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**Management 4.0 in Theory and Practice:  
The Strategic Role of Digital Solutions in Selected Organizations**

**Doctoral School of Business and Management**

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**CORVINUS UNIVERSITY OF BUDAPEST**

Doctoral School of Business and Management

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The Strategic Role of Digital Solutions in Selected Organizations**

**DOCTORAL DISSERTATION**

**Borbála Szedmák**

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# I. Introduction

## I. 1. Research field

Nowadays, it has become clear that digital transformation is not only a technological but also a social and economic challenge that drives all actors in the economy to take action. Companies that successfully implement digital transformation - not only in production but also in business administration processes - can gain a significant competitive advantage, focus on higher value-added activities, and operate more efficiently. However, organizations usually cannot adopt and use digital tools properly and face great difficulties in terms of digital transformation.

According to the reports of the European Commission, Hungary lags far behind the EU average in terms of digital development (see, for example, the DESI indicator), especially in the field of corporate use of digital technologies: companies typically do not take advantage of the opportunities offered by digital technologies. During my studies, project assignments, and previous research and work experience, I had the chance to personally study the attitudes of 100+ CEOs towards digitalization, and as part of questionnaire-based quantitative research, I analyzed the Industry 4.0 readiness of 300+ companies in the CEE region. Besides identifying some good practices, I could see that many companies are reluctant to use digital technologies. The operation of many domestic firms is still paper-based, and a significant number of business leaders still rely on their gut feelings and experience, and reject data-based decision-making and decision support systems.

The Fourth Industrial Revolution is one of the most popular topics of international research activity and is of great interest within management sciences, but many questions remain unanswered in the field of management.

In my doctoral dissertation,<sup>1</sup> I aim to answer the question **(RQ) of what the role of digital solutions (DSs) in strategy is**. I examine the question in two different contexts: the internationalization of SMEs and the digital transformation of public services. In my dissertation, I use the theoretical foundation of dynamic capabilities.

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<sup>1</sup> The research within Project no. [C1760262] has been implemented with the support provided by the Ministry of Culture and Innovation of Hungary from the National Research, Development and Innovation Fund, financed under the KDP-2021 funding scheme.

I compiled my dissertation from my articles:

- **Szedmák, Borbála** and Szabó, Zsolt Roland (2025). Success factors of digital solution implementation. *Budapest Management Review* (ahead-of-print).
- Szabó, Zsolt Roland, **Szedmák, Borbála**, and Tajti, Anna (2021). The relationship between digital development and export activity of Hungarian SMEs. *External Economic Bulletin*, 65(November – December), 3–27. <https://doi.org/10.47630/KULG.2021.65.11-12.3>
- **Szedmák, B.**, Varga, L., Szabó, Z.R. (2025). Digital Transformation of Public Services: The Case of the Document Management Application. *International Journal of Public Administration* (online first). <https://doi.org/10.1080/01900692.2025.2520522>

The dissertation was supported by the Cooperative Doctoral Scholarship, and was prepared in cooperation with the industry partner, who is focusing on implementing digital solutions in the case of fast-growing SMEs and in the public sector. Thus, investigating how digital solutions can help SMEs' goals and transform public services is of key interest: these are the research areas that generate business value for the partner company. According to this, the second article of my dissertation investigates how digital solutions can contribute to the growth of the firm, and the third article analyzes the main steps, goals, and benefits of the digital transformation of public services. While digital transformation is widely researched, these remain research gaps (as detailed later).

Journal articles are expected to be complete in themselves, leading to the repetition of certain sections of the dissertation, such as the introduction, theoretical background, and research methodology, across different chapters.

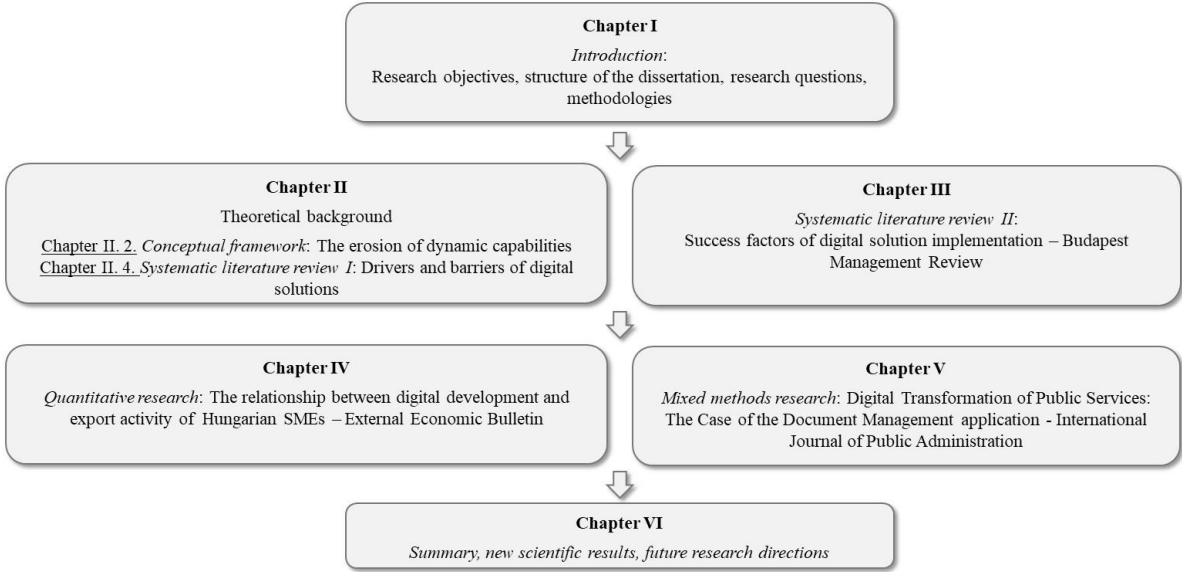
## **I. 2. Structure of the dissertation**

In the first chapter of my dissertation (Chapter I), I outline the objectives of my research, the structure of my dissertation, the research questions, and the methodologies used. Chapter II presents the theoretical background. After reviewing the "main stations" in the evolution of strategic management, and providing a theoretical foundation, I present a conceptual framework that explains how dynamic capabilities erode and are built (Chapter II. 2.). It helps us understand how and why organizations can (or cannot) stay competitive in the digital era: if they cannot react successfully to the changes triggered by digitalization, their dynamic capabilities, thus their competitiveness erode, but if they are successful, their dynamic

capabilities become stronger. Digital solutions, at the same time, can improve organizations' dynamic capabilities. Then I define the concept of Management 4.0, and summarize the results of a systematic literature review about the drivers and barriers of digital solutions (Chapter II. 4.).

The next three chapters present the articles that my dissertation is compiled of. Chapter III is a systematic literature review titled "Success factors of digital solution implementation". Then, I present two cases that point out how dynamic capabilities enable strategic goal achievement with the help of digital solutions. In Chapter IV, by using a quantitative methodology, I investigate "The relationship between digital development and export activity of Hungarian SMEs", and highlight how digital solutions can support firms in entering existing (international) markets. Chapter V, by using mixed methods, presents the "Digital transformation of public services: The case of the document management application," which shows how the implementation of a digital solution can revolutionize a whole sector. In Chapter VI, I summarize the results, highlight the new scientific results, and point out future research directions.

Figure 1: The structure of the dissertation



Source: own construction

**I. 3. Relevance of the research, research gaps**

Digitalization is one of the biggest challenges and opportunities of our age. It is a key priority for organizations to figure out how to respond to the changes and constantly renew their operations and business models in order to remain competitive in the digital era in the long term and reach their strategic goals.

The areas my dissertation focuses on are based on the Cooperative Doctoral Scholarship, my personal interest, work experience, and research projects. The examined areas are the following:

## **Chapter II. 2. – The erosion of dynamic capabilities**

Recognizing, exploring, and exploiting new opportunities and the efficient and effective management that promotes this are of key importance. An organization's competitive position and capacity for renewal are greatly influenced by whether it has dynamic capabilities: whether it is able to “integrate, build and reconfigure its internal and external competencies to address rapidly changing environments” (Teece et al., 1997: 516), or bring about changes.

Strong dynamic capabilities – i.e., a strong performance, compared to competitors, in all three domains: sensing, seizing, transforming - are crucial due to the volatile, uncertain, complex, and ambiguous (VUCA) nature of the global economy: in an ever-changing environment, it is necessary not only to adapt to and adjust but also to influence and shape the business environment (Teece, 2021). Since 2020, the environment has grown increasingly complex, marked by a rapid succession of interconnected crises on an almost unprecedented scale. The simultaneous occurrence of multiple global and local crises - the COVID-19 pandemic and its health impacts, the global climate emergency, ongoing conflicts (particularly the war in Ukraine), and the widespread cost-of-living crisis - has created an interconnected dynamic that amplifies their effects (Henig and Knight, 2023). In the polycrisis era, it is of key importance to answer the challenges in real-time.

Digital solutions can help organizations better answer these changes and challenges by improving organizations' sensing, seizing and transforming capabilities: organizations with dynamic capabilities can process more data (sensing), prepare and make decisions with better algorithms (seizing), and track implementation and deviation (transforming).

On the other hand, digitalization poses a great challenge for organizations. If they cannot react to the change triggered by digitalization, their dynamic capabilities can erode – but if they are successful in adapting to “the new rules of the game”, their dynamic capabilities can even become stronger.

The literature on dynamic capabilities is rich; however, the erosion of *capabilities* is under-researched, while the erosion of *dynamic capabilities* represents a research gap (Zhang et al., 2023; Rahmandad & Repenning, 2016). The conceptual framework fills this gap.

## **Chapter II. 4. – Drivers and barriers of digital solutions**

In the digital era, it is a key question of how different digital solutions, systems can help organizations' competitiveness. It is thus essential to understand what these solutions are, and what the latest research results are regarding the drivers and barriers of their implementation. While previous studies have analyzed the drivers and barriers/ challenges of individual systems by conducting systematic literature reviews (e.g., Ali et al., 2023; Elmonem et al., 2026), the integrated, comprehensive analysis of multiple digital solutions calls for further research.

### **Article 1 – Success factors of digital solution implementation**

While digital solutions offer several benefits, as detailed in Chapter II. 4., organizations often face difficulties in connection with implementing them. The evaluation of information system success has been a key research focus for decades (Sidorova et al., 2013). Studies reveal a high failure rate in achieving anticipated benefits in DS projects due to their complexity and the challenges associated with implementation (Pishdad and Haider, 2013). Despite growing investments and the expanding DS market, evidence suggests that many organizations struggle to gain significant value from their DS initiatives. Thus, it is of key importance to study the factors leading to success or failure.

The issue is especially relevant in the Hungarian context: in terms of digital maturity, Hungary lags significantly behind the European Union average (European Commission, 2025), particularly in the corporate use of digital tools. Identifying the success factors can help companies advance the digitalization of business processes to the next level of maturity.

Success factors have been examined in numerous previous studies using the PRISMA method (e.g., Barbieri et al., 2023; Al-Assaf et al., 2025), by focusing on individual systems; however, the integrated analysis of multiple digital solutions is a research gap. A search in the Web of Science and Scopus databases using the keywords (“management information system” OR MIS OR “digital solution”) AND “success factor” AND “systematic literature review” produced no results. Our study aims to address this gap: it explores the success factors (and pitfalls) of implementing digital solutions. The added value of the research is that the results of the literature review are interpreted in the Hungarian context, highlighting the key points and specificities while taking into account the characteristics of the local management culture.

## **Article 2 - The relationship between digital development and export activity of Hungarian SMEs**

The contribution of SMEs is extremely important to the growth of GDP, foreign trade, and job creation. Their competitiveness is of paramount importance both at the national and international levels (Prasanthi & Rao, 2019). More than 99 percent of enterprises operating in Hungary are small and medium-sized, and SMEs provide employment opportunities for nearly two-thirds of those employed in the business sector.

Technological developments have led to the exponential expansion of international communication and information networks, thereby reducing barriers to international trade and increasing opportunities for the globalization of business activities. These changes create an environment in which internationalization becomes more feasible and potentially more attractive for small and medium-sized enterprises (SMEs) (Pett et al., 2004; Hortoványi, 2016). The increasing digitalization of the global economy enables SMEs to internationalize and scale up (Stallkamp & Schotter, 2019; North & Lorenzo, 2020).

Although the barriers to internationalization, which historically favored large companies with the necessary resources, have been significantly reduced, many SMEs still lag behind in terms of both competitiveness and internationalization. It is therefore useful to identify which digital solutions can help SMEs' foreign market activities and how SMEs that engage in export activities differ, regarding the usage of digital solutions, from other companies that are present only in domestic markets.

Many experts have examined the internationalization of companies, more specifically SMEs, including export activity (Losoncz & Nagy, 2020), and a large number of research results have been produced on the use of digital technologies and their benefits among SMEs (Szabó et al., 2020). Each of these is an important area in its own right, and their importance is growing nowadays. However, identifying the connections between internationalization and the application of digital enterprise technologies remains a research gap.

## **Article 3 - Digital transformation of public services: The case of the document management application**

Digital transformation of public service delivery has been on the agenda in the past few decades (Dunleavy et al., 2006; Hao et al., 2020). However, moving towards a „true digital public administration" has only recently become crucial - partly as a result of the COVID-19 pandemic (Mergel et al., 2023; Moser-Plautz and Schmidhuber, 2023). As a result of the rapid

advancement of information and communication technologies (ICTs), governments worldwide have progressively embraced various e-government features over the past few decades. Digital transformation outside the public sector is constantly reshaping citizens' expectations regarding the necessity for public administrations to provide high-value, real-time digital services (Mergel et al., 2019). Although many governments have not achieved their objective of digitizing all public services and administrative processes, there has been a notable increase in the adoption of new digital technologies, resulting in significant changes within public sector organizations (Enang et al., 2020; Gil-Garcia et al., 2018).

Although the topic of digital government has received considerable scholarly attention, there is a need for more empirical studies, particularly those focusing on evaluating service performance (Hanisch et al., 2023; Panagiotopoulos et al., 2019; Tangi et al., 2020; Zhu et al., 2024). The efficiency gains resulting from digital transformation in the public sector are often not quantified and are not examined in the long term (Gabryelczyk, 2020), particularly not in the Central and Eastern European region (CEE) (Dan and Pollitt, 2015).

