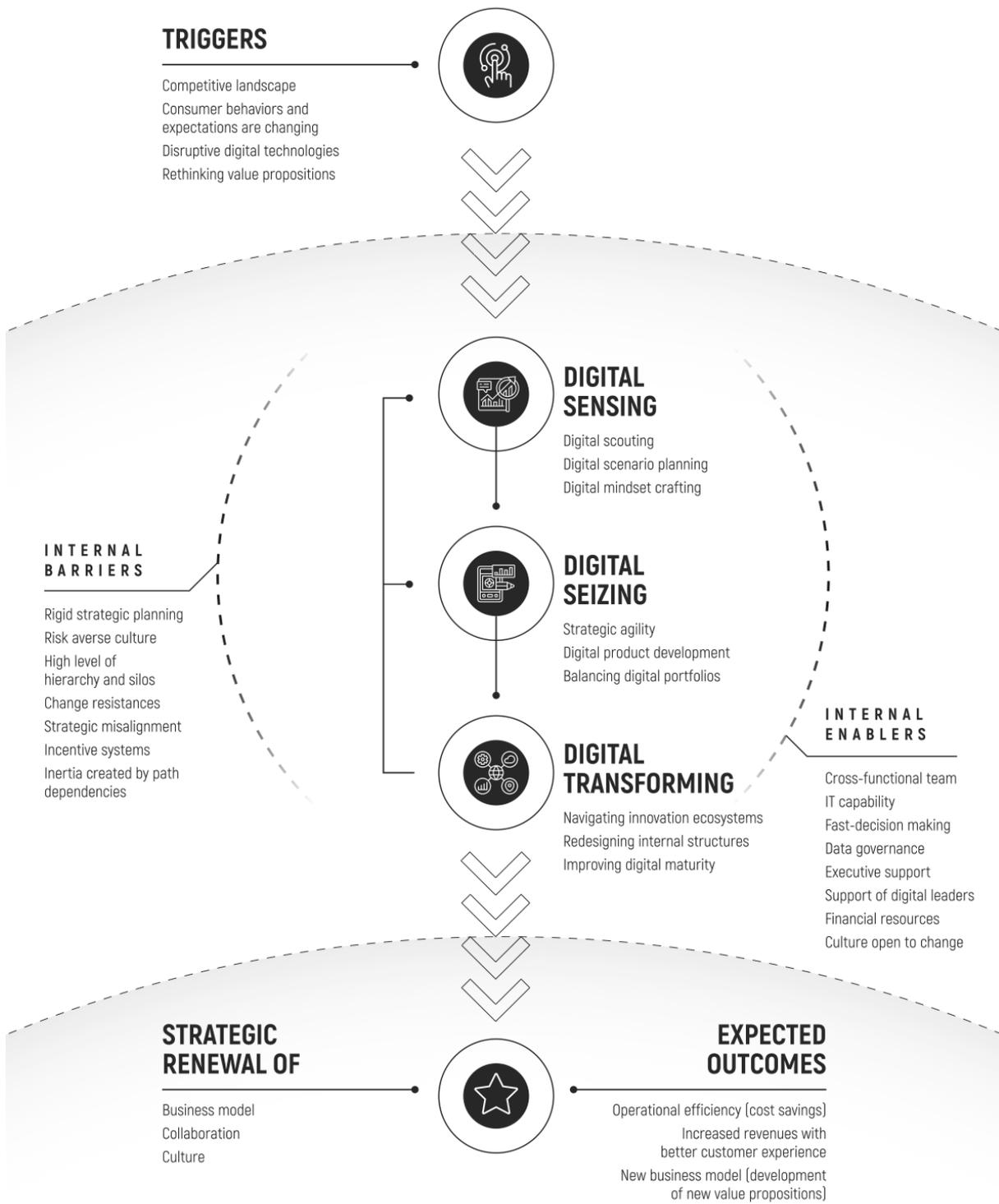


Figure 5.2 - Digital Transformation Framework

In regard to the dynamic capabilities, corroborating Warner and Wäger (2019) and Yeow et al. (2018), we found out that sensing capabilities are not limited to identifying technological opportunities but encompass other environmental capabilities.

Organizations must use digital technologies to understand the external context in order to assess their business and examine the fundamental innovations to build. Data is critical to learn and evaluate potential opportunities for further developments (Gimpe et al., 2018; Bharadwaj et al., 2013). Furthermore, engaging with customers through digital channels is fundamental to clarify what is happening outside an organization (Singh and Hess, 2017).

