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Designing a Comprehensive Understanding of Digital Transformation and its Impact

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Designing a Comprehensive Understanding of Digital Transformation and its Impact

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Abstract Many researchers, managers, and companies are currently dealing with digital transformation. Yet, there exists a research gap on the exact meaning and scope of this transformation. In this paper, an in-depth literature study was performed and synthesized to inductively construct a conceptual framework that reconciles the distinct definitions and aspects of digital transformation. From the framework, we derived a novel and comprehensive definition of digital transformation which was validated against the literature and shown to be exhaustive. Furthermore, our definition explicitly explains why digital transformation is happening and accelerating. Researchers and practitioners can use the framework to position their work and to gain a better understanding of its wide scope and impacts. This work can be among the first steps towards a unified understanding of digital transformation.

Keywords: • Digital transformation • Definition • Business Transformation • Digitalization • Digital Transformation Framework •

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1 Introduction

In recent years, the increasing use of digital technologies has had a major impact on many aspects of our civilization. This rapid change is frequently called digital transformation (DT). Academic research on DT has mainly focused on two aspects. First, a significant body of research exists on the different impacts and changes DT has on society and business. Secondly, many papers provide guidelines, models, and lessons for companies to aid with their transformation. Despite the sheer amount of research, there is still no clear, well-agreed upon definition for DT (Goerzig & Bauernhansl, 2018; Haffke, Kalgovas, & Benlian, 2016). There exist significant semantic differences in the terminology used and several authors have suggested delimiting the various definitions (Morakanyane, Grace, & O'Reilly, 2017; Vial, 2019). Furthermore, this vagueness in understanding demonstrates the lack of a coherent theoretical frame that reconciles all aspects of DT (Henriette, Feki, & Boughzala, 2015).

This study seeks to address these research gaps by organizing the extant literature around a theoretical framework and by proposing a novel, and exhaustive definition. For that reason, three research questions are formulated:

- How is DT defined in the existing literature?
- How can the various aspects of DT be organized around an integrative framework?
- How can DT be defined in a comprehensive way?

To do so, this paper performs and synthesizes an in-depth terminology study to inductively develop a framework and definition of DT. The results of this study provide new insights into the nature of DT and can aid researchers and practitioners with framing their work. This work further highlights new research avenues and can be among the first steps towards a unified definition of DT.

The paper proceeds as follows: the next section discusses the methodology. In section 3, we give an overview of the literature study and analysis which are used in the next section as the basis for the construction of the DT framework. The framework is then used to introduce a sound and comprehensive definition of DT in section 5. The next section validates our work against the literature before giving the conclusion and future work in section 7.

2 Methodology

In line with the research questions, an inductive approach was conducted wherein observations from the literature, i.e. DT definitions, were analyzed for patterns which were used to develop a conceptual framework. This methodology is commonly used to build a construct of a phenomenon (Lodico, Spaulding, & Voegtle, 2010; Vial, 2019). First, we performed an in-depth terminology study in search of DT definitions. We started by reviewing the top results for 'digital transformation' in two databases (Scopus and Google Scholar) and extended this through a backward and forward search up to 115 articles. The articles include conference and journal papers but also highly cited professional papers, e.g. industrial reports, since we are interested in both sides. The papers were analyzed and their definitions, in total 13, were extracted. Then, the results were compared and completed with the findings of previous systematic DT literature reviews (Morakanyane et al., 2017; Vial, 2019) which resulted in a total of 17 unique definitions. Only original definitions, which do not paraphrase others, were kept. Secondly, we decomposed the definitions into frequent key components to identify the essential aspects of DT. Thirdly, we developed a DT framework which reconciles all the key components and from it, a novel and exhaustive DT definition was derived. Lastly, the definition and framework were validated against the existing definitions in the literature by positioning them on the framework.

3 Conceptual Groundwork

The terminology study resulted in 17 different DT definitions, as summarized in Table 1. A striking observation is the wide scope range: from using technology to improve the performance of a company (Westerman et al., 2011) to the changes in all aspects of people's life (Stolterman & Fors, 2004). This seems to confirm the lack of a universal definition.