Moreover, further research is necessary to comprehend the differences among digital transformation strategies in various countries and to understand the specifics of digital transformation projects in the public sector in order to develop a comprehensive theory of digital transformation, focusing on public administration (Mergel et al., 2019).

#### **I. 4. Main research questions and methods**

The goal of this section is to outline the objectives, main research questions, and methodologies of my research in order to offer readers a clearer understanding of the concept, methods, and structure of the articles, summarized in Table 1. In my dissertation, I use a diverse set of methodologies, including a systematic literature review, a conceptual paper, quantitative research, and mixed research, consisting of both a quantitative analysis and qualitative interviews. The detailed research methodology will be discussed in the core chapters of my article-based dissertation.

In my doctoral dissertation, I aim to answer the question **(RQ)** of **what the role of digital solutions is in strategy**. How do they help the strategy of a firm? Which digital solution gives the most advantage?

## **Chapter II. 2. – The erosion of dynamic capabilities, conceptual framework**

The article aims to understand the process leading to dynamic capability erosion.

Building on Shapira's (2011) methodology, the chapter aims to develop a coherent and meaningful conceptual framework to enhance our understanding of how dynamic capabilities erode and are built. While the field of dynamic capabilities is a widely researched topic, the erosion of such capabilities is a research gap, as described in previous chapters. According to Shapira (2011), at the early stages of scientific exploration in a new domain, it is recommended to develop frameworks that systematically organize empirical observations. The presented framework provides a structured approach for organizing empirical observations and clearly and precisely describes this structure. It generates new insights and introduces new perspectives on specific phenomena – the erosion of dynamic capabilities.

The conceptual framework is supported by three cases of Fortune 500 companies. Two of the chosen companies – Supervalu and Kraft - were among the 100 highest-revenue-generating companies in the United States by rank of total revenue in 2010, but then their dynamic capabilities declined, thus they lost their prominent position in the list. As a counterexample, Oracle, the third case introduced in the chapter, was able to improve its position in the list, as the company could successfully “fight” against dynamic capability erosion, resulting in stronger dynamic capabilities.

## **Chapter II. 4. – Drivers and barriers of digital solutions, systematic literature review**

The aim of this chapter is to understand the drivers and barriers of digital solutions by conducting a systematic literature review to identify, assess, and interpret relevant research on a specific question, field, or phenomenon (Bapuji and Crossan, 2004). According to the authors, systematic reviews enhance the quality of the article review process by ensuring a structured, transparent, and reproducible approach. Unlike traditional narrative reviews, systematic literature reviews follow a scientific, replicable, and transparent methodology. A systematic literature review must comprehensively cover all relevant literature, making the processes of sample selection, screening, and description crucial. These steps ensure transparency, allowing other researchers to replicate and build upon the research process and findings (Briner and Denyer, 2012; Jesson et al., 2011). A systematic literature review is a method for evaluating and synthesizing all available research on a specific question, topic, or phenomenon. Its goal is to provide an objective evaluation of the subject by employing a reliable, rigorous, and transparent methodology. A systematic literature review can have multiple purposes, including

summarizing existing knowledge on a specific topic, identifying gaps in the current literature, and highlighting areas for further research, or establishing a framework to effectively position new research (Kitchenham, 2004). It consists of three main stages: planning the review, executing the review, and reporting, documenting the review (Kitchenham and Charters, 2007; Brereton et al., 2007).

To systematically identify and select scientific literature related to the research topic, I followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (PRISMA, 2020; Page et al., 2021). This method ensures comprehensive coverage of relevant literature while maintaining transparency and traceability throughout the search process.

### **Article 1 – Success factors of digital solution implementation, systematic literature review, and qualitative research**

The article aims to understand the success factors of digital solution implementation by conducting a systematic literature review (as discussed above). In order to enhance validity, the factors identified through the systematic literature review were complemented with qualitative interviews. These interviews served to contextualize the literature findings within the Hungarian settings and to triangulate them with the perspectives of experts experienced in the implementation of digital solutions.

Systematic literature reviews are rarely complemented by expert panels, which constrains the applicability of their findings within specific managerial cultures. To ensure that our results can be meaningfully translated into the Hungarian business context, we incorporated insights of practicing professionals who triangulated the literature-based outcomes (Chikán et al., 2006), thereby reinforcing both theoretical rigor and practical relevance (Balaton, 2011). We conducted semi-structured interviews, a method that facilitated the emergence of previously unarticulated insights and enabled the exploration of new themes beyond a strictly predefined set of questions (Molnár, 2010). Interviewees were selected through expert sampling, with criteria requiring several years of managerial experience as well as substantial involvement in the implementation of digital solutions.

### **Article 2 - The relationship between digital development and export activity of Hungarian SMEs, quantitative research**

The goal of the article is to explore the relationship between digital development and export activity of Hungarian SMEs is. We hypothesized the following:

Hypothesis 1: The more important export is for the continuous operation of an SME, the more likely it is to use digital systems and solutions.

Hypothesis 2: The more important export is expected to be for an SME's operations in three years, the more likely it is to use digital systems and solutions.

Hypothesis 3: SMEs that are already present in foreign markets use digital solutions and systems to a greater extent than those that do not plan to enter foreign markets.

Hypothesis 4: SMEs that plan to enter foreign markets use digital solutions and systems to a greater extent than those that do not plan to expand to foreign markets.

Hypothesis 5: SMEs that plan to enter foreign markets use digital solutions and systems to a greater extent than those already present in a foreign market.

In order to analyze these hypotheses, we used a quantitative survey (Sukamolson, 2010). When the variables examined in the research are exact and well quantifiable, and generalizability is important, a quantitative methodology is recommended (Szokolszky, 2004). To test the previously described hypothesis, the relationship between digital system usage and the variables assessing the importance of export and presence in foreign markets was measured by using Spearman's correlation, comparison of means, and the Scheffe post hoc test. The responses of 316 managers and top managers at Hungarian SMEs were analyzed, with 86% of the respondents being CEOs or owners.

### **Article 3 - Digital transformation of public services: The case of the document management application, mixed methods**

The goal of the article is to explore the antecedents, goals, results, and effects of the digital transformation of public services. Besides, we wanted to quantify the efficiency gains and analyze changes in case closing times, referring to the speed of completing a service.

Article 3 uses a mixed method approach in order to triangulate the sources (Jack and Raturi, 2006). In the frame of qualitative research, document analysis was performed, and 24 expert interviews were conducted in order to get to know the analyzed project, its antecedents, goals, and the results and effects of the project. Semi-structured interviews were used. Semi-structured interviews consist of predefined questions based on topics identified earlier by the researcher, in order to guide the conversation toward the areas and issues the interviewer wishes to address (Qu and Dumay, 2011). At the same time, they offer flexibility for the interviewee and the researcher as well, and allow the researcher to explore new topics by not strictly adhering to

pre-prepared questions. They leave room for new questions and foster a more informal conversation. As a sampling strategy, we used a comprehensive sample (Miles and Hubermann, 1994): we interviewed all key stakeholders.

In order to empirically measure the effects of the nationwide digitalization project in the public sector, quantitative analysis was performed as well by using a longitudinal dataset for the period of 2017-2022. We have followed the digitalization of 1324 entities (aka tenants), meaning more than 3000 municipalities. We hypothesized the following:

Hypothesis 1: Digital transformation of the public administration system results in significant efficiency gains.

Hypothesis 2: A centralized ICT-based infrastructure enhances the pace of transactions.

Hypothesis 3: Electronic transactions are inherently more efficient than paper-based transactions.

Hypothesis 4: Digital transformation of the public administration system also enhances paper-based transactions.

Table 1: Summary of the research

	<b>Chapter II. 2.</b>	<b>Chapter II. 4.</b>	<b>Article 1</b>	<b>Article 2</b>	<b>Article 3</b>
<b>Research method</b>	Conceptual paper	Systematic literature review	Systematic literature review and qualitative research	Quantitative research	Qualitative and quantitative research
<b>Theoretical background</b>	Dynamic capabilities	Digital solution implementation	Digital solution implementation	Digital solutions Internationalization of SMEs	Digital transformation of public services
<b>Research questions and hypotheses</b>	<b>RQ:</b> How do dynamic capabilities erode?	<b>RQ:</b> What are the drivers and barriers of digital solutions?	<b>RQ:</b> What are the success factors of digital solution implementation?	<p><b>RQ:</b> What is the relationship between digital development and export activity of Hungarian SMEs?</p> <ul style="list-style-type: none"> <li>• Which digital solution helps SMEs' internationalization?</li> </ul> <p><b>Hypothesis 1:</b> The more important export is for the continuous operation of an SME, the more likely it is to use digital systems and solutions.</p> <p><b>Hypothesis 2:</b> The more important export is expected to be for an SME's operations in three years, the more likely it is to use digital systems and solutions.</p> <p><b>Hypothesis 3:</b> SMEs that are already present in foreign markets use digital solutions and systems to a greater extent than those that do not plan to enter foreign markets.</p> <p><b>Hypothesis 4:</b> SMEs that plan to enter foreign markets use digital solutions and systems to a greater extent than those that do not plan to expand to foreign markets.</p> <p><b>Hypothesis 5:</b> SMEs that plan to enter foreign markets use digital solutions and systems to a greater extent than those already present in a foreign market.</p>	<p><b>RQ 1:</b> What are the antecedents, goals, results, and effects of the digital transformation of public services?</p> <p><b>RQ 2:</b> What are the efficiency gains of the project?</p> <p><b>Hypothesis 1:</b> Digital transformation of the public administration system results in significant efficiency gains.</p> <p><b>Hypothesis 2:</b> A centralized ICT-based infrastructure enhances the pace of transactions.</p> <p><b>Hypothesis 3:</b> Electronic transactions are inherently more efficient than paper-based transactions.</p> <p><b>Hypothesis 4:</b> Digital transformation of the public administration system also enhances paper-based transactions.</p>

<b>Data collection</b>	N/A	Web of Science database	Web of Science database and expert interviews	Survey of managers and top managers at Hungarian SMEs	Document analysis, expert interviews, longitudinal dataset
<b>Sample size</b>	N/A	n=246	Literature review: n=246; interviews: n=10	n=316	Expert interviews: n=24; dataset: n=1324

Source: own construction

## **II. Theoretical background**

### **II. 1. The evolution of strategic management**

#### **II. 1.1. What is strategy?**

For practitioners, strategy is an integrated set of choices about „battlefields“: products, customers, geographies, and „weapons“: the sources of competitive advantage, designed to achieve a sustainable competitive advantage. For researchers, the strategy field focuses on explaining performance differences among firms. Ultimately, all strategy definitions are statements about ends and means: where do we want to go and how are we going to get there?

While Porter's Five Forces model (Porter, 1985) gives a valuable tool for understanding why some industries are more profitable than others, industry averages mask a lot of variation. Understanding the difference between the performance of two firms requires understanding both industry and intra-industry differences, as firms can perform well in bad industries or perform poorly in attractive industries. Performance can be different not just across industries, but e.g., across countries, or firm size as well.

Sadun et al. (2017) point out that companies with strong management outperformed their competitors in terms of several performance indicators (productivity, patents, output growth, operating profit, and R&D expenditures), and management quality is different between countries, and within countries as well. Schmalensee (1985) found that the industry accounts for approximately 20% of the variation in business unit profits. Rumelt (1991) identified business-unit effects to explain 44-46%, industry effects 9-16% and corporate-parent effects 1-2% of variation. McGahan and Porter (1997) reported that year, industry, corporate-parent, and business-specific effects contribute 2%, 19%, 4%, and 32%, respectively, to the overall variance in profitability.

Collis and Rukstad (2008) highlight that every company should have a strategy statement that aligns behavior within the firm and specifies the objective and scope of activity, as well as source of advantage. Porter (1980) defines strategy as a comprehensive framework outlining how a business will compete, its objectives, and the policies required to achieve those objectives. Ghemawat (1991) highlights the importance of commitment in connection with strategy. Firms experience "lock-in" with a particular strategy when they invest in durable, specialized, and non-transferable resources that are difficult to alter. Conversely, they may become "locked out" of new opportunities by prioritizing other choices. As organizations build expertise in a specific strategy, they face inevitable "lags" due to accumulated assets and

"inertia" caused by rigid organizational cultures. Because these commitments are largely irreversible, they drive the need for long-term strategic foresight.

Van den Steen (2017a, p. 2616) gives a functional definition of strategy: "the smallest set of choices to optimally guide (or force) other choices". A decision is more likely to be strategic when it is a central, high-level choice, involves uncertainty but has clear consequences, and remains consistent. Van den Steen (2017b) proposes a three-fold test of whether a set of choices is a strategy: guidance (do they provide necessary and sufficient guidance), specificity (is it evident how the proposed set of core choices would not apply to a different competitor), and conciseness (are they cumulative in nature, and as simple as possible).

Leiblein et al. (2018) argue that strategic management is not about studying isolated decisions but, instead, interdependent decisions. The authors look at interdependence from three aspects: interdependence across contemporaneous decisions (referring to the interactions across choices that a firm makes), interdependence across other economic actors (responding to and acting in ways to elicit a response from other market participants), and interdependence through time (strategic decisions guide future decisions - with some degree of path dependence). The authors make a critical differentiation between nonstrategic decisions, which can be important but are made in isolation, and strategic decisions, which are made in complex interdependent systems, the interdependence of which allows them to potentially shape future actions. Mintzberg (1978) defines strategy as a "pattern in a stream of actions".

## **II. 1.2. Strategy frameworks**

*Emergent Strategy vs Design School.* According to the representatives of the design school, economic strategy is defined as the alignment between a firm's capabilities and available opportunities, positioning it within its environment (Christensen et al., 1982) – in Mintzberg's (1990, p. 172.) translation, "finding out what you are good at and matching it with what the world wants and needs." Christensen et al. (1978) highlight that besides market opportunities ("might do") and the competences and resources of the company ("can do"), the personal values and goals of the strategist ("want to do") and societal obligations ("should do") are also important factors in strategy formulation process which is deliberately guided by conscious thought.