We noted that organizations should enable entrepreneurial behavior and promote a digital mindset across their workforce to identify changes outside their boundaries. With that sensing capability, they would change existing products to digital ones and digitize current processes, activities, and operations considering internal resources. The barriers we mentioned earlier challenged this capability building, particularly considering obstacles, such as the inertia created by path dependencies and organization's silos.

Additionally, we saw that incumbent organizations should create capacities that connect them with networks in the world's technology hubs to recognize technological trends—sensing information about new opportunities that will enable them to propose new value propositions (Warner and Wäger, 2019; Vial, 2019).

With respect to the seizing capabilities, our research showed that organizations need to consider capabilities that enable them to take advantage of the opportunities identified (Warner and Wäger, 2019; Teece, 2007). Corroborating Chanas et al. (2019) and Warner and Wäger (2019), our findings showed that the DT strategy must be adaptive and lean. In other words, organizations must promote new ideas spreading them across the organization, also rapidly allocating the necessary resources to collect external feedback as soon as possible. Without an agile reallocation, organizations would lose the ability to innovate and stay competitive.

We also found out that combining design, business, technology, and operations skills will allow organizations to understand customer and market needs. We call that capability “product development” because it presents a customer-centric mindset required to change the way organizations see their product and services supported by a technology perspective. Furthermore, that capability allows them to know how to work inductively and use agile methods to validate hypotheses.

The last general seizing capability we found is related to portfolio management. When everything is a priority, nothing is a priority. A good portfolio of initiatives contemplates actions that help an organization's business model remain competitive in the short term and promote innovations that can produce results in the medium and long term. However, without focus, an organization is at serious risk of not coming out of the inertia created by its path dependencies.

In regard to the transforming capability, we noticed that collaborating with an international network, incumbent companies, startups, and rivals can enable organizations to design customer-centric offerings (Warner and Wäger, 2019; Schuchmann and Seufert, 2015). That kind of capability can be a challenge for incumbent organizations, mostly because as they take a leadership position in the market, they stop looking for and accessing outside trends.

Corroborating Warner and Wäger (2019), Wiesboeck and Hess (2019), Gimpel et al. (2018), and Tumbas et al. (2018), we found out that organizations should arrange different skills in team-based structures to build fit for purpose offerings. Regardless of defining a governance structure that leads DT, we noticed that a straight connection alignment between C-level managers is critical to keep the DT goal precise and clear.

Finally, leveraging digital knowledge inside organizations is essential to (re)adapt the current resources to be optimal for a new digital strategy (Warner and Wäger, 2019; Wiesboeck and Hess, 2019; Gurbaxani and Dunkle, 2019; Gimpel et al., 2018; Dery et al., 2017). Arrangements and practices that support employees in learning, unlearning, and relearning digital technologies and new skills are the keys to reshaping the future of work. Our findings showed that organizations need to be aware of the new professional profiles required for the future so that they can take actions to develop them.

The dynamic capability framework proposed in this study provides an opportunity to envision the path incumbent organizations will navigate through DT. Using Figure 5.2 as a map in a specific context will provide useful insights to drive changes to organizations' capabilities. Our findings empirically demonstrate the dynamic capability theory application, thus increasing its robustness (Schilke et al., 2017).

5.2 Practical Implications

In addition to the theoretical contributions explained previously, our study can support leaders and organizations that are facing DT.

First, the theoretical model can help organizations determine what elements they need to change and the factors encompassing DT. Considering the complex and holistic scope of organizational changes associated with DT, it is easy to see that they can be painful and hard to be managed. Each element described in the dynamic capability framework generically describes the triggers, enablers, barriers, dynamic capabilities, expected outcomes, and strategic renewals surrounding digital transformation in incumbent organizations.

Second, the challenges, triggers, and enablers described considering academic productions would give a shortcut of variables to be handled by organizations during the DT journey. Our findings provide a clear path of issues that organizational actors must consider, enabling them to foresee and plan actions to streamline the transformational process.

Third, the dynamic capabilities outlined that business agility and adaptable teams are required to seize business opportunities. Organizations need cross-functional teams to deliver small batches in short periods to validate business hypotheses, reduce risks, rethink rules, optimize processes and respond quickly to market changes. Agile methodologies and product development should not be an IT matter; instead, they should be spread across the organization.