Table 1: Definitions of Digital Transformation

#	Year	Authors	Definition of Digital Transformation
[1]	2004	Stolterman & Fors	'Changes that the digital technology causes or influences in all aspects of human life'
[2]	2011	Liu et al.	'Organizational transformation that integrates digital technologies and business processes in a digital economy'
[3]	2011	Westerman et al.	'Use of technology to radially improve the performance or reach of enterprises'
[4]	2012	White	'Arises from the blending of personal and corporate IT environments'
[5]	2013	Fitzgerald et al.	'The use of new digital technologies (social media, mobile, analytics or embedded devices) to enable major business improvements (such as enhancing customer experience, streamlining operations or creating new business models)'
[6]	2015	Schuchmann & Seufert	'The realignment of technology and new business models to more effectively engage digital customers at every touchpoint in the experience lifecycle'
[7]	2015	Solis	'The realignment of, or new investment in, technology, business models, and processes to more effectively compete in an ever-changing digital economy'
[8]	2016	Berghaus & Back	'Technology-induced change on many levels in the organization that includes both the exploitation of digital technologies to improve existing processes, and the exploration of digital innovation, which can potentially transform the business model'
[9]	2016	Demirkan, Spohrer & Welser	'The profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies

			and their impact across society in a strategic and prioritized way'
[10]	2016	Hess et al.	'The changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes'
[11]	2017	Morakanyane et al.	'An evolutionary process that leverages digital capabilities and technologies to enable business models, operational processes and customer experiences to create value'
[12]	2017	Reddy & Reinartz	'In traditional sense, 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 in created within this system'
[13]	2017	Parviainen et al.	'Changes in ways of working, roles, and business offering caused by adoption of digital technologies in an organization, or in the operation environment of the organization. This refers to changes at process, organization, business domain and society level'
[14]	2018	Ebert & Duarte	'Technology-driven continuous change process of companies and our entire society'
[15]	2018	Goerzig & Bauernhansl	'A fundamental change process in enterprises initiated by new competitive advantages through the evolution of IT into an essential part of the value creation'
[16]	2018	Hinings et al.	'The combined effects of several digital innovations bringing about novel actors, structures, practices, values and beliefs that change, threaten, replace or complement existing rules of the game within organizations, ecosystems, industries or fields'

[17]	2019	Vial	'A process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies'

By analyzing the DT definitions, it is possible to decompose them into the most frequent (f) key components: *use of digital technologies (f:17), new business models (f:9), internal operations (f:8), customer experience (f:4), society transformation (f:4), change process (f:4), organizational transformation (f:3), digital innovation (f:3), digital economy (f:3), organizational transformation (f:3), value creation (f:2), and products and services (f:2).*

4 Constructing the Digital Transformation Framework

To reconcile the various characteristics of DT, all the key components above are organized around a conceptual framework, illustrated in Figure 1. The framework summarizes the key components and the DT literature in three axes, their segments, and the interactions between the axes. The axes represent the three transformations that can be extracted from the components: business transformation (*internal operations, products and services, organizational transformation, and new business models*), digital technologies transformation (*digital innovation*), and society transformation (*society transformation*).