Mintzberg and Waters (1985) distinguish between deliberate (intended, planned) and emergent (patterns formed in the absence of explicit intentions) strategies. Most organizational strategies are neither purely deliberate nor purely emergent. They fall along a continuum, blending both

elements based on organizational control, leadership, and environmental predictability. The authors emphasize emergent strategies because they provide opportunities for organizations to learn and adapt. These strategies enable organizations to respond to changing environments, testing, and evolving actions over time. However, as Ansoff (1991) warns, in rapidly changing environments, the pace of developments is so fast that firms relying on Mintzberg's emergent strategy formation risk their own survival. By the time they introduce a new product or service, they may find the market already dominated by more forward-thinking competitors who strategically planned their moves in advance.

*Positioning and Generic Strategies.* Porter (1996) distinguishes between operational effectiveness (executing similar activities better than competitors) and strategic positioning, which refers to executing different activities from competitors or carrying out similar activities in different ways. Continuous improvement in operational effectiveness is essential for achieving superior profitability, but it is typically not sufficient on its own. The key is to select activities that are different from those of competitors. Thus, according to Porter, strategy involves establishing a unique and valuable position by engaging in a distinct set of activities. Positions can be defined by customer needs (needs-based positioning), customer accessibility (access-based positioning), or the range of products or services a company offers (variety-based positioning).

Porter (1985) defines three competitive strategies based on two dimensions: competitive advantage (low cost or differentiation) and competitive scope (choice of target). Cost advantage is usually associated with production characteristics, while differentiation advantage involves offerings that are unique and have special value for some buyers. A broad scope offers the possibility of more sales, while a narrow scope (focus strategy) allows the firm to better serve a segment of buyers by offering superior value.

Competitive advantage cannot be achieved by simply increasing customers' willingness to pay or decreasing costs: the gap must be increased between willingness to pay and cost. It sounds obvious that a firm should go after a dual advantage; however, there are trade-offs between choices, and there is the risk of being stuck-in-the-middle (meaning that the firm fails to develop its strategy in at least one of the three dimensions). Managing trade-offs provides sustainability. According to Porter (1996, p. 70), "the essence of strategy is choosing what not to do".

*Value-Based Strategies.* Brandenburger and Stuart (1996) highlight the importance of creating "added value". According to the authors, the maximum possible value that can be captured by

the vertical chain of a supplier, firm, and buyer is the difference between the willingness to pay of the buyer and the opportunity cost of the supplier. A player's added value is defined as the difference between the total value created by all players and the value that would be created without that player. For a firm to have a positive added value, and thus the potential to capture value, it must be different from its competitors. This difference, or asymmetry, can occur in four ways, corresponding to the four value-based strategies:

- Raising buyers' willingness-to-pay for the firm's product (classic differentiation)
- Lowering suppliers' opportunity costs of providing resources to the firm
- Lowering buyers' willingness-to-pay for competitors' products
- Raising suppliers' opportunity costs of providing resources to competitors

*Resource-based view.* Before this view, much of the literature in the field focused on external factors such as industry structure and market competition as the primary drivers of competitive advantage. Penrose (1959) shifted the focus from external environments to a firm's internal resources and capabilities as the key drivers of growth. According to Penrose (1959), unused and/or underutilized resources are key sources of firm expansion. New productive services are continually becoming available to a firm (e.g., increasing knowledge with experience). If these services can only be used profitably via expansion, the firm has an internal incentive to grow. This focus on internal resources laid a critical foundation for the resource-based view of strategic management that would be developed over the next decades.

Wernerfelt (1984) highlights two problems in the prior literature that had been holding back the development of growth strategy: 1) overemphasis of product market analysis, and 2) a limited definition of "resources" in economics research. A broader view of resources (including, e.g., technological skills, brand names, trade contacts) is needed in order to better understand how firms can gain advantages over their competitors and continue growing. The author highlights that a first-mover advantage can happen when a resource holder can sustain a competitive position relative to other holders and third parties, leading to a resource position barrier. Such a barrier is similar to Porter's concept of a barrier to entry. An entry barrier without a resource position barrier exposes the firm to threats from diversifying entrants, while a resource position barrier without an entry barrier prevents the firm from effectively capitalizing on its advantage.

According to the resource-based view (Barney, 1991), the firm is a bundle of resources. However, not all resources equally contribute to competitive advantage. For a resource to be strategically valuable, it must fulfill the criteria of being valuable, rare (amongst rivals and potential rivals), imperfectly imitable, and non-substitutable. Resources that are valuable help

firms exploit opportunities or neutralize threats; resources that are rare are not widely possessed by competitors; resources that are difficult to imitate create barriers for competitors to replicate the firm's success; and non-substitutable resources cannot be easily replaced by other resources.

It is not enough for a firm to possess valuable resources—these resources must also be protected from imitation. Competitive advantage is attributable to ownership of valuable resources (assets, skills, capabilities) which enable a firm to perform activities in ways others cannot imitate. Dierickx and Cool (1989) identified five important characteristics that lessen the imitability of an asset: time compression diseconomies (e.g., early mover advantage), asset mass efficiencies (e.g., success breeds success, it's hard to catch up), interconnectedness of asset stocks (e.g., complementary stocks), asset erosion (e.g., decay, knowledge decays), and causal ambiguity (e.g., difficulty in knowing what variables/bundles are driving success makes it hard to imitate).

Peteraf (1993) ties together different resource-based view research into a parsimonious model with four critical conditions that must be met. Heterogeneous resources in limited supply contribute to creating value (creating rents). Ex post limits to competition prevent the rents from being competed away. Imperfect mobility ensures that valuable factors remain with the firm; assets stick to firms. And ex ante limits to competition keep costs from offsetting the rents.

Ahuja and Katila (2004) fill in an unexplained gap in the resource-based view of the firm by addressing the question of how firms end up with differing resource positions. The authors propose that this resource heterogeneity results from a firm's responses to idiosyncratic problems in the market, which can further turn challenges into opportunities by charting new search paths.

While the resource-based view says that it is very difficult to transfer some types of resources, Capron et al.'s (1998) empirical study highlights that resources valuable in an industry may presumably be valuable to another firm in the same industry, and horizontal acquisition allows such resources to be transferred to other firms.

*Dynamic capabilities.* The core question in strategic management is how companies can achieve and maintain a competitive advantage. The answer of Teece et al. (1997, p. 516.) is by having dynamic capabilities, defined as „the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." The essence of a firm's dynamic capabilities resides in the firm's organizational processes, which are shaped by the firm's asset positions and evolutionary paths. The authors position their framework (and

define how it can initiate a new research line) by comparing it with models of strategy emphasizing the exploitation of market power and the importance of "strategizing" - the competitive force framework (pioneered by Porter, 1980) and the strategic conflict framework (based on Shapiro, 1989) -, and models of strategy emphasizing efficiency – the resource-based view. The first two frameworks state that rents (profits) originate from privileged product market positions, while the latter highlights the importance of firm-level efficiency advantages, but does not explain the mechanisms that help entrepreneurial rents and competitive advantage to be sustained. The framework of dynamic capabilities fills this gap.

The importance of developing new capabilities is partially developed in Penrose (1959), but the specifics of how to develop and renew capabilities as business environments change were not detailed. The dynamic capabilities approach provides a coherent framework to combine existing knowledge and foster prescription.

The framework of dynamic capabilities helps overcome the limitations of the resource-based view. Eisenhardt and Martin (2000) highlight the limitations of the resource-based view in the context of dynamic markets: the resource-based view is not able to sufficiently explain how and why certain firms achieve competitive advantage in an environment characterized by rapid and unpredictable change. Thus, a high-velocity environment is a boundary condition for the resource-based view.

Pisano (2017) points out that the existing research on dynamic capabilities lacks clarity on how firms identify and select the capabilities that lead to a competitive advantage. He aims to make the framework more prescriptive by developing a taxonomy for capability choices. However, Linden and Teece (2018) argue that Pisano's approach oversimplifies the complex interplay between capabilities, strategy, and market dynamics. Capability decisions are rarely made in isolation. Firms often develop capabilities while simultaneously shaping their market strategy.

Although widely studied, the concept of dynamic capabilities remains fragmented, with varying definitions and unresolved debates (Schilke et al., 2018). Some scholars (e.g., Winter, 2003; Eisenhardt & Martin, 2000; Helfat and Winter, 2011) limit dynamic capabilities to routines. Winter (2003) makes a distinction between ad hoc problem-solving (organizational improvisation, firefighting) and using dynamic capabilities. In his view, they represent two distinct approaches to change. Others argue for a broader view that includes both routines and ad hoc decisions (Teece, 2014).

The concept of dynamic capabilities represents a hierarchy (Winter, 2003). Ordinary capabilities refer to "doing things right". These capabilities are non-change-focused (Verreyne et al., 2016) and influence an organization's efficiency in producing today's products. Ordinary capabilities alone may be sufficient in stable environments, but in uncertain settings, dynamic capabilities are essential for innovation and long-term survival (Teece, 2018a).

Dynamic capability "microfoundations" (Teece, 2019) can modify and recombine existing ordinary capabilities and develop new ones (Teece, 2007). High-level or high-order dynamic capabilities drive these "microfoundations" and help managers sense possible avenues of development, revise business models, and implement them to seize these opportunities, satisfy customers, shape markets, capture value, and transform to realign the organization's resources and ensure continued renewal. I use the term dynamic capabilities as an equivalent of these high-level dynamic capabilities. "Microfoundations" help establish routines within a given framework, while high-level dynamic capabilities help create completely new frameworks.

Dynamic capabilities are key to maintaining profitability (Teece, 2018b) and evolutionary fitness, and responding to VUCA (volatile, uncertain, complex, and ambiguous) conditions: in an ever-changing environment, it is necessary not only to adapt to and adjust but also to influence and shape the business environment (Teece, 2021). In essence, dynamic capabilities are most valuable when firms face change, which is increasingly constant in today's environment.

## **II. 2. The erosion of dynamic capabilities**

While environmental turbulence can threaten firms, it also offers opportunities, and the firm's ability to sense, seize, and transform determines whether it survives or thrives. However, dynamic capabilities are not permanent; they erode over time if not continually reinforced, a process this chapter conceptualizes.

The literature on dynamic capabilities is rich; however, the erosion of *capabilities* is under-researched, while the erosion of *dynamic capabilities* represents a research gap (Zhang et al., 2023; Rahmandad & Repenning, 2016). While earlier studies acknowledge that capabilities may decline over time (see chapter II. 2.1.), the process and mechanisms of dynamic capability erosion are not examined in-depth. Yet, understanding how and why dynamic capabilities erode is essential for explaining firm performance heterogeneity and long-term survival. This chapter fills the gap by introducing the concept of dynamic capability erosion, outlining its mechanisms,

and offering a conceptual framework to identify early warning signs, showing that even successful firms can lose their competitive strength over time.

### **II. 2.1. Sources of capability erosion**

Previous literature has identified some phenomena leading to the erosion of capabilities, which is defined as “systematic loss of effective capabilities already established in an organization” (Rahmandad & Repenning, 2016, p. 651). Capability erosion is discussed mostly in general by researchers (see e.g., Rahmandad and Repenning, 2016; Argote, 2012; Ritter and Walter, 2012), not distinguishing between ordinary and dynamic capability erosion. In the following, I introduce the most important reasons related to erosion; however, the mechanisms leading to erosion are different in the case of ordinary and dynamic capabilities (see Chapter II. 2.2).

**Turnover.** Organizations often temporarily deviate from an efficient capability configuration to an inferior one due to turnover (Rahmandad and Repenning, 2016) or unsatisfactory organizational memory systems (Argote, 2012). (Key) personnel turnover and incomplete transfer of knowledge significantly contribute to knowledge depreciation (Argote et al., 1990; Martin de Holan and Phillips, 2004; Stratman et al., 2004; Rao and Argote, 2006; Ton and Huckman, 2008; Benkard, 2000; Darr et al., 1995; López and Sune, 2011). Knowledge is embedded in individuals; people can act as repositories of organizational memory (Walsh and Ungson, 1991), and if individual knowledge cannot be converted to organizational knowledge, turnover of high-performing employees can hurt the capabilities and performance of the organization, and disrupt the performance of members who were dependent on the departing member.

The rate of turnover also matters: the fastest depreciation can be observed in organizations that experienced the highest turnover (Argote, 2012). The rate of depreciation can be surprisingly high: according to Benkard (2000), the annual rate can be 40%.

**Misuse of technologies.** Technologies act as repositories of organizational knowledge (Levitt & March, 1988), thus they can make knowledge more resistant to depreciation (Darr et al., 1995). Automated technologies, therefore, should help preserve operating routines and reduce the threat of capability erosion in an organization (Ross et al., 2023). A manager's effective use of management support systems can help reduce the decline in the ability to seize opportunities (Roberts et al., 2021). On the other hand, the lack or misuse of these technologies can lead to capability erosion (Malmi et al., 2023).

***Externally sourcing key activities.*** If an organization externally sources key activities, such as innovation, in order to expand its resource base, it might reduce its own investments in these areas as well, which leads to the erosion of these capabilities. When suppliers are given almost complete responsibility for innovation and information functions, there is a risk of capability erosion (Ritter and Walter, 2012).

***Working harder instead of working smarter.*** If the workload increases, managers could react in two ways: they could either require higher work speed (i.e., working harder to achieve short-term gains) or add resources to the system and improve processes (i.e., working smarter to achieve long-term gains). Organizations often underinvest in capabilities and resources that yield delayed payoffs (Hendricks and Singhal, 2001; Repenning and Sterman, 2002) and tend to focus on short-term initiatives by sacrificing long-term ones (Marginson and McAulay, 2008). Increasing the work speed often results in shortcuts, workarounds (Morrison, 2015), and inefficient firefighting (Repenning, 2000, 2001), which erode organizational capability and can also lead to poor performance and mistakes. The stronger the unfavorable temporal trade-off when departing from the optimal configuration, the more significant the capability erosion is (Rahmandad and Repenning, 2016). Correcting these mistakes means an additional future workload and pressure, which leads to further errors. However, there is a delay in perceiving the demand and workload; in the short term, managers can see that work gets done; the system operates as if there are no additional errors (Repenning and Sterman, 2002; Rahmandad and Repenning, 2016). As a result, the delay enhances the system's apparent capacity. If the delay grows, and the fungibility of resources in connection with the unfavorable trade-off increases, capability erosion is more significant (Rahmandad and Repenning, 2016).