Fourth, incumbent organizations need to get out of their premises and stay in touch with customers, business partners, and innovation ecosystems. With that sort of capability, they can lower the costs of creating solutions that do not meet customer needs and put their new businesses on a faster growth track.

Fifth, while increasing their IT infrastructure through DT, organizations also benefit from investing in the flexibility of their IT capability and its adaptability to fast-changing digital technologies to remodel their businesses fully. Offering consistent customer experience combined with smart products and services depends on seamless data processing and fully IT integration.

Finally, an organization's management team needs to take responsibility for articulating and reinforcing the need to create businesses that reach new customers in new ways to succeed in DT. In other words, an organization's C-suit team has to promote a mindset that challenges

traditional operating models and ways of thinking. From top to bottom, leadership roles are critical to guiding the transformation from a strategic standpoint, fostering the co-creation of new products with ecosystem players, embracing uncertainty by a trial-and-error mindset, and promoting structures that ensure ongoing cultural refreshment.

5.3 Limitations

This study has some limitations. First, the literature review did not add databases, such as "Google Scholar," "business source complete," and papers published in conference proceedings while sampling the documents we analyzed. We knew that kind of decision could limit our conclusions in such a diverse subject as DT.

Second, the number of interviewees interacting with DT could have been more significant, allowing a better understanding of the case studies. Also, listening to participants in diverse levels impacted by DT would be interesting to expand the overview of the factors and the capabilities that were in place, considering a different perspective and reducing some existing bias.

Third, our findings have a sort of subjectivity as they are interpretations from the collected data. Although we used sources beyond transcripts, only the researchers had access to the complete dataset and conducted the coding procedures and result analysis.

Fourth, the framework proposed was evaluated by a small group of practitioners. We did not consider academic specialists' opinions on digital transformation.

Finally, the number of organizations studied, and their diversity is a small basis for conclusions about other incumbents undergoing DT, thus restricting the generalization of the results.

5.4 Suggestions for Future Research

Considering the multidisciplinary aspect of the subjects presented in this study, there are countless opportunities for future research.

Firstly, we encourage other researchers to test the transferability and generalizability usage of our dynamic capability framework by analyzing more empirical cases considering the presented elements. Additionally, further research can use quantitative methods to refine and measure the

variables proposed by the framework, by testing DT antecedents, moderators, and mediators and the results.

Secondly, our study focuses on organizational aspects, although employees' characteristics and culture can also play a vital role in incumbent organizations' DT. Our results highlighted the relevance of leadership and managerial capabilities as well as employees' innovation mindset. We encourage new research showing the effects of organizational tenure, the workforce's intertwined generations, skills diversity, management systems, and C-suite's board arrangements in incumbent organizations' attempts to reach DT.

Thirdly, there is undoubtedly room for empirical research proposing the microfoundations of the dynamic capabilities demanded by DT. As extensively described in this study, DT is an interchange between digital technologies and strategy. We highlight the relevance of producing more academic research reporting microfoundations that compose Sensing, Seizing, and Transforming capabilities keeping the theory tied to an organizations' changes.

Finally, one of the significant challenges for IT leaders is to deal with an ecosystem that requires a balance between new ways of generating revenue by improving the customer experience while maintaining an organization's business model operation. In this regard, considering IT a relevant DT enabler and a better understanding of how the IT department can build and (re)configure its capabilities to enable organizations to thrive during DT would have relevant managerial value, particularly in a context where organizations do not see technology as a strategic tool.

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APPENDIX 1 – SURVEY QUESTIONNAIRE

We are a research team investigating digital transformation in incumbent organizations.

Incumbent organizations are established companies belonging to traditional industries such as retail, automotive, or financial services, which were financially successful in the pre-digital economy, but to which the digital economy poses existential threat findings.

This study's primary goal is to investigate the capabilities incumbent organizations need to develop during a digital transformation.

As an expert, we are requesting your participation in this study to evaluate the proposed model. For that, please follow the steps below:

1. Watch the video containing a brief explanation of the model.
2. Read a short document describing the triggers, barriers, facilitators, and each of the dynamic capabilities that set the model.
3. Fill in the form with your opinion and expertise on the issue.
4. Send an audio message answering the following question: what were the main conclusions offered by the model to understand an organization's digital transformation?

This questionnaire is anonymous, and the collected data will only be used within the scope of the research project.