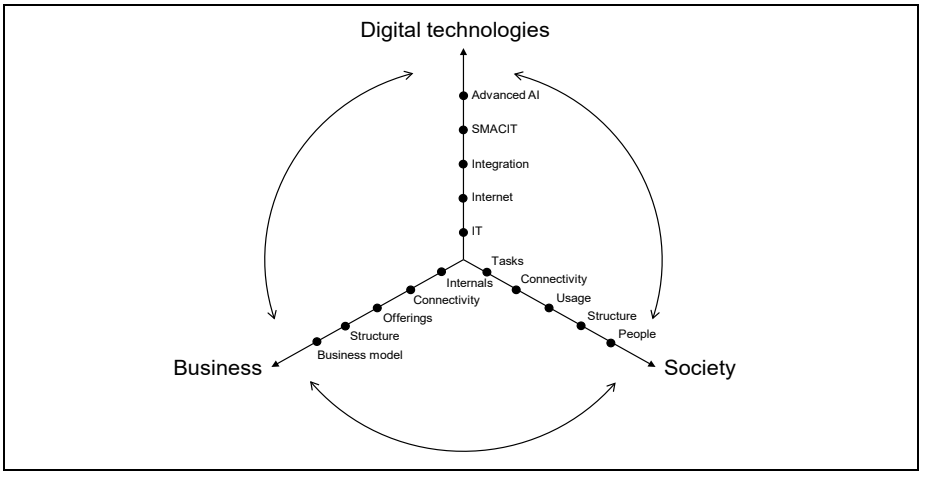

Figure 1: The Digital Transformation Framework

Digital technologies transformation, i.e. *digital innovation*, is represented by the vertical axis in Figure 1. Many digital technologies that are steering DT can be accredited, of which five important waves in the past 50 years are mentioned chronologically (Carter, 2018; Porter & Heppelmann, 2014; Singh & Hess, 2017). While the last wave, advanced artificial intelligence (AI), is still in its early stages, it is included because many businesses see it as a potential technology for DT in the near future (Carter, 2018; HM Government, 2017).

- IT: automation of isolated activities, and problem calculations
- Internet: inexpensive, ubiquitous connectivity and information sharing
- Integration: more affordable, widespread computing power and possibilities
- SMACIT: social media, mobile, analytics, cloud computing, and Internet of Things
- Advanced AI: tasks that normally require human intelligence

Business transformation, the left axis, can be understood as the changes in organizations to bring about significant performance improvements or *value creation* (McKeown & Philip, 2003). A growing number of aspects of the business are changing, which we summarize in 5 categories inspired by the keywords and related work (Kane et al., 2017; Venkatraman, 1994; Wade, 2015). The categories are ranked chronologically, as these aspects frequently change in this order (Morgan & Page, 2008; Venkatraman, 1994).

- Internals: changes in *internal operations*, technology, and labor
- Connectivity: changes in the connection between processes, businesses, and entities
- Offerings: new or enhanced *products and services*
- Structure: changes in the structure, roles, and culture, i.e. *organizational transformation*
- *Business model*: changes in business scope, management, and strategy

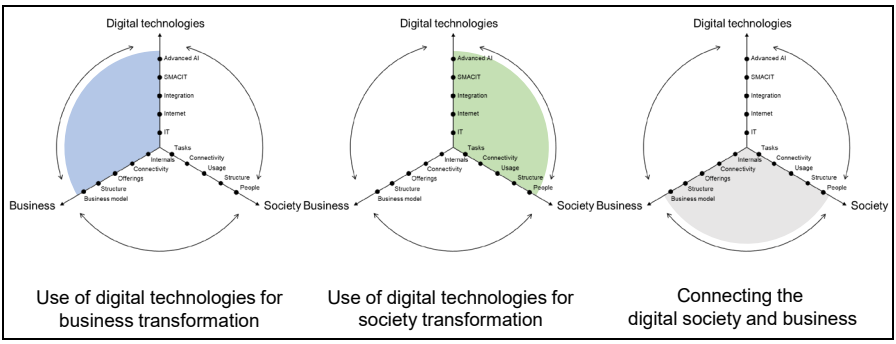

Figure 2: The Segments of the Digital Transformation Framework

In the scope of DT, the business changes are brought by the increased exploitation and *use of digital technologies* (Venkatraman, 1994; Wade, 2015), as represented by the left segment in the DT framework (see Figure 2). The simple use of new technologies for the same way of working in these aspects is not enough; businesses must transform their approaches in these aspects (Earley, 2014). Ideally, the companies should aim to integrate the digital technologies to change all aspects, and eventually the business model itself (Kane et al., 2017). This means that each aspect of the business should be optimized given the current digital technologies.

It is important to note that these aspects do not always change in this order. For example, a company can be digitalizing its business model while maintaining its old structure. Furthermore, the change process above can reiterate for every new digital technology wave. Hence, it is a process in which various business aspects can change subsequently and simultaneously with different digital technologies.