***Strong corporate governance.*** Stronger corporate governance reduces employment security, thus it makes management more risk-averse (Hambrick and Mason, 1984; Balsmeier et al., 2017). In this way, it erodes the firm's innovation capabilities needed to create valuable new knowledge and hinders retaining the corporate inventors responsible for the firm's exploration capabilities. Inventors and R&D scientists are crucial to a firm's innovative capabilities as they typically possess highly relevant and valuable knowledge, often complex and tacit, which is essential for their employer's competitiveness (Migueluez, 2019). These departing inventors and key colleagues are more productive and are more willing to engage in explanatory R&D work than those who remain (Markus and Swift, 2020).

***Technological changes, discontinuities.*** Social, technological, economic, ecological, political, legal, and ethical changes all affect companies' capabilities; however, in our digital age,

technological changes and discontinuities need special attention as they might cause radical capability erosion overnight.

Seismic shifts in industries caused by radical technological innovations often lead to a misalignment between incumbent firms' capabilities (Abebe et al., 2024). A competence-destroying discontinuity makes useless the expertise required to master the technology it replaces (Tushman and Anderson, 1986). An industry evolves through a series of technology cycles, each initiated by a technological discontinuity. These discontinuities are breakthrough innovations that significantly advance the technological state-of-the-art in an industry. Each technological discontinuity starts a new technology cycle, leading to an era of ferment marked by two overlapping processes: competition between technical regimes and competition within the emerging technical regime. The new technology replaces its predecessor during the era of substitution, and, during the era of design competition, radical innovations, often initially crude, are refined into more sophisticated versions. Multiple competing designs typically emerge, each incorporating the breakthrough advance in different ways. The emergence of a dominant design concludes the era of ferment, which is followed by a period of incremental change (Anderson and Tushman, 1990, 1991). Not being able to react to these technological discontinuities can have fatal consequences: "The inability to adapt to a new technical order seems to kill more firms than the inability to withstand a recession in the industry" (Anderson and Tushman, 1991, p. 30). In the case of competence-destroying discontinuities, the initial innovators are usually newcomers to the industry, while competence-destroying process innovations are typically initiated by veterans, i.e., firms that already compete in the industry (Anderson and Tushman, 1991).

Capability erosion as a result of technological changes and digitalization has been highlighted by some other scholars, too. According to Meng et al. (2022, p. 1017), the rise of digitalization and the emergence of new technology-driven business models can lead to digital attrition, i.e., "the erosion of the capacity for, and effectiveness of, a firm's IT capability investments". Langley and Rieple (2021) have also investigated the threat that digital attackers pose to incumbent firms and their capabilities and performance. On the other hand, changes can also mean opportunities for firms to outcompete their rivals: when digital attackers appeared in the fashion industry, the higher-performing incumbent firms were able to build capabilities and counter the attack of newcomers.

## **II. 2.2. The process of dynamic capability erosion**

### What is dynamic capability erosion?

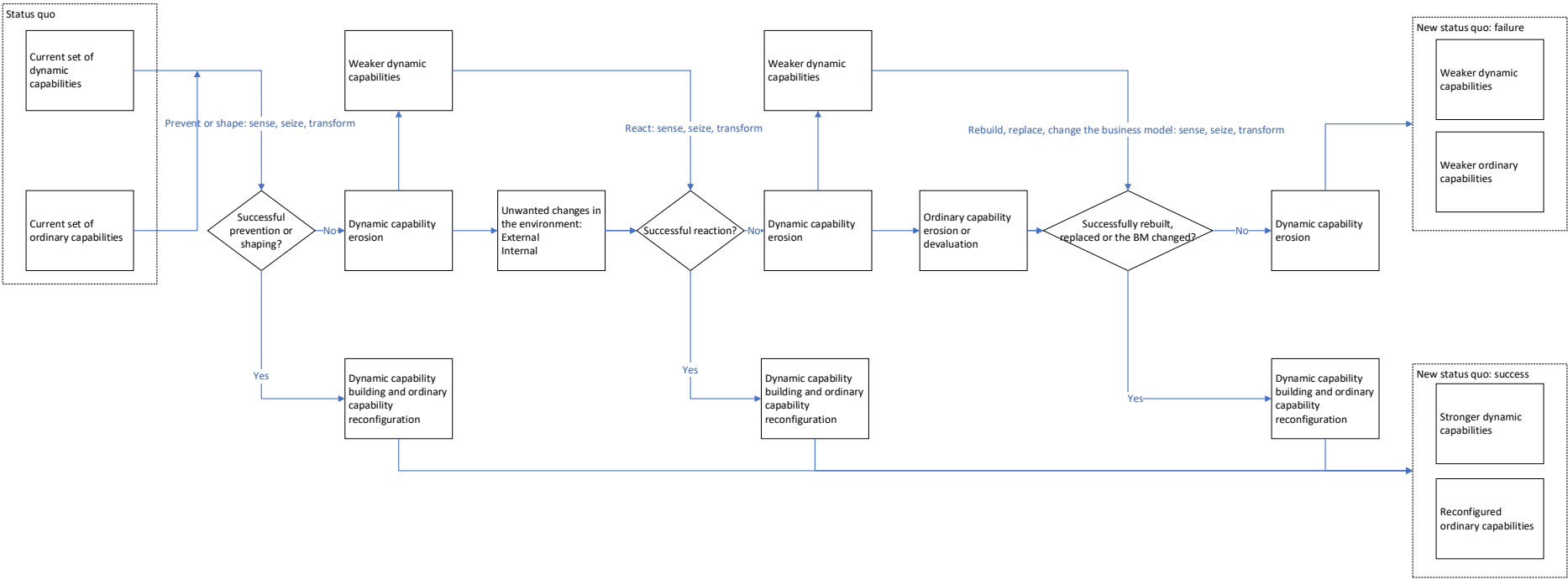
The strength of an organization's dynamic capabilities has to be assessed relative to the unwanted change the organization is facing. An unwanted change is determined as a challenge or threat that could erode or devalue the capabilities of the firm. A firm has strong dynamic capabilities if it can cope with the given change, and it has weak dynamic capabilities if it is not able to do so. An organization faces multiple changes at the same time, and the cumulative sensing, seizing, and transforming capabilities determine the overall strength of an organization's dynamic capabilities. Dynamic capability erosion happens if an organization's cumulative sensing, seizing, and/ or transforming capabilities weaken. If a firm cannot cope with a new challenge – meaning that it has weak dynamic capabilities in that relation -, it weakens its overall dynamic capability strength, thus its dynamic capabilities erode.

### The process of dynamic capability erosion

Phenomena leading to capability erosion affect the current status quo. Regardless of the strength of the organization's dynamic and ordinary capabilities, the process of erosion is the same. If there is an unwanted change in the environment, it is a question of whether the organization can prevent the change or shape the environment with the help of its current set of dynamic capabilities. The strength of ordinary capabilities moderates the effectiveness of dynamic capabilities. The ability to navigate uncertainties in the external environment has been described as an emerging dynamic capability by Langley and Rieple (2021), however, the authors did not connect it to dynamic capability erosion. According to Figure 2, if the company is unable to prevent the change or shape the environment, the failure leads to dynamic capability erosion.

In this case, the organization has weaker dynamic capabilities, with the help of which it has to react to the unwanted changes. If it is not successful, according to the definition above, the firm's dynamic capabilities are eroded. Dynamic capability erosion not only results in weaker dynamic capabilities but also leads to ordinary capability erosion (i.e., the organization is not able to do what it has been able to do) or devaluation (i.e., the ordinary capabilities that the firm has are not valuable anymore).

Figure 2: The process of dynamic capability erosion



Source: Own construction

It is a question of whether the organization can rebuild or replace the eroded or devalued ordinary capabilities, or can change the business model in a way that these eroded or devalued ordinary capabilities are not missing. If the firm is not able to do so, its dynamic capabilities erode again, and the company reaches a new status quo (failure) with weaker dynamic and ordinary capabilities.

This is what happened in the case of Kraft Heinz (Dowd, 2019). 3G Capital and Berkshire Hathaway are well-known in the world of private equity for arranging mega-mergers, then cutting costs and laying off employees in order to have great returns. This was their idea with Kraft Heinz, too. Shortly after they acquired HJ Heinz, 600 employees were laid off, and then they were searching for a new, even larger company to merge with Heinz. Soon, the deal was made: as Kraft and Heinz merged in 2015, the third-largest food and beverage company was established in North America. The investors followed their well-proven recipe: within less than five months, more than 5000 employees were laid off, and several plants were closed. There was no free Jell-O in the company headquarters anymore, either. So far, the plan was working: shares of Kraft Heinz were steadily increasing. However, it did not last long. Soon, the investors were looking for another big company to acquire in order to find more synergies and cut more costs – and of course, earn more money. The target company was Unilever. However, Unilever's board of directors did not accept the offer, saying that the premium was too low. The real reason behind refusing the offer was that the CEO knew that the key player behind the offer was 3G, which wanted to follow the same principles as before, i.e., focusing exclusively on deep cost-cutting and shareholder value. After the refusal, the stock prices of Kraft Heinz started to fall sharply, and the company lost its industry-dominating position. Furthermore, it had to make a significant adjustment to its financial results as a result of an SEC investigation, which further lowered its stock prices.

The company was not able to prevent the unwanted change of decreasing demand. Reorganizing the company with the help of 3G was a reaction; however, it failed. Laying off employees led to the disruption of routines and organizational coordination and the loss of tacit knowledge. As a result, not only the dynamic, but also the ordinary capabilities eroded as well. The resources that they "spared" by cost-cutting were not used to invest in the future and shape the industry, nor were they even used to invest in the current markets and focus on increasing sales of the current products (Barrie, 2019). Rebuilding or replacing these eroded ordinary capabilities or changing the business model was not an option for the company: focusing on the

costs created myopia in the management team, which made it impossible to sense the problem. The failure to do so further eroded the firm's dynamic capabilities.

Another example of dynamic capability erosion is Supervalu, an American wholesaler and retailer of grocery products. The company was among the highest revenue-generating companies in the United States by rank of total revenue, according to the Fortune 500 list. However, the company's shares started to decline in the 2010s, and in 2018, Supervalu was acquired by United Natural Foods Inc., the leading distributor for Whole Foods Market and other natural foods retailers. Shortly after, the Supervalu brand disappeared.

Customer preferences changed: consumers increasingly favored more affordable goods, due to which the profitability of the value chain decreased (Tsintsadze, 2016). It impacted Supervalu's primary customer base, independent retailers, which experienced a significant decline. To counteract the shrinking market share of its independent grocer customers, Supervalu aimed to bolster its retail (Schafer, 2018). It maintained its wholesale volume by acquiring the stores of customers who had exited the business. The aggressive growth had its price: the organization could not effectively adjust to it, e.g., according to the financial reports (Supervalu 2010, 2011, 2012), the company was facing challenges in updating/ maintaining its complex IT systems. The company prioritized discount stores and implemented aggressive cost-cutting measures as part of this strategy. Several locations were also closed due to the focus on discount stores. Supervalu's vision was to become "America's Neighborhood Grocer" through greater focus on consumer needs and enhancing sales (Supervalu, 2010, 2011, 2012). With this initiative, management aimed to give Supervalu an advantage in the highly competitive grocery industry. The team of executives was also renewed; the new CEO and president had formerly held the same position at Walmart (Tsintsadze, 2016). However, these initiatives failed.

Supervalu was able to build strong capabilities, thus it could manage the growing wholesale market. The growth of the company prevented the organization from facing the turbulence of the retail market for decades. However, customer needs changed irreversibly, which eliminated the solid foundation of growth. Without further growth, Supervalu could not prevent the unwanted effects of the changing customer needs. As a reaction, the company had to strengthen its retail presence. However, the large actors in this new business had stronger dynamic and ordinary capabilities; Supervalu was lacking several capabilities. Capabilities that made the company successful in the wholesale business were less valuable and could not be transferred to the retail business.

In order to (re)build the missing capabilities, a new CEO was appointed. Even the most dynamic CEO in the world cannot perform properly if they do not have a supportive organization. Transforming an organization takes years and requires tremendous resources and capabilities. If an organization starts this process too late, when it is in a deep crisis, the chances of success are almost zero.

An organization with strong dynamic capabilities will not let capability distance grow too large: the firm will prevent the change or successfully shape the environment. Of course, an organization cannot control everything perfectly. Even if it has very strong dynamic capabilities, there is always the unexpected, as we live in very uncertain times. There might be unforeseen changes, in which cases it might not be possible to prevent the change or shape the environment in order to avoid them. However, an organization that has dynamic capabilities will be able to intervene at a later point: it will react to the change or rebuild, replace the eroded or devaluated dynamic capability, or change the business model.

On the other hand, unwanted changes can be opportunities as well for strengthening dynamic capabilities. Successfully acting in any of the stages described above leads to dynamic capability building and ordinary capability reconfiguration, which results in a new status quo (success) with stronger dynamic and reconfigured ordinary capabilities. Oracle was a highly profitable key player in the global business software market with its on-premise solutions: the core business was stable and profitable, and there were no signs of maturity or decline in product life cycle or demand when cloud computing, a new phenomenon, was starting to emerge. In 2009, the CEO of Oracle said in an interview that cloud computing would not kill the company, and that "it is just a rental system."

Within a few years, the company realized that it was more than that: it meant a potential threat to the company; however, the top management team was able to prevent this: they decided to cannibalize the successful on-premise business and focus on cloud solutions. When the top management team began this strategic renewal journey toward cloud computing, the technology was in its early development phase, making the cloud not only unproven but also risky. The management team was fully aware of the risk of repositioning the business model to cloud solutions, as it might lead to decreased revenues and profitability; however, it also became clear that the company would lose its market position if it did not invest in cloud. The company appointed a new president, mobilized the salesforce to explore the viability of cloud solutions, and adjusted the commissions and KPIs to increase cloud revenues.

Besides financial incentives, the company also established a new business unit that focused on selling cloud solutions to a new customer segment, SMEs, which did not have the resources to invest in on-premise solutions but were interested in cloud technology as it required a smaller upfront investment. The top management team was able to implement the new strategy with little organizational inertia and resistance, thanks to the centralized management control system, which was used extensively throughout the organization. It provided the top management team with timely information about all organizational activities. The success of the strategic renewal is obvious: several years later, Oracle is still among the key players in the business software industry and provides leading cloud solutions. The challenge strengthened the company's dynamic capabilities and made it more "evolutionary fit" and resistant.