Demographics

1) Please, select the industry where you are currently working:

Arts, culture, sports, and entertainment

Real estate

Automotive

Trade

Consultancy

Perfume and Cosmetics

Energy

Pharmaceutical

Government

Education

Media and communication

Oil and Gas

Finance

Telecommunication

Retail

2) Please, select your current professional position:

Manager

Director

Consultant

Other:

3) How many years have you been conducting organizational transformation?

One or less

1-2

2-3

3-4

4-5

5-10

Ten or more

External Triggers

5) Check the digital transformation motivators (external triggers) (you may check more than one):

- Competitive landscape
- Consumer behaviors and expectations are changing
- Disruptive digital technologies
- Rethinking value propositions

6) What other triggers do you believe organizations should look at? Why?

Internal Barriers

7) Which of the barriers below do you believe are responsible for slowing down the digital transformation? Select all that apply:

- Rigid strategic planning
- Resistance to change
- High-level hierarchy and silos
- The inertia created by path dependencies

8) What other internal barriers do you believe organizations deal with in the digital transformation? Why?

Internal Enablers

9) Which of the internal enablers below do you believe support the digital transformation? Select all that apply:

- Cross-functional teams

Fast decision making

Executive support

IT capability

Data governance

10) What other internal enablers do you consider? Why?

Digital Sensing

“Sensing” refers primarily to the identification or creation of new market opportunities. It should not be limited to the rather generic ability to scan the environment. More importantly, it should include the ability to interpret and make sense of objective data in a creative fashion, which involves evaluation, assessment, and judgment processes that are hard to imitate (Teece, 2007, 2014).

11) Regarding Digital Scouting (observing the digital universe), what capabilities does an organization need to develop for a digital transformation? Select all that apply:

Scanning for technological trends

Screening of digital competitors;

Reaching and engaging customers and online communities

Sensing customer journey pain points

12) What other Digital Scouting capabilities should an organization develop?

13) Regarding Digital Planning (planning from the digital context), what capabilities does an organization need to develop for a digital transformation? Select all that apply:

Interpreting future digital scenarios

Formulating digital strategies based on internal and external data

14) What other Digital Planning capabilities should an organization develop?

15) About Digital Mindset Crafting, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

- Establishing a long-term digital vision
- Enabling an entrepreneurial mindset
- Advocating a digital mindset
- Arranging a visionary/innovative skill team to define the right digital strategy

16) What other Digital Mindset Crafting capabilities should an organization develop?

Digital Seizing

“Seizing” requires the mobilization of productive resources to achieve advantage from possibilities in an innovative approach (Teece, 2014). Teece (2014) stresses the role of coordination routines to combine and deploy several parts of a given set of resources in an entrepreneurial fashion toward the development of new products and services. Businesses need to invest in complementary assets and capabilities such as manufacturing, distribution, and complementary technologies to seize new opportunities and capture value from innovations to achieve successful commercialization (Teece, 2014). A responsive organization or business model must also exist to enable the adequate exploitation of new opportunities as they are recognized (Teece, 2010).

17) Regarding Strategic Agility, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

- Pacing strategic responses
- Rapidly reallocating resources
- Accepting redirection and change

18) What other Strategic Agility capabilities should an organization develop?

19) Regarding Rapid prototyping, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

- Creating minimum viable products

Using approaches such as agile project management, process flexibility, lean start-up, design thinking, continuous deployment, and integrated development

Using a digital innovation lab

20) What other Rapid prototyping capabilities should an organization develop?

21) Regarding Balancing Digital Portfolios, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

Balancing internal and external options

Scaling up innovative business models

Setting an appropriate speed of execution

22) What other Balancing Digital Portfolio capabilities should an organization develop?

Digital Transformation

Organizations may overcome severe challenges through different “transformation” (also named “reconfiguration”) orchestration processes (Teece, 2014). This capability function enables both new resource formulation and modification of an existing resource foundation to keep a firm's resources in close strategic alignment with customers, partners, and the broader business environment (Teece, 2014). The “transformation” aspect of dynamic capabilities is required when radical opportunities are triggered (Teece, 2014).

23) Regarding Navigating Innovation Ecosystems, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

Joining a digital ecosystem

Interacting with multiple external partners

Exploiting new possibilities of co-creation or coopetition

24) What other Navigating Innovation Ecosystems capabilities should an organization develop?

25) Regarding Redesigning Internal Structures, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

Defining digital transformation leadership

Creating digital business unit

Digitalization of business models

Designing team-based structures

26) What other Redesigning Internal Structures capabilities should an organization develop?