Society Transformation is represented by the right axis and can be understood as the changes happening in people, customers, and societies over time. In the context of DT, it is about the changes happening due to the increased *use of digital technologies*, as represented by the right segment in the DT framework (see Figure 2). People are becoming increasingly digitalized because they adopt digital technologies in every aspect of their lives. This affects their acceptance of digital trends, their identity, their notion of privacy, their work, the way they communicate, and the way they live (Hanelt et al., 2015; Schwab, 2015). As customers, their consumption patterns, notion of ownership, demands, and

product knowledge have changed intensively (Berman, 2012; Schuchmann & Seufert, 2015; Schwab, 2015). As an aggregated effect, this also happens with the entire society (Ebert & Duarte, 2018). In brief, these changes can be summarized in five categories. Similarly to the business changes above, we argue that these changes usually happen in this order but do not have to. Likewise, these changes can happen subsequently and simultaneously with different technologies.

- Tasks: changes in isolated tasks and activities
- Connectivity: changes in communication, informedness, and network
- Usage: changes in products and services used in daily life
- Structure: changes in work-life balance, habits, and routines
- People: changes in people's values, notion of ownership, identity, and way of living

The connection between society and business, and the *customer experience* are changing too, represented by the bottom segment of the DT framework (see Figure 2). The digital businesses are increasingly being connected to the digital society through the linking of the private and corporate IT (Parviainen et al., 2017), or the co-creation of value between digital customers and digital businesses (Gray et al., 2013). This includes digital interactions, distribution (Lanzolla & Anderson, 2008), cooperation, information sharing and co-specialized investments (Katsamakas, 2014). Several important digital players have profited from this digital connection such as Airbnb, Uber, and eBay.

Lastly, the changes that happen along the three axes cannot be considered as a single event or one-time exercise. Instead, it is a continuous *change process* fueled by digital innovations and breakthroughs (Krell & Gale, 2005; Parviainen et al., 2017) in which the different transformations become increasingly connected. Several authors refer to this interconnected state as the *digital economy* (Hinings et al., 2018; Liu et al., 2011; Solis, 2015).

5 What is Digital Transformation?

5.1 Introducing a Novel Definition

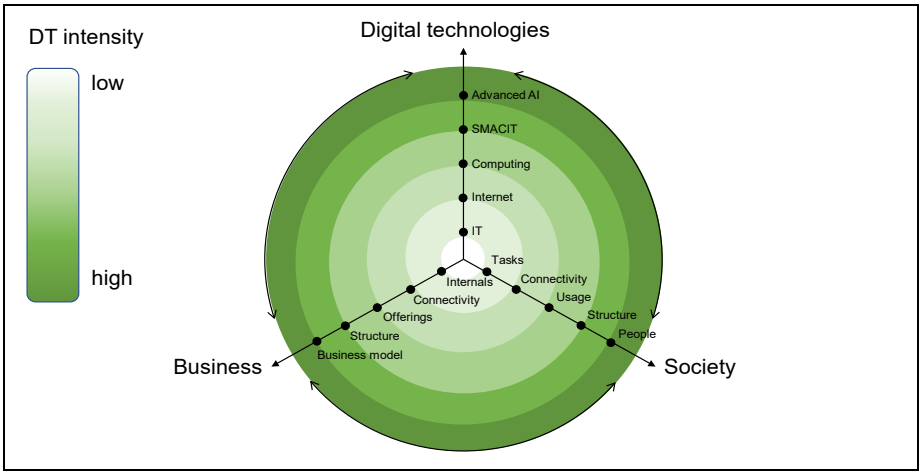

Figure 3: The Digital Transformation Process

We argue that DT concerns the entirety of the changes above. Thus, it can be understood as the circular motion towards the outer edges of the DT framework in which digital technologies iteratively bring forward more changes in business, society, and their connections, shown in Figure 3. We expand this idea, by arguing that DT is happening and steered by the increased interactions between these developments, illustrated by the two-headed arrows between the axes in the framework. This makes the different transformations intertwined which dramatically increases the DT's velocity (Bharadwaj et al., 2013; Demirkan et al., 2016), scope and impact. Thus, the following DT definition is proposed:

> *Digital transformation is the continuously increasing interaction between digital technologies, business, and society, which has transformational effects and increases the change process's velocity, scope, and impact.*

5.2 The Interactions

Between digital technologies and business. New digital technologies or innovation pressure businesses into digitally transforming due to the risk of competitors gaining a competitive edge by adopting those technologies (Bharadwaj, 2000; von Leipzig et al., 2017). This vulnerability has also been referred to as digital Darwinism: only the most responsive enterprises to digital innovation survive (Schwartz, 2002; Solis, 2015). In turn, this threat leads businesses to adopt a more risk-promoting culture and structure to become more agile and innovative (Kane et al., 2015), which can be the key to future success (Christensen, Raynor, & McDonald, 2015). This cohesion between digital innovation and business is becoming increasingly imperative such that a digital strategy, which consolidates both strategies (Sebastian et al., 2017), and new executives functions such as Chief Digital Officers (CDOs) are often introduced (Singh & Hess, 2017).