### **II. 2.3. Contributions**

Dynamic capabilities help the company adapt to and shape the ever-changing environment and can ensure its long-term success. The question often arises as to why previously well-functioning companies go bankrupt, since they once had strong dynamic capabilities, i.e., they were able to successfully deal with previous challenges. The conceptual framework described above explains this and helps us detect the signs of failure in advance. Organizations do not simply forget how to be dynamically capable: dynamic capability erosion is a complex process that happens through the organization's failure to prevent an unwanted change/ shape the environment accordingly, failure to react to the change, and failure to rebuild, replace the eroded or devaluated ordinary capabilities, or adjust the business model accordingly.

A "healthy" company has strong dynamic capabilities and is resistant to changes, while an "unhealthy" one has weak dynamic capabilities and is more exposed to minor changes. The model introduced in the chapter highlights that it is possible to make an "unhealthy" firm "healthy" by "training" it with smaller changes that the company can cope with. Every "fight" that the company wins against the challenges, builds its dynamic capabilities and makes it more "evolutionary fit". If an organization has strong dynamic capabilities, it can see what is not working and can try to fix it. If it has weak dynamic capabilities, it may try to react in some ways, but usually, it does not work, and the firm is getting into more and more trouble. Too many errors and failures create a negative self-image, burn resources, and weaken dynamic capabilities. In order to avoid this, it is advisable to "train" the firm with changes that are challenging enough, but which are possible to cope with.

The conceptual framework highlights that the strength of an organization's dynamic capabilities has to be evaluated in relation to the unwanted change it encounters. The unwanted change is a challenge or threat that could erode or devalue the capabilities of the firm. An organization's ability to manage such challenges indicates strong dynamic capabilities, while its inability to do so shows weak dynamic capabilities. By introducing the concept of the relative strength of dynamic capabilities, the basics of measuring dynamic capabilities are redefined: dynamic capability scales have to be viewed dynamically, in the light of the given challenge.

### **II. 3. Management 4.0**

Digital transformation is reshaping organizations globally and drives companies of all sizes and industries to redefine their business models to remain competitive (Fernandez-Vidal et al., 2022). Companies have developed new business models and adapted existing ones to create value in the digital age and drive innovation. Digital transformation is reshaping the economy and has become a strategic priority for senior management.

The stages of digital transformation include digitization, digitalization, and digital transformation. The first two incremental phases are often considered essential to achieve the most comprehensive stage of digital transformation (Loebbecke and Picot, 2015; Parviainen et al., 2017). Digitization is converting analog information into digital information (Verhoef et al., 2021), e.g., scanning physical documents or transforming analog media. It is a widespread phenomenon across all industries, where traditional products are either replaced by digital alternatives or enhanced with new digital capabilities. Digitalization refers to the use of IT or digital technologies (Brennen and Kreiss, 2016) to transform, enhance, and optimize existing business processes, leading to more efficient coordination and creating added value for customers by improving user experiences (Pagani and Pardo, 2017). Digital transformation includes more than improving products and processes: it influences business models, organizational and management structures, as well as entire supply chain processes. It is a company-wide change leading to new business models (Iansiti and Lakhani, 2014; Pagani and Pardo, 2017). Digital transformation impacts the entire organization and its business operations (Amit & Zott, 2001). It goes beyond digitalization by restructuring processes to alter the business logic of a company or its value creation model.

Industry 4.0 is a sub-concept of digital transformation, referring to the digitalization of production (Horváth et al., 2019). By following the concept of Industry 4.0, several other “4.0” concepts have emerged, referring to digital transformation in various fields, e.g., Performance

management 4.0 (Sardi et al., 2023), Quality 4.0 (Oliveira et al., 2025; Sony et al., 2021), Pharma 4.0 (Barenji et al., 2024), or Human resource 4.0 (Salvadorinho et al., 2024).

According to Gonzalez et al. (2024), if a company utilizes advanced ICTs, it evolves into an Organization 4.0. While the authors use the term to refer mainly to Industry 4.0 technologies (i.e., technologies helping the digitalization of production), I use the term Management 4.0 to refer to the usage of technologies and systems – hereinafter digital solution(s) (DS) - that help management and business administration processes, decision making, operations and back-office functions in the digital age. I propose that these solutions have become the new foundations of strategy as they provide an opportunity for the strategic apex - "those at the very top of the hierarchy, together with their own personal staff" (Mintzberg, 1979, p. 19) - to directly control the organization, thus they influence the business model and organizational structure of the company.

According to Szabó (2024), a digital solution (DS) encompasses a broad array of internet-based, communication, and other digital technologies, and tools. As the main DSs in connection with Management 4.0, I investigate enterprise resource planning (ERP), customer relationship management (CRM), business intelligence (BI), document management systems (DMS), workflow management systems (WF) and robotic process automation (RPA).

### **II. 3.1. Enterprise resource planning (ERP)**

By the early 1990s, several companies faced significant IT integration challenges and required a comprehensive software solution that could seamlessly connect various functional areas while enabling them to share a centralized database without data inconsistencies or loss of flexibility. In response, software vendors developed Enterprise Resource Planning (ERP) systems in the mid-1990s to address these integration issues, enhance business efficiency, and provide organizations with a unified IT solution within a single software platform (Loonam and McDonagh, 2005).

For the past few decades, ERP systems have served as the foundation for integrated business process management within organizations (Kamdjoung et al., 2020). ERP is a software solution that integrates various functional areas within an organization, creating a seamless link across the entire supply chain. Companies are increasingly recognizing that survival in the global business landscape requires enhancing not just their internal efficiency but also optimizing their entire supply chain. Nowadays, competition extends beyond individual companies to include their supply chains, urging firms to stay up-to-date and invest heavily in advanced technologies

and systems, such as ERP solutions (Davenport and Brooks, 2004). ERP systems are designed to incorporate best industry and management practices, ensuring the delivery of the right product to the right place at the right time with minimal cost (Rao, 2000). These systems facilitate the seamless flow of information across a company, encompassing financial and accounting data, human resources, supply chain operations, and customer information (Davenport, 1998). ERP systems can enhance business functions by integrating various modules (such as purchase, sales, human resources, finance, accounts, and operations) in an organization (Alzahrani et al., 2021). These various modules are unified through a shared data model and database system, ensuring seamless integration across functional areas. This, in turn, facilitates the interconnection of different business functions, ultimately enhancing overall integration capabilities (Klaus et al., 2000). An ERP system is capable of integrating, optimizing, and coordinating the flow of physical goods, cash, and information across various functional areas and throughout the company's entire supply chain (Zheng et al., 2000).

A key advantage of modern ERP systems is that they enable a high level of integration across different business functions (Rao, 2000). They contribute to business value creation by streamlining processes, enhancing collaboration, centralizing enterprise data, lowering operational and administrative costs, and improving on-time deliveries, among other benefits (Badewi et al., 2018).

When companies decide to implement an ERP system, their initial decision typically centers around selecting the specific modules that align with their business needs. Most organizations choose only the necessary modules that fulfill their functional requirements instead of implementing the entire system: implementing the entire ERP package and accessing all system functionalities can be very expensive, making it unaffordable for many companies (Sheikh, 2003).

While ERP systems have traditionally been adopted by capital-intensive industries (Chung and Snyder, 2000), their use is increasing rapidly across various industries (Rao, 2000).

### **II. 3.2. Customer relationship management (CRM)**

Attracting new customers is more expensive than retaining existing ones (Kohli et al., 2001). More importantly, organizations must not only focus on customer retention but also on expanding their customer base (Zeithaml et al., 2001). The 80/20 rule suggests that 20% of customers generate 80% of an organization's sales (Winer, 2001), highlighting the importance of fostering long-term customer relationships to maximize profitability (Zeithaml et al., 2001).

Businesses are increasingly recognizing the significance of understanding their customers more deeply, and are concentrating their marketing strategies on fostering long-term relationships with customers through enhanced Customer Relationship Management (Kannan and Rao, 2001).

To enhance customer retention, organizations can utilize information and communication technologies, such as CRM applications, which can help implement personalized marketing (Storbacka & Lehtinen, 2001), conduct customer value analysis, and offer product customization (Johnson & Nunes, 2003). CRM applications are enterprise information systems designed to digitize customer-facing business processes across the value chain, including marketing, sales, and post-sales support (Goodhue et al., 2002). They provide robust functionalities for collecting, processing, and utilizing customer data (Liu et al., 2013). CRM applications rely on a centralized customer data repository, where they continuously collect and store customer-related information. This includes customer responses to campaigns, historical records of customer requests, and data on initial and repeat purchases (Mithas et al., 2005).

An integrated information system with relevant, real-time, and accurate data can provide organizations with a comprehensive view of customer information, which is essential for organizations to adopt a customer-centric approach (O'Halloran, 2003). Information on customer purchases enhances a firm's understanding of customer preferences (Ernst et al., 2011), purchasing behaviors (Minami and Dawson, 2008), and shifts in demand (Padmanabhan et al., 2006). With the help of analytical tools, firms can identify consumer patterns, assess customer profitability, and extract valuable insights, which enables them to enhance their services (Davenport et al., 2001).

With the help of a CRM system, organizations can identify and build long-term relationships with their most profitable customers by fostering mutually beneficial interactions (Storbacka & Lehtinen, 2001). Strategies such as personalizing services, customizing products, and cross-selling can help enhance customer profitability. Research indicates that poor service and negative interactions are the primary reasons customers leave companies (Johnson & Nunes, 2003). An integrated information system can positively shape these perceptions by providing customers with timely access to information about the organization's products and services (O'Halloran, 2003). Additionally, it empowers employees with valuable customer insights, enabling them to offer more personalized and value-added products and services (Nykamp, 2001).

### **II. 3.3. Business intelligence (BI)**

The data organizations collect about their customers, competitors, and operations are valuable resources with significant potential value. However, effectively transforming vast amounts of diverse organizational data into meaningful action is a complex challenge (Sun et al., 2017). Business intelligence (BI) encompasses a wide range of IT-based solutions for data management, analytics, and information delivery, specifically designed to address this challenge. Recognizing its importance, many organizations have made BI and analytics a strategic priority, investing heavily in both BI technologies and the development of analytical expertise (Kiron et al., 2011). In today's era of rapid technological advancements and intense competition, BI systems have become increasingly popular among executives and decision-makers due to their ability to deliver complex insights to support decision-making (Ain et al., 2019).

Torres and Sidorova (2019) define BI and analytics systems as those that utilize data collected from other systems to generate actionable insights. These insights are then delivered either to other organizational systems or directly to human decision-makers. Outputs typically include predictions, reports, or visualizations. According to Davenport (2014), BI refers to tools designed to support data-driven decision-making, with a primary focus on reporting. Power and Heavin (2018) refer to BI as an umbrella term that encompasses a range of concepts and methods aimed at enhancing business decision-making through fact-based decision support systems and software tools designed to extract and analyze data from corporate databases. According to Negash (2004), BI systems integrate data collection and storage with analytical tools to provide planners and decision-makers with detailed internal and competitive information. BI systems facilitate the consolidation, integration, organization, and analysis of data from various sources, including customer activities, supply chains, and competitors. They transform data into actionable knowledge for managerial decision-making (Trieu, 2017). As these definitions show, the role of BI in supporting decision-making is often highlighted, with most definitions containing enhancing decision-making or generating insights as the primary objectives (Phillips-Wren et al., 2021).

Organizations typically utilize BI systems in their daily operations to analyze economic and market trends, as well as internal data related to process efficiency and productivity. Advocates of BI systems argue that they can significantly enhance a firm's ability to make well-informed decisions, thus enhancing their intellectual capacity and risk management effectiveness (Shollo and Galliers, 2016).

By leveraging BI systems, firms can gain a clearer understanding of their current operational conditions, performance, and external factors essential for improved planning and coordination. Beyond standard reporting, BI systems enable organizations to generate novel and deeper insights. Their primary objective is to enhance organizational capabilities through effective data utilization (Shollo and Galliers, 2016). BI systems can provide timely and valuable market and organizational information, which can help strengthen the firm's competitive advantages.

In the past, BI systems were primarily used for strategic purposes (Herring, 1988), and the total number of required reports was relatively low. However, this has changed in recent years as many companies have started using BI systems for operational purposes as well. Advances in data storage and analysis capabilities have enabled companies to rely on data not only for strategic decisions but also for operational decision-making. Initially, this shift was expected to provide competitive advantages; however, it has led to a dramatic increase in the total number of reports, slowing down knowledge workers' ability to search for information, leading to higher search costs for companies (Schulz et al., 2015).

### **II. 3.4 Document management systems**

Document processing involves the following steps - which may not always be fully executed (Cristani et al., 2018):

- Converting a physical document into a digital format,
- Identifying the classes that the document belongs to and associating it with relevant attributes,
- Analyzing the document's structure,
- Recognizing the document's contents and associating them with corresponding tables in a database,
- Converting the identified content into data entries within the designated database tables.

Several companies continue to rely on paper-based documents in their processes, which is often considered inefficient. Digitizing documents is a promising alternative. A prerequisite for handling digital documents is the implementation of a document management system (DMS) that enables archiving in accordance with data access principles and ensures the verifiability of digital records (Leyer and Hollman, 2014).

Document management refers to the acquisition, processing, organization, and storage of documents while ensuring accuracy, efficiency, security, and reliability, regardless of format

(Leikums, 2012). An extensive use of standardized forms and a rule-based nature of business – such as in the case of financial services - create a strong basis for adopting a DMS.

The document management functionality is often embedded in other DSs, e.g., workflow systems. Many of these systems offer capabilities that extend beyond the core functions of the traditional DMS. By integrating document management features directly into other business applications, operational efficiency can be enhanced, and document handling can be streamlined (Iverson and Burkart, 2007).

### **II. 3.5. Workflow management systems**

It is a key success factor in today's dynamic business environment to manage effectively and efficiently core business processes that generate value to customers, suppliers, and employees. By prioritizing the automation, optimization, and continuous improvement of core business processes, organizations can strengthen their commitments to customers, employees, partners, and suppliers, thereby gaining a sustainable competitive advantage. In response to rising competition and increasingly demanding customers, it is recommended that companies shift their focus away from hierarchical and functional structures and focus on entire business processes (Reijers, 2006). “Process orientation” is identified as an advantageous management practice (Davenport and Short, 1990).