27) Regarding Improving Digital Maturity, what capabilities does an organization need to develop for a digital transformation? Select all that apply:

Identifying digital workforce maturity

External recruiting of digital talent

Leveraging digital knowledge inside the firm

28) What other Improving Digital Maturity capabilities should an organization develop?

Change and Impact of Digital Transformation

29) What is the strategic renewal of the digital transformation for organizations? Select all that apply:

Business model

Collaboration

Culture

30) What other strategic renewal should arise during a digital transformation?

31) What are the expected outcomes of the digital transformation for organizations? Select all that apply:

Operational efficiency (cost savings)

Increased revenues

New cost-revenue model

32) What other outcomes should an organization expect from a digital transformation?

Final message

Thank you for your time and the knowledge shared. Your support will enhance the quality of the proposed model.

APPENDIX 2 – CASE STUDY’S QUESTIONNAIRE

Interviewee Information

	Notes
Position	
Leadership experience	
Education	
Role in the digital transformation	

Data Collection Information

	Notes
Date	
Start (time)	
Finish (time)	
Duration (minutes)	

Opening

1. What is digital transformation for you?

External Triggers

2. When did the digital transformation process start in the firm?
3. What were the firm’s digital transformation triggers (internal or external)?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Competitive landscape
- () Consumer behaviors and expectations are changing
- () Disruptive digital technologies
- () Rethinking value propositions

Barriers

4. What have been the perceived barriers since the digital transformation started?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Rigid strategic planning
- () Resistance to change
- () A high degree of hierarchization
- () The inertia created by path dependencies (e.g., past experience, past decisions, current structures, current infrastructures)

Internal Enablers

5. What are the internal enablers that have been supporting the digital transformation? The items below were mentioned in the literature review and will not be asked during interviews.

- () Cross-functional team
- () IT capability
- () Fast decision-making
- () Executive support
- () Data governance

Digital Sensing

6. How has the firm been scanning for digital transformation opportunities?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Scanning for technological trends
- () Screening of digital competitors
- () Reaching and engaging with customers and online communities
- () Sensing customer journey “pain points” (a pain point is a specific problem that prospective customers of your business are experiencing. In other words, you can think of pain points as plain and simple problems. Like any problem, customer pain points are as diverse and varied as your own prospective customers).

7. How has the firm been using data (internal or external) to design its strategy for digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- Formulating digital strategies upon internal or external data
- Interpreting future digital scenarios

8. How has the firm been sensitizing its employees to digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- Establishing a long-term digital vision
- Encouraging an entrepreneurial mindset
- Advocating a digital mindset
- Building a visionary/innovative skill team to define the right digital strategy

Digital Seizing

9. How has the firm been revamping its strategy for digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- Pacing strategic responses
- Rapidly reallocating resources
- Accepting redirection and change

10. What are the capabilities your firm has been building to implement opportunities identified for the digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- Creating minimum viable products
- Using approaches, such as agile project management, process flexibility, lean start-up, design thinking, and continuous software deployment
- Using a digital innovation lab

11. How has the firm been considering the implementation of the identified opportunities for digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Balancing internal and external options
- () Scaling up innovative business models
- () Setting an appropriate speed of execution

Digital Transforming

12. How has the firm been using external players for reconfiguring its resources for digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Joining a digital ecosystem
- () Interacting with multiple external partners
- () Exploiting new possibilities of co-creation or co-opetition

13. What changes in the firm's structure have been affected by digital transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Digital transformation leadership
- () Digital business unit
- () Designing team-based structures

14. What changes in the firm's business model have been triggered by transformation?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Digitalization of business models

15. How has the firm been improving its workforce digital maturity?

The items below were mentioned in the literature review and will not be asked during interviews.

- () Identifying digital workforce maturity
- () External recruiting of digital talent
- () Leveraging digital knowledge inside the firm

Impacts and Changes

16. What are the currently observed impacts of digital transformation for the firm?

The items below were mentioned in the literature review and will not be asked during interviews.

- Business model
- Collaboration
- Culture

17. What is the expected economic outcome of digital transformation for the firm?

The items below were mentioned in the literature review and will not be asked during interviews.

- Operational efficiency (cost savings)
- Increased revenues
- New cost-revenue model

Lessons Learned

18. What were the lessons learned since the beginning of the digital transformation in the firm?