Vice versa, businesses influence digital technologies by imposing quality standards, adopting certain technologies, and demanding specific solutions (Baden-Fuller & Haefliger, 2013). The government can also play a significant role in this relation: it can decide what practice is appropriate for digital disruptors, the time lag between innovation and policy legitimation, and can influence the standard-setting through its purchasing power (Hinings et al., 2018).

Between digital technologies and society. Digital technologies influence society into digitally transforming by offering improvements, exciting products, and convenient services in daily life. Vice versa, society can influence the digital innovation by its adaption of certain digital technologies, its purchase behavior, and its demands (Baden-Fuller & Haefliger, 2013; Risselada, Verhoef, & Bijmolt, 2013).

Between business and society. Digitalized businesses foster the DT of societies by offering more services, convenience, and benefits to their digital customers. For example, many transport companies offer small discounts for ordering tickets with their app versus from the kiosk. This nurtures customers to adopt this digital service, who in turn put more pressure on the companies that do not yet offer this service. Digitalized businesses also impact the job market, such as the creation of the digital skills job gap (Westerman & McAfee, 2012),

the rising number of jobs that can be replaced by machines (Guest, 2014), and changes in the type of work (Parviainen et al., 2017).

In turn, the digitalized society heavily influences businesses. First, customers demand the same digital convenience they experience in their private lives when interacting with businesses. Hence, businesses must deliver convenient digital interactions at every touchpoint in the customers experience lifecycle (Schuchmann & Seufert, 2015). Secondly, digitalization influences customers' behavior: customers are less loyal, more informed, tolerate fewer errors and form higher expectations (Henriette et al., 2015; Horlach, Drews, & Schirmer, 2016). Thirdly, not only the customers but employees become more demanding about their working conditions (Solis, 2015; Westerman et al., 2011).

5.3 Example of DT Interactions

As an example of how these interactions steer DT, the history of Netflix is modeled on the framework in Figure 4. Netflix started as an online DVD rental/delivery company. When internet technologies that allowed for streaming of videos were adopted by customers (1), Netflix was influenced to digitalize some of their products (2) and opened its streaming service (3). In turn, this fostered the digital service acceptance of society (4), and due to the success, Netflix started transforming its organizational structure (5) to focus on streaming services and by confining the DVD rentals. In a similar fashion started the shift towards mobile (6, 7, 8 and 9). Now, Netflix's business model is online-streaming only (10). This fostered the acceptance of digital business models in society (11). Consequently, this caused pressure on other media companies to digitalize their business models (12), for example, the streaming services boom we witness today (McDonald & Smith-Rowsey, 2016).