Effective business process management requires a seamless flow of information among participants and a strong support for collaborative work. Recent advancements in workflow management systems (WF) and technologies play a vital role in facilitating these tasks (Mentzas et al., 2001).

Workflow management systems have been on the market since the early 1990s, while their conceptual predecessors date back even further. Recognized as one of the most effective system types for facilitating collaborative work, WF systems have gained significant traction (Reijers and van der Aalst, 2005).

Workflow management functionality has been integrated into various other systems, e.g., ERP and CRM, highlighting its widespread adoption and success (Reijers and van der Aalst, 2005). Workflow management is often defined as a dimension of an ERP system. It helps companies achieve their business objectives efficiently by coordinating work activities and ensuring the availability of necessary human resources and relevant information required to complete tasks effectively (Shatat and Udin, 2012). Since every business relationship is unique, with distinct coordination and adaptation needs, the inflexible nature of ERP systems necessitates additional

applications to address these limitations in an interorganizational context (Ekman & Windahl, 2014).

### **II. 3.6. Robotic process automation**

The rise of robotic automation is transforming the workplace. Following the revolutions brought by customer relationship management and enterprise resource planning, a new concept, robotic process automation (RPA) is set to redefine business operations. Recently, it has gained significant interest and is widely adopted (Schlegel et al., 2024). RPA is being increasingly implemented across various business areas and industries, and is a leading process technology (Santos et al., 2020). RPA is a software platform consisting of virtual robots to interact with existing application software in the same manner as a human would for processing tasks or transactions. It is a broad term encompassing tools that interact with the user interface of other systems in a way that employees do (van der Aalst et al., 2018). Gartner (2022) highlights RPA's capability to execute "if, then, else" statements on structured data.

RPA focuses on automating business processes to enhance efficiency and reduce costs by minimizing the time employees spend interacting with information systems. It automates repetitive tasks such as typing, extracting, copying, and transferring large volumes of data between systems. By handling these structured, manual tasks, RPA enables employees to focus on higher-value activities. Santos et al. (2020) summarized the criteria that a process has to fulfill in order to be successfully automated. These include voluminous transactions, frequent interaction with other DSs, and standard processes that are prone to human errors. RPA is ideal for processes where employees extract inputs from multiple systems, process them, and transfer the processed data into other systems such as ERP and CRM (Lacity et al., 2016). With RPA, costly system integrations are not necessary. The existing IT infrastructure does not have to be modified, as robots can interact with on-screen elements through the front-end, mimicking human actions (Santos et al., 2020). RPA can have new functionalities more quickly than other IT solutions relying on API-based integrations, thus RPA's implementation can take just two to four weeks instead of months or years (Asatiani and Penttinen, 2016). While traditional process-related information systems often rely on manual input, RPA can automate this step (Gartner, 2022).

### **II. 3.7. AI-enabled digital solutions**

Artificial intelligence (AI) is reshaping industries, and its usage has become crucial for organizations aiming to generate new value. The emergence of AI has served as a significant

catalyst for the evolution of digital solutions: it is often integrated into digital solutions to enhance their efficiency and effectiveness. AI strengthens CRM by enabling precise data analysis and personalized customer interactions, thereby lowering costs and fostering customer acquisition, retention, and loyalty (Gupta et al., 2020). It can provide suggestions to strengthen customer relationships and detect potential churn (Overgoor et al., 2019) while freeing sales staff from routine tasks to focus on strategic and creative activities (Lindgreen and Antioico, 2005). AI-enabled CRM systems can substantially enhance the customer experience (Natrajan et al., 2022) and support every step of the customer journey (Bu et al., 2022). AI enhances the analysis of sales calls, supports a more precise customer segmentation, and increases customer satisfaction and loyalty. It can generate deeper insights and more accurate predictions of consumer behavior. Compared to traditional CRM, AI empowers enterprises to engage with customers at a fundamentally new level (Chatterjee et al., 2020). Business intelligence also benefits significantly from AI, as AI-enabled tools provide organizations with the compelling opportunity to perform intelligence tasks more rapidly, comprehensively, cost-effectively, and accurately than traditional methods (Hoffman and Freyn, 2019).

AI is often integrated into RPA, ERP, workflow, and document management systems as well. By combining RPA's capacity for automating routine tasks with AI's cognitive capabilities, organizations can streamline workflows, enhance efficiency, and significantly improve productivity. When integrated with AI, RPA systems can replicate many aspects of human decision-making and problem-solving, thereby broadening the scope of tasks that can be automated (UIPath, 2025). AI integrated into ERP enhances efficiency across business functions by accelerating tasks by up to 90%. It can generate tangible value throughout the enterprise, from supply chain to sales: it can detect defect at an early stage of the manufacturing process, enhance operator productivity, and maintain consistent quality, help cut costs, lower risks, and boost efficiency in procurement, increase revenue, mitigate risk, optimize working capital, and maintain regulatory compliance, accelerate staffing, recruitment, onboarding, payroll processes, and hiring decisions, reduce customer acquisition costs, streamline the sales cycle, and enhance customer loyalty and retention, drive personalization and improve product discovery (SAP, 2025). An AI-Ready workflow and document management system can predict process bottlenecks, automatically optimize tasks, and increasingly free professionals from administrative work. It can create a digital work environment where all information is readily accessible, decisions are made quickly and on a solid basis, and business operations run smoothly, efficiently, and sustainably (DMS One, 2025).

Several authors highlight the strategic potential of AI-enhanced digital solutions. As Alnofeli et al. (2025) point out, the integration of AI is pivotal in elevating CRM from a transactional tool to a strategic organizational asset, leading to competitive advantage. While RPA is recognized as a significant tool at the tactical and operational levels, Moderno et al. (2024) point out the strategic potential of AI-enabled RPA: enhancing resource utilization by transforming business processes and optimizing the firm's performance, thus enabling the strategic reallocation of resources.

## **II. 4. Drivers and barriers of digital solutions**

### **II. 4.1. Methodology**

In order to identify the drivers and barriers of digital solutions, I searched for documents on Web of Science, because it is a platform that includes impactful and relevant peer-reviewed research on the subject of interest. The literature review was conducted in March 2025. The following logical search was used: TS=("management information system" OR "business intelligence" OR "robotic process automation" OR "software robot" OR "document management" OR "workflow" OR "customer relationship management" OR "enterprise resource planning" OR "industry-specific system"); the query searched in abstracts, titles, and among keywords. The following selection inclusion/ exclusion criteria were used:

- Document type: article or review article.
- Published in a Scimago Q1-ranked journal.
- Management focus (journals listed under the Scimago subject area “Business, management and accounting” and “Strategy” or “International business” or "Management information systems" or "Management of technology and innovation" subject categories).

The initial search resulted in 112,856 documents, out of which 78,207 were articles or review articles. Then, journals that do not fulfil the criteria described above were excluded; articles published in the following journals were taken into consideration: Decision Support Systems, Business Process Management Journal, International Journal of Information Management, International Journal of Production Research, and Journal of Enterprise Information Management. After applying these filters, 589 articles were identified, out of which 398 articles were excluded due to irrelevant topic and/ or a technical focus (their titles or the abstracts were unrelated to the research questions). The process resulted in 191 articles, which were analyzed. Based on these articles, 55 further publications were included. These papers were not among

the initial search results as a result of filtering, because they were published in other journals that belong to different scientific fields, subject areas, or subject categories, or were not published in Q1-ranked journals. Figure 3 in Chapter III. 2. summarizes the steps and results of the process.

## **II. 4.2. Drivers**

### Institutional pressures

Chaubey and Sahoo (2021) point out the role of mimetic pressure as a driver of IT system adoption. When organizational technologies are not well understood, goals are unclear, or there is uncertainty, organizations may model their operation based on other organizations (DiMaggio and Powell, 1983). It has been observed that when there is a lack of clarity regarding the outcomes of projects, organizations tend to imitate others within the same industry (Dubey et al., 2018; Zuo et al., 2020).

Chaubey and Sahoo (2021) highlight the impact of normative pressures regarding IT system adoption. Normative pressures arise from collective expectations within specific organizational contexts regarding appropriate and legitimate behavior (Liu et al., 2010). Lowry et al. (2010) and Zhu et al. (2006) suggest that normative isomorphism plays a significant role in driving the adoption and diffusion of new technological innovations within organizations.

Coercive pressure is also a significant driver of IT system implementation (Sharma and Daniel, 2016). It often stems from local government policies, regulatory authorities, or the expectations of the community and local institutions (Chaubey and Sahoo, 2021). When organizations are substantially reliant on external resource providers, they are compelled to conform to the rules, standards, or procedures dictated by these entities (Kharuddin et al, 2015).

A significant driver of management information system adoption can be the willingness to follow market trends and keep up with customers' expectations. According to the case study of Sarkis and Sundarraj (2003), the company analyzed lacked a proper ERP system, thus could deliver products in just 6 months, while its best competitor could do it in less than a month. As a consequence, customers indicated that without improvements, they would take their business to other suppliers. De Búrca et al. (2005) also highlight the driving force of customer demand: from the supplier's perspective, the adoption of extended ERP systems is primarily influenced by the demands of their larger partners.

### Customer

As a result of process improvement induced by using a management information system, firms can enhance their service quality, and their processes can become more reliable (Martin and Cheung, 2005). Reijers and van der Aalst (2005) also highlight the driver of increased service quality. DSs can contribute to having fewer errors and consistent quality (Reich and Braasch, 2019; Alberth and Mattern, 2017). DSs help manage product variety (Forza and Salvador, 2008) and can enhance customer responsiveness (Kamhawi, 2008) and personalization. As Sen and Sinha (2011) point out, personalized offerings generate a substantial increase in conversion rates, thus can lead to significant performance improvement. As a result of these factors, customer satisfaction (Kohli et al., 2001) and customer loyalty (Bucher et al., 2009) can be increased.

### Decision support

Enhanced decision-making is one of the primary motivations for investing in new technology (King and Burgess, 2006). DSs can improve decision making by enhancing data collection, analysis, and reporting (Wolfe and Tasse, 1979) and data accuracy (Moalagh and Ravasan, 2013), improving the quality of information (Kumar et al., 2002), and improving the speed of information retrieval (Zantout and Marir, 1999). By providing a seamless flow of information (Mentzas et al., 2001), decision time and cost can also be reduced (Holsapple and Sena, 2005). Accurate data and information help predict and detect (quality) problems (Wolfe and Tasse, 1979), improve (strategic) planning and control (Olson et al., 2013), and enhance business development, which, according to Laukkanen et al. (2007), is the primary objective of ERP adoption across companies, with medium-sized enterprises considering it especially important. Easily accessible, accurate data helps user independence from management as the information system enables users to perform their tasks autonomously (Agourram, 2009).

Accurate data can improve the transparency of organizational processes, too. A transparent DS can enhance employees' trust and improve the acceptance of decisions. As the case study of Vallurupalli and Bose (2018) shows, a performance management system made performance goal setting transparent, performance comparisons became simplified, and decisions derived from performance metrics were clear.

### Knowledge management

DSs enhance knowledge generation and sharing (Massey et al., 2001), transferring (El Sayed, 2006), and knowledge processing (Rouhani et al., 2016). The case introduced by Massey et al.

(2001) shows how integrated information technologies enhance performance by enabling knowledge access, organization, and distribution to those who need it. The project analyzed by Lebreton et al. (2008) helped organize and structure scattered knowledge across a complex supply chain.

As Lopez-Nicolas and Soto-Acosta (2010) point out, ICTs enable information and knowledge exchange, integrate data, documents, and employees, and support the sharing of individual experiences across the organization, thus enhancing organizational learning. The vast volume of information and knowledge within modern organizations that must be captured, stored, and shared - together with the geographic dispersion of sources and users and the dynamic nature of information - makes technological support not optional but a necessity. According to Agourram (2009), a successful information system implementation supports a knowledge-based organizational culture.

#### Productivity and efficiency

According to Williams et al. (2013), firms can invest in IT systems to rationalize overlapping data and resources, thus improving efficiency. Another driver regarding efficiency is to standardize systems, processes, and the operation of the organization, which can support the organization's broader strategic goals (Sarkis and Sundarraj, 2003). Vallurupalli and Bose (2018) highlight that management information systems can offer real-time online information for continuous performance monitoring, thus enhancing the productivity of review meetings and discussions by focusing on solutions rather than data-related concerns.

Shatat and Udin (2012) also highlight improved efficiency among the benefits of a management information system: according to their research, the usage of an ERP system leads to easy and reliable access to data and information, reduced cycle time, faster delivery, and elimination of redundant data and operations. Rao (2000) also points out the benefits of reduced lead time and cycle time, and on-time shipments. Time saving as a benefit is highlighted by Reich and Braasch (2019) as well. Küng and Hagen (2007) observed not only a decrease in lead time but also an increase in employee productivity and improvements in work quality across various processes as a result of the WF system implementation. DSs, specifically software robots, can perform tasks faster than humans (Lacity and Willcocks, 2017; Vishnu et al., 2017), leading to improvements in productivity.

Kogetsidis et al. (2008) highlight time and cost reduction of business processes, and accelerated transaction processing. Vallurupalli and Bose (2018) also point out the benefit of enhanced

efficiency, as, according to their case study, employees were able to monitor their own performance or that of their subordinates as a result of the implementation of a performance management system. According to Iris and Cebeci (2014), efficient system usage can support the implementation of lean principles. Chen and Lin (2021) highlight that BI-related capabilities can improve operating efficiency and performance. According to Santos et al. (2020), organizations use process automation in order to optimize their operations and maximize employees' productivity. DSs – especially software robots - do not get sick, tired, or distracted, and can work 24/7 every day (Reich and Braasch, 2019; Lacity and Willcocks, 2017), and – due to their scalability -, they can easily handle peaks in service demand (Lacity and Willcocks, 2017; Vishnu et al., 2017).

According to Martin and Cheung (2005), an IT system (in this case, an ERP system) can eliminate or significantly reduce tedious, labor-intensive, and time-consuming "paper shuffling", leading to improved service quality and more reliable processes, such as ensuring timely payments to suppliers. One of the key advantages of a DS is its ability to facilitate process restructuring (Aversano et al, 2002). Even the attempt to introduce such a system has positive impacts, as it encourages organizations to critically evaluate and improve their processes. In other words, initiating a DS project can catalyze organizational change. However, as Reijers and van der Aalst (2005) point out, without a system, stakeholders may not take the changes seriously. The driver of process standardization is also highlighted by Sarkis and Sundarraj (2003), while Joia (1998) points out that DSs can help innovate old processes.

The successful implementation and efficient utilization of an ERP system can significantly enhance supply chain network efficiency (Wieder et al., 2006) and supply chain management performance (Zheng et al., 2000; Wieder et al., 2006; Cotteleer, 2002; Akkermans et al., 2000) by, e.g., integrating internal business processes and strengthening relationships and collaboration with suppliers, customers, and supply chain partners. Easy and reliable access to data from any point within the supply chain helps eliminate redundant data and operations, ultimately leading to improved supply chain management performance (Shatat and Udin, 2012). Muscatello et al. (2003) highlight that an ERP system can enhance the capability to oversee and manage the extended network of suppliers, partners, and customers as a unified and integrated system. Davenport and Brooks (2004) also highlight that ERP systems can help companies share information with their partners.

## Strategy

DSs can improve organizational (Massey et al., 2001) or firm performance (Dong, 2012) and competitiveness (Gunasekaran and Ngai, 2007).

The driver of improving effectiveness is pointed out by, e.g., Williams et al. (2013) and Vallurupalli and Bose (2018). The latter authors highlight that a DS improves the effectiveness of the goal-setting process by enhancing the clarity of the defined goals. According to Shatat and Udin (2012), an ERP system can contribute to scalability. As Liu et al. (2023) show, management information systems can assist in processing strategic information, which is essential for driving technological innovation.

As pointed out by Shatat and Udin (2012), an ERP system can help enterprises adapt to changing business environments. Reijers (2006) also highlights that DSs – in their case, business process management systems – offer more flexibility to accommodate change regarding the structure of supported business processes.

Management information systems can help businesses' internationalization by facilitating global expansion through e-commerce and e-business (Shatat and Udin, 2012). Enhanced decision support provided by DS can also help the organization to integrate regions (Williams et al., 2013). According to Vallurupalli and Bose (2018), the implementation of an IT system in a company is typically a reaction to an organizational issue or crisis.

As de Búrca et al. (2005) point out, the implementation of a DS can change power dynamics within the organization: power is shifting to individuals who have embraced the IT agenda. DSs can replace humans with robots in the case of rule-based, repetitive tasks, thus can eliminate repetitive work and enable employees to concentrate on higher-value tasks (Suri et al., 2017; Aguirre and Rodriguez, 2017; Reich and Braasch, 2019), such as problem solving and exception handling, which improves job satisfaction and enhances motivation. The usage of these systems can also generate new job opportunities, e.g., robot management or advanced data analytics (Asatiani and Penttinen, 2016).

A management information system can lead to recurring savings in salaries and overhead costs (Martin and Cheung, 2005). Cost reduction as a benefit is also highlighted by Shatat and Udin (2012), Kogetsidis et al. (2008), Santos et al. (2020), and Reich and Braasch (2019). Lebreton et al (2008), Watson et al. (2006), and Wixom et al. (2008) also point out the driver of financial benefits. Liu et al. (2013) highlight that firms implementing DSs achieved a significant increase

in terms of several indicators (Return on Sales, Assets Turnover, Return on Assets, Debt-Assets Ratio, and Return on Equity).

As Yiu et al. (2020) point out, DSs – in their case, BI systems specifically - enhance firms' profitability while mitigating risks. Firms with stronger employee relationships and greater process institutionalization benefit more.

Table 2: Drivers of DS implementation

<b>Driver</b>	<b>Items</b>	<b>Reference*</b>
Institutional pressures	Mimetic pressure/ Observability/ Competitive pressure	Kharuddin et al. (2015)/ Qutaishat et al. (2023)/ Sarkis and Sundarraj (2003)/ Ain et al. (2019)
	Normative pressure	Zhu et al. (2006)
	Coercive pressure/ Ensuring external and internal compliance/ Conformance with acts/ Business partner pressure/ Customer expectations, demand	Sharma and Daniel (2016)/ Brocke et al. (2011)/ Lameijer et al. (2024)/ Sarkis and Sundarraj (2003)/ de Burca et al. (2005)
Customer	Customer satisfaction	Kohli et al. (2001)
	Customer loyalty/ Brand loyalty	Bucher et al. (2009)/ Eskafi et al. (2013)
	Customer responsiveness	Kamhawi (2008)
	Personalized offerings	Sen and Sinha (2011)
	Managing product variety	Forza and Salvador (2008)
	Improved quality/ Improved services	Martin and Cheung (2005)/ Teo et al. (2006)
Decision support	Improve decision-making	Holsapple and Sena (2005)
	Data collection, analysis, reporting	Wolfe and Tasse (1979)
	Reduced decision time and cost	Holsapple and Sena (2005)
	Improving the quality of information/ Managing data redundancy/ Data accuracy	Kumar et al. (2002)/ Kumar et al. (2002)/ Moalagh and Ravasan (2013)
	Information management	Qiu et al. (2011)
	Improving the speed of information retrieval	Zantout and Marir (1999)
	Seamless flow of information	Mentzas et al. (2001)
	Keeping the plans up to date	Wolfe and Tasse (1979)
	Business development	Laukkanen et al. (2007)
	Predict and detect (quality) problems	Wolfe and Tasse (1979)
	Panoptic gaze/ Transparency, trust	Kayas et al. (2008)/ Vallurupalli and Bose (2018)
	(Strategic) planning and control	Olson et al. (2013)
	User independence from management	Agourram (2009)
Knowledge management	Knowledge generation and sharing/ Knowledge becomes transferable/ Knowledge diffusion/ Better knowledge processing/ Structuring of scattered knowledge	Massey et al. (2001)/ El Sayed (2006)/ Gunasekaran and Ngai (2007)/ Rouhani et al. (2016)/ Lebreton et al. (2008)
	Organizational learning	Lopez-Nicolas and Soto-Acosta (2010)
	Support a knowledge-based organizational culture	Agourram (2009)
Productivity and efficiency	Operational performance/ Improved operational efficiency/ Increase the firm's future performance potential	Madapusi and D'Souza (2012)/ Kohli et al. (2001)/ Bharadwaj et al. (1999)
	Process improvement/ Implementation of lean principles	Joia (1998)/ Iris and Cebeci (2014)

	Coordination improvements	Gattiker (2007)
	Time saving	Rao (2000)
	Eliminate extra manual work/ Reduction of paper flow	Salo (2007)/ Joia (1998)
	Error reduction	Badewi et al. (2018)
	Inventory reduction	Kamhawi (2008)
	Personnel reduction	Annamalai and Ramayah (2011)
	Improve supply chain management performance/ Better control of customers' sales	Akkermans et al. (2000)/ May et al. (2013)
	Individual performance, productivity	Hou (2012)
	Support teamwork/ Collaborative environment/ Coordination/ Cooperation/ Communication	Joia (1998)/ Joia (1998)/ Bafoutsou and Mentzas (2002)/ Bafoutsou and Mentzas (2002)/ Bafoutsou and Mentzas (2002)
Strategy	Enhanced innovation/ Enhance product development	Kumar et al. (2023)/ May et al. (2013)
	Competitiveness/ Organizational performance	Gunasekaran and Ngai (2007)/ Massey et al. (2001)
	Organizational crisis/ Need for change/ Adaptability to change/ Agility	Vallurupalli and Bose (2018)/ Drummond et al. (2017)/ Reijers (2006)/ Ghasemaghaei et al. (2017)
	Enhanced scalability	Shatat and Udin (2012)
	Future growth	El Sawah et al. (2008)
	Improved effectiveness	Bucher et al. (2009)
	Internationalization	Shatat and Udin (2012)
	Integrate regions	Williams et al. (2013)
	Focus on higher value-added tasks, activities/ New job opportunities	Agourram (2009)/ Asatiani and Penttinen (2016)
	Opportunity of the moment	Buonanno et al (2005)
	Shifting power/ Impact on the user's career – promotion	de Burca et al. (2005)/ Agourram (2009)
	Company flexibility	Reijers and van der Aalst (2005)
	Financial benefits	Kumar et al. (2002)

\*1st appearance among the articles examined.

Source: own construction

## II. 4.3. Barriers

### Human resources

According to Shtub (2001), an important barrier regarding management system usage stems from management education. There is a gap between the knowledge managers require to use these systems efficiently and effectively and the curriculum they completed in the past. This highlights the importance of establishing digital manager education programs for practicing managers.

User competency refers to the ability to fully leverage technology to optimize task performance. A lack of user competency leads to users being dependent on IT personnel even in the case of routine tasks (Pishdad and Haider, 2013). As Loh and Koh (2004) point out, unskilled personnel can cause serious problems in different phases of the implementation project, as even skilled staff need training to adapt to new procedures and data handling in the ERP system. The lack

of knowledge of the project leader can also significantly hinder the project. Project leaders must be able to respond effectively at critical decision-making points, a competence that is not easily taught but develops through experience.

According to Kamdjoug et al. (2020), unqualification of the stakeholders can contribute to project failure. The project team lacked the expertise to identify key specifications that needed to be considered in the project, and project managers had insufficient understanding of project management principles, and consultants assigned to the project were also inexperienced, which hindered success. The case study of Williams et al. (2013) reached similar conclusions: project managers seemed to lack sufficient IT and organizational awareness to effectively engage with other departments. They were primarily focused on existing financial workflows and processes and lacked a comprehensive understanding of how the system would transform organizational processes.

User resistance is another key issue. Employee resistance to new technology is a common challenge for organizations implementing DS. A low perceived value of the management information system increases the level of resistance and employee grumbling (Alzahrani et al., 2021). Williams et al. (2013) also highlight the problem of negative perceptions of the system and user resistance, e.g., because of learning new terminology in addition to adapting to new job roles and responsibilities (using an unfamiliar system). Due to the complex functions and interface of management information systems, users often do not want to use them (Wong et al., 2016). According to the results of Mahmud et al. (2017), status quo bias and technostress significantly influence end-user grumbling. According to Popovič (2017), users' resistance to a system is primarily driven by the fear of losing power and control over information, the need to acquire new skills for performing routine tasks, and changes in the decision-making approach. The fear of losing power over information was also highlighted by Seah et al. (2010). Fear of losing jobs or being substituted by DSs and uncertainty about the future could trigger anxiety, too (Schlegel et al., 2024). Fear of change and uncertainty, and fear of loss of power and status (Joa, 1998) are also highlighted as reasons for user resistance. As El Sayed (2006) points out, DS implementation can redefine expertise, which might not be advantageous for employees. Drummond et al. (2017) draw attention to the effects of previous negative experience (as a result of a failed attempt), while Joia (1998) points out that a reward system not considering innovation can make system implementation a risky project for managers.

Some individuals, often referred to as "process heroes", believe they have a deeper understanding of business processes than the newly implemented system. As a result, they resist

using the system as intended and instead create their own processes, routines, and norms to perform their tasks. This behavior hinders the system's acceptance, adaptability, and integration within the organization, ultimately delaying its full adoption (Pishdad and Haider, 2013).

The case study of Kamdjoug et al. (2020) highlights the destructive effect of negative social influence. There was a tense social climate and friction among the organization's top management, as many executives disagreed with the choice of ERP. They favored a different software solution, believing that the chosen one was not suitable for the organization and its business processes. The resistance of certain executives and employees significantly strained the relationship between consultants and managers. The tense atmosphere was evident during meetings and training sessions, hindering the progress of the implementation process.

#### Financial resources and profitability

Quiescent et al. (2006) highlight that, in terms of financial resources, the main barrier is the costs and efforts associated with the business process redesign project that the enterprise must undertake to align its processes with those in the provided IT solution (rather than the high cost of the system, as many affordable solutions even for SMEs are now available). De Búrca et al. (2005) highlight the high cost of (integration) expertise, whether it is sourced internally or contracted for the duration of an integration project.

A common issue is the unplanned costs that arise from new requirements emerging after the system's design has been finalized. Furthermore, there are several hidden costs in implementation (Yusuf et al., 2004), e.g., the cost of training an entire workforce on a new system, the complexity of integrating the new system with existing systems, the cost of data conversion, i.e., migrating data from legacy systems to the new system, which includes modifying data formats and hiring specialized professionals, high consulting costs (many companies do not allocate proper budgets for consulting services, leading to unexpected financial burdens), and project timeline misconceptions, i.e., a delay in project completion beyond the expected timeline (Soh et al., 2000; Momoh et al., 2010). Conflicts with external parties, such as consultants and ERP vendors, and internal conflicts are found to be instrumental regarding project delays.

While the implementation of DSs is expected to bring financial benefits, some authors highlight cases where organizations have gained minimal or no benefits (Gessner and Volonino, 2005; Phan and Vogel, 2010). As Dowlatshahi (2005) points out, the return on investment may not be evident during the initial years.

### Organizational factors

Organizational and structural reasons (Buonanno et al., 2005), unreadiness for change (Kamdjoung et al., 2020), and a lack of organizational resources (Dey et al., 2010) pose significant barriers to DS adoption.

Furthermore, while DSs can handle several routine-based processes, if a process involves numerous exceptions, it must be managed by human workers, adding complexity as both robots and employees need to be synchronized (Schlegel et al., 2024) to ensure seamless task execution without errors. Since robots and systems require supervision, new responsibilities will emerge for workers to monitor their performance and verify the accuracy of outcomes, potentially reducing the time available for higher-value tasks (Santos et al., 2020).

According to Constantiou et al. (2019), a key organizational barrier arises when decision-making relies on managerial intuition due to the inability of BI systems to fully support complex and unstructured problems. Hoang and Bui (2023) also highlight the barrier of the preference for using experience rather than data-driven decision-making. As Malaurent and (2015) point out, workarounds can also cause problems: users addressed misfits of the system by creating their own solutions, i.e., workarounds. While these adjustments allowed the ERP system to function, they also led to challenges at company headquarters, where reduced transparency and potentially misleading information became significant issues. Nguyen and Mutum (2012) mention the risk of depleting customer trust, as customers might feel that the CRM system exploits them.

Liu et al. (2013) point out that purchasing commercial CRM modules may not necessarily provide a firm with a significant competitive advantage. Since standard CRM modules offer pre-built functions readily available in the market, they are more susceptible to competitor imitation, which can diminish their value. On the other hand, integration can enhance a firm's long-term competitiveness, as it is more challenging for competitors to replicate.