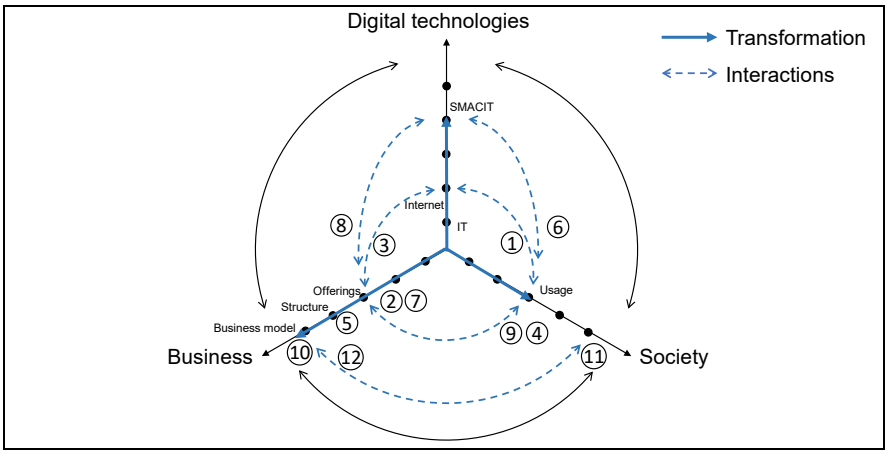

Figure 4: Netflix Case Example

5.4 Related Terminology in the Literature

Prior research has argued that DT is characteristically different from previous IT-enabled transformations due to its larger external impact (Ismail, Khater, & Zaki, 2017), its digital interactions and distributions (Lanzolla & Giudici, 2017), the network competition (Katsamakas, 2014) and more. Other authors, such as Vial (2019) argue that DT is an evolution of IT-enabled transformation. The DT framework provides a comprehensive answer to this problem, as the inner circles can be understood as what was previously called IT-enabled transformation and the outer circles of what several authors limit their definition of DT to. Thus, the DT framework explains both terms as part of the DT process but with different scopes.

In light of the increased literature that highlights the importance of being customer focused when embarking DT in businesses (Berman, 2012; von Leipzig et al., 2017; Weill & Woerner, 2015) and the rise of peer collaborative companies, e.g. Booking, it is argued that digital business transformation concerns the exploitation of both the opportunities brought forward by digital technologies, and by the digital society. In a similar fashion, the digital society transformation considers the use of digital technologies for changes in society and the changes in their relationship with businesses. Finally, the digital technologies innovation includes the increased use in business and society, and their respective reversed influence, as illustrated in Figure 5.

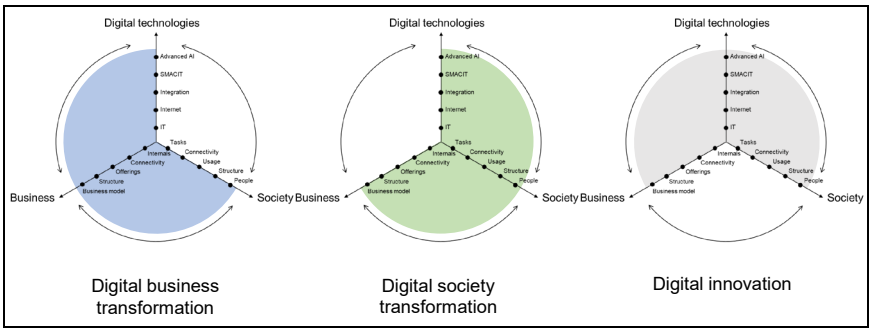

Figure 5: The Digital Transformation of Business, Society, and Technology

6 Validation of the Digital Transformation Framework

It is possible to validate the DT framework and definition against the definitions found in the literature by positioning these on the framework, as shown in Figure 6, Figure 7 and Figure 8. The definitions are placed on the DT framework as circular segments to indicate their scope. Three different figures and several distinct colors were used solely for clarity purposes. The spherical segments overlap such that the outer segment also includes the inner segments; for example, definition 2 extends definition 3. It is worth noting that all definitions could be placed on the DT framework, and their ensemble takes the form of the framework, which lends some validity that the framework and definition are consistent with the literature.

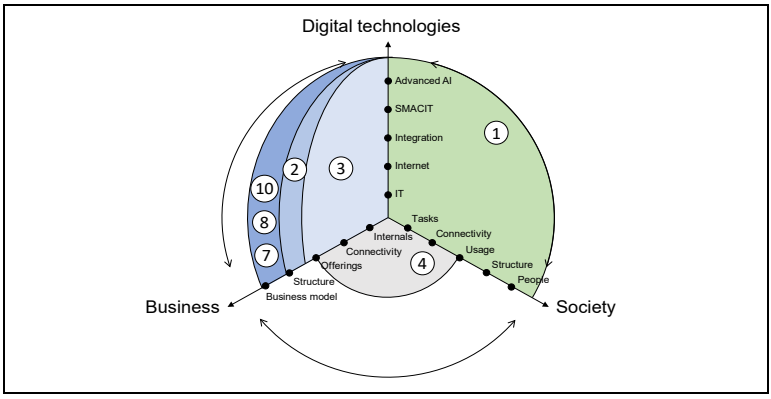

Figure 6: Validation Part I

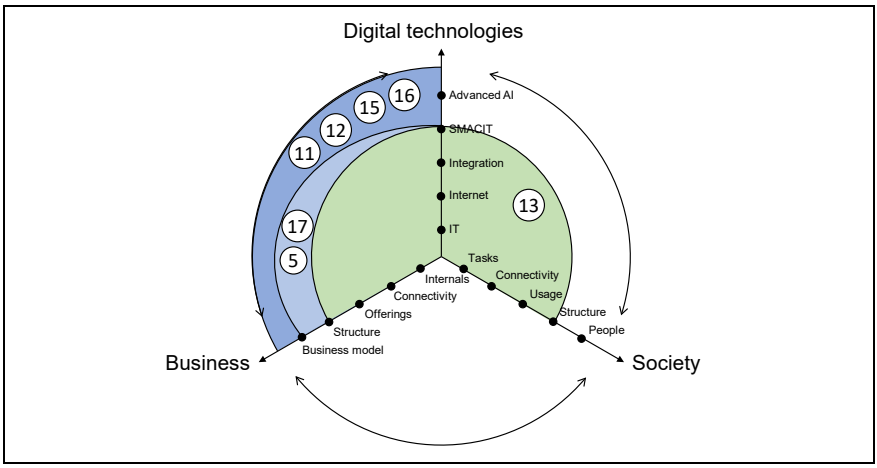

Figure 7: Validation part II

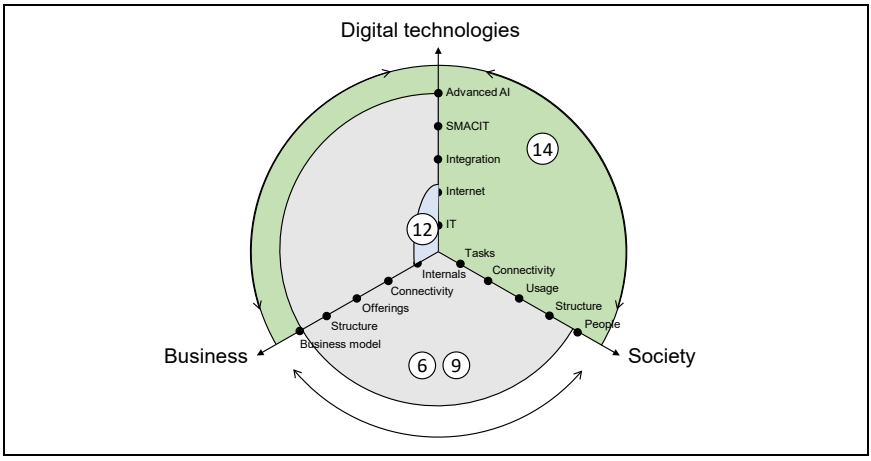

Figure 8: Validation Part III

7 Conclusion and Future Work

Digital transformation has received a great deal of attention in research but lacks a unified definition. In this paper, we contribute to the information systems research literature by providing a conceptual framework that reconciles the various aspects of DT and use it to formulate a novel and comprehensive DT definition, which were validated against the literature. These findings assist an understanding about the scope, forces, and impact of DT and can be among the

first steps towards a unified definition, which is the key element of a well-developed scientific discipline (Torgerson, 1958). Additionally, practitioners and researchers can use the DT framework to frame their work.

In future work, the following use cases of the DT framework will be investigated:

- Modeling a company's current state on the DT framework together with its customers allows for the identification of DT opportunities and threats. This could be seen as misalignments between the axes.
- Second, by modeling several companies, or even countries, on the framework, the DT framework could be used as a comparison tool.
- Third, by giving weights to the respective segments and transformations, the DT framework can be used as a maturity tool or to derive DT metrics from.

Despite its exploratory nature, this study offers novel insights into the concept of DT and raises intriguing questions regarding the nature and the impact of the interactions between digital technologies, society, and business. In future studies, considerably more research will need to be done to determine how these interactions impact and shape DT, and to validate the framework empirically. Moreover, future research should be conducted to better understand how businesses can exploit the opportunities brought by a digital society.

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