Another barrier is the fear of sharing performance data with customers and suppliers, as a result of an integrated management information system. Reluctance to share data stems from a lack of trust, as it may reveal the company's performance (de Búrca et al., 2005).

Unique and specific business processes are often a key strength of small firms, and altering or eliminating them – in order to fit the requirements and processes of an IT system - could jeopardize their survival and flexibility (Quiescenti et al., 2006). Furthermore, management information systems, especially ERP systems, do not accommodate informal processes, which

leads to reduced efficiency in business process management and limits the organization's ability to adapt to changing business requirements in a flexible way (Greasley and Wang, 2017).

### Technology

According to the survey of Peng and Nunes (2009), DS containing outdated and incomplete customer records, documents, and inventory records is one of the top ten risks. This risk can arise from various factors, such as improper system usage due to inadequate user training or flaws in system design (Vosburg and Kumar, 2001). Outdated data (Loh and Koh, 2004), flawed data (McBride, 2014), or dirty data (Vosburg and Kumar, 2001) can lead to several negative consequences for a company, including difficulties in targeting high-value customers and tailoring special sales offers to specific customer segments. This may diminish customer loyalty, reduce retention rates, and contribute to the loss of existing customers (Wright and Donaldson, 2002). Flawed data can also lead to inaccurate sales forecasts (Peng and Nunes, 2009).

DSs have to be maintained, which means extra tasks (Schlegel et al., 2024). E.g., when systems are updated or modified, the software robots may need to be reconfigured, which can be both expensive and time-consuming (Santos et al., 2020). This is true for other DSs as well, as they have to follow changes in operations in order to be able to provide up-to-date information, help with the daily operation, and avoid errors.

Managers have varying information needs based on their experience and specific situations. Therefore, reports should be adaptable and customizable to meet managers' actual needs. However, not all DSs on the market offer the flexibility needed to accommodate these demands. Additionally, report structures, formats, and content designed for one national context may not seamlessly translate or apply to another. Thus, foreign DSs might not be suitable for local businesses (Soh et al., 2000). As a result, managers in certain situations may struggle to access the critical information they need.

Enterprise systems, especially ERP solutions, are modular, and while selecting more modules enhances integration benefits, it also increases costs, risks, and the extent of required changes. As Peng and Nunes (2009) point out, companies often face the risk of having difficulties in achieving seamless integration between existing modules or between current and newly added modules. An ERP vendor's integrated solution often fails to meet all of a company's business needs. As a result, many companies procure software modules from multiple vendors to build a customized ERP system. However, this approach can increase complexity and make system

integration more challenging. Even when all modules come from the same provider, solid integration is not guaranteed.

While a higher number of modules adds to project complexity (Aloini et al., 2007), not only internal integration can present challenges: an even greater complexity arises when firms integrate ERP systems with non-ERP environments (Ash and Burn, 2003). Compatibility and integration with other DSs can also be problematic (Fletcher and Wright, 1995), which may lead to poor data and business processes and having insulated technological islands (Peng and Nunes, 2009). As businesses have to manage an ever-growing amount of information, system integration becomes increasingly complex (Youngberg et al., 2009). The constant evolution of organizations and their environments has led to technical, organizational, cultural, and political challenges, making the integration process highly complex and demanding (Huang et al., 2003). Groiss and Eder (1997) and Schlegel et al. (2024) also point out the importance and the challenge of system integration: the complexity of multiple enterprise systems grows with their interoperability (Flechsigt et al., 2022). Therefore, ensuring proper synchronization of different data formats is essential for accurate processing.

Implementing specific DSs can lead to outdated IT systems persisting within organizations far beyond their economically justified lifespan (Koch and Fedtke, 2020). E.g., implementing RPA is reasonable when the cost of programming legacy systems becomes economically unviable (Koch and Fedtke, 2020), resulting in the deployment of software robots within outdated IT infrastructure (Schlegel et al., 2024) - instead of adopting new DSs which fulfil the modern needs of the organization.

Table 3: Barriers of DS implementation

<b>Barrier</b>	<b>Items</b>	<b>Reference*</b>
Human resources	Lack of knowledge, abilities, experience, and skills	Shtub (2001)
	(User) resistance	Joia (1998)
	Availability and retention of skilled people	Kumar et al. (2002)
Financial resources and profitability	Cost/ Delays/ Implementation time	Fletcher and Wright (1995)/ Soh et al. (2000)/ Dowlatshahi (2005)
	ROI	Dowlatshahi (2005)
Organizational factors	Structural reasons	Buonanno et al. (2005)
	Lack of system integration with other functional areas	Torkzadeh et al. (2006)
	Unreadiness for change	Kamdjoug et al. (2020)
	Lack of organizational resources	Dey et al. (2010)
	Complexities of human – DS cooperation	Santos et al. (2020)
	Reliance on intuitive judgement	Constantiou et al. (2019)
	Workarounds	Malaurent and Avison (2015)

	Risks of depleting customer trust	Nguyen and Mutum (2012)
	Imitability	Liu et al. (2013)
	Fear of transparency	de Burca et al. (2005)
	Unique processes get eliminated	Quiescenti et al. (2006)
Technology	Outdated, incomplete documents/ Data quality/ Relevant information is not available	Peng and Nunes (2009)/ Fletcher and Wright (1995)/ Schulz et al. (2015)
	Inappropriate forecasts	Peng and Nunes, 2009
	Complexity	Qutaishat et al. (2023)
	System quality and performance/ System issues	Kumar et al. (2002)/ Soroor et al. (2009)/ Constantiou et al. (2019)
	System maintenance	Loh and Koh (2004)
	Inflexibility	Soh et al. (2001)
	Integration between modules and other DSs/ Incompatibility of systems	Fletcher and Wright (1995)/ Joia (1998)
	Security problems	Shibl et al. (2013)
	No trust in the knowledge base	Shibl et al. (2013)
	Selling of an unreal system	Joia (1998)
	Obsolete IT systems being revived	Koch and Fedtke (2020)
	Dependence on the IT supplier	May et al. (2013)
	Knowledge-intensive business processes cannot be automated	Marjanovic (2005)

\*1st appearance among the articles examined.

Source: own construction

### III. Success factors of digital solution implementation<sup>2</sup>

#### Abstract

Digitalization is one of the greatest challenges and opportunities of our time. While digitalization offers numerous advantages, organizations also face significant difficulties in implementing digital solutions, making it essential to examine the factors that lead to success or failure. This paper explores and contextualizes the success factors of digital solution implementation - technological factors, technology – organization fit, and management competence - through a systematic literature review (PRISMA) and qualitative interviews. The qualitative research emphasizes the crucial role of project champions, process orientation, and experiential learning in the success of digital solution implementations in the Hungarian context.

*Keywords:* digital transformation, ERP, CRM, document management system, workflow system, business intelligence, software robot

#### III. 1. Introduction

Digital transformation is fundamentally reshaping organizations and drives companies - regardless of industry or size - to rethink their business models in order to remain competitive (Fernandez-Vidal et al., 2022). A key question is how various digital solutions (DSs) can support organizational competitiveness. These solutions have become the new foundations of strategy as they allow strategic decision-makers to control the organization directly, thus influencing the company's business model and organizational structure.

DSs support decision-making (Holsapple & Sena, 2005), improve the organization's effectiveness (Vallurupalli & Bose, 2018) and efficiency (Williams et al., 2013), and facilitate adaptation to change and flexibility (Reijers, 2006). They contribute to internationalization (Szabó et al., 2021), better meeting customer needs and expectations (de Burca et al., 2005), and ensuring legal compliance (Lameijer et al., 2024; Szedmák et al., 2025). They also increase transparency (Vallurupalli & Bose, 2018), enable a stronger focus on higher value-added tasks (Suri et al., 2017), and may lead to cost reduction (Santos et al., 2020).

Nevertheless, failure is common, as DS implementation projects are highly complex and come with numerous challenges (Pishdad & Haider, 2013). Despite a growing DS market, many

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<sup>2</sup> **Author contributions:** **Borbála Szedmák:** Conceptualization, Data curation, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing; **Roland Z. Szabó:** Conceptualization, Methodology, Supervision

organizations struggle to generate real value from their DS initiatives. Therefore, it is of utmost importance to examine the factors that lead to success - or failure. This question is particularly relevant in the Hungarian context: Hungary significantly lags behind the European Union average in terms of digital development (European Commission, 2025), especially in the field of corporate use of digital technologies. Identifying the success factors can help companies take the digitalization of business processes to the next level.

Numerous prior studies have investigated success factors through systematic literature reviews (PRISMA), typically focusing on individual systems (e.g., Barbieri et al., 2023; Al-Assaf et al., 2025). Nevertheless, a research gap remains concerning the integrated analysis across multiple systems. A search in the Web of Science and Scopus databases using the keywords ("management information system" or MIS or "digital solution") and "success factor" and "systematic literature review" yields no results. Our research aims to fill this gap: by conducting a systematic literature review and qualitative interviews, we explore the success factors (and pitfalls) of DS implementation. The added value of our research lies in interpreting the results of the literature review within the Hungarian context, highlighting key points and unique characteristics of local management culture.

According to Szabó (2024), DS encompasses a wide range of internet-based communication and other digital technologies and tools. Among the DSs, we examined the ecosystem of management information systems, where the dominant approach has shifted from a product focus to a service-oriented perspective that better serves customer needs (Füzes, 2019). Based on Szabó et al. (2021), this article focuses on the following, commonly used systems: Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Business Intelligence (BI), Document Management Systems (DMS), Workflow Management Systems (WF), and Robotic Process Automation (RPA).

Our research highlights the importance of technological factors, the fit between technology and the organization, and managerial competence. The qualitative findings emphasize the critical role of project champions, a process-oriented mindset, and experiential learning in the success of domestic implementations.

The structure of the article is as follows: first, the methodology is presented, followed by an outline of the success factors identified in the literature and the findings of the qualitative research. Next, we compare and triangulate the factors highlighted in the literature with those raised by our interviewees, based on which we formulate recommendations. Finally, we

summarize our findings, discuss the limitations of the study, and propose directions for future research.

### **III. 2. Methodology**

The success factors of DS implementation were identified through a systematic literature review. The goal of the review is to identify, evaluate, and interpret relevant research on the given question, field, or phenomenon in a structured, transparent, and reproducible manner (Bapuji & Crossan, 2004). We followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009; Page et al., 2021), as this method ensures comprehensive coverage of relevant literature while maintaining transparency and traceability throughout the search process. The prevalence of this method within the field is illustrated by the fact that in the Scopus database, within the subject area of Business, Management and Accounting, the keyword "PRISMA" appeared in the title, abstract, or keywords of only 41 articles or review articles in 2020, whereas in 2024 this number was 541.

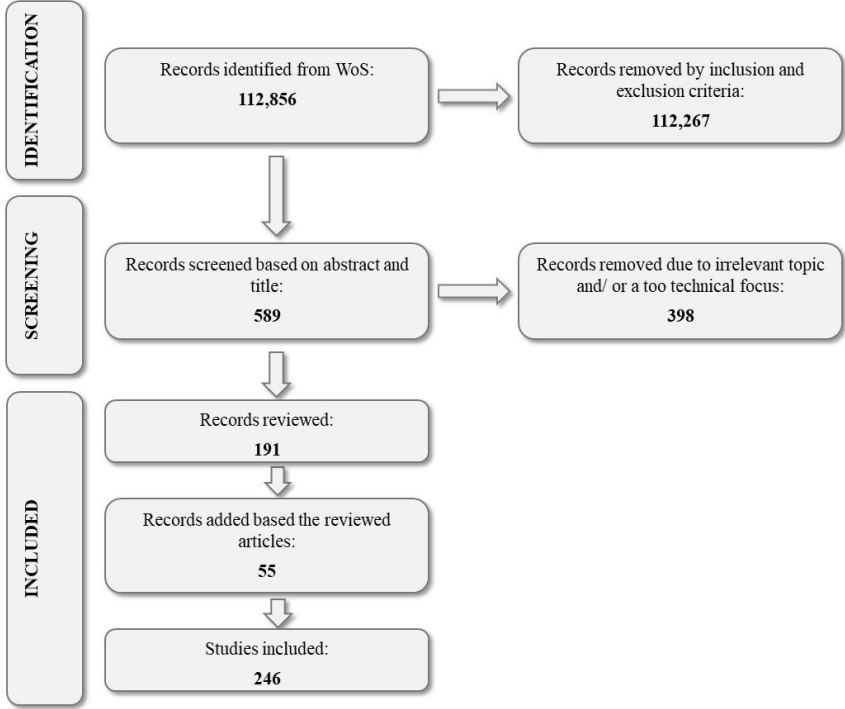
The Web of Science database was used to identify the success factors of DS implementation, as it is a platform that includes impactful and relevant peer-reviewed research on the subject of interest. The literature review was conducted in March 2025. The following logical search was used: TS=("management information system" OR "business intelligence" OR "robotic process automation" OR "software robot" OR "document management" OR "workflow" OR "customer relationship management" OR "enterprise resource planning" OR "industry-specific system"); the query searched in abstracts, titles, and among keywords. The following selection inclusion/exclusion criteria were used:

- Document type: article or review article.
- Published in a Scimago Q1-ranked journal.
- Management focus (Scimago subject area "Business, management and accounting" and "Strategy" or "International business" or "Management information systems" or "Management of technology and innovation" subject categories).

The initial search resulted in 112,856 documents, out of which 78,207 were articles or review articles. Articles published in the following journals were taken into consideration: Decision Support Systems, Business Process Management Journal, International Journal of Information Management, International Journal of Production Research, and Journal of Enterprise Information Management. After filtering, 589 articles were identified, out of which 398 articles

were excluded due to irrelevant topic and/ or a technical focus. The process resulted in 191 articles, which were analyzed in detail. Based on these articles, an additional 55 publications were included that were not part of the original search results but were relevant to our research question. Figure 3 summarizes the steps and results of the process.

Figure 3: Steps of the systematic literature review



Source: own construction

All success factors mentioned in the articles included in the sample were coded, and the main categories were defined on the basis of the codes developed. The literature analysis was complemented with qualitative interviews conducted with experts experienced in DS implementation.

A novel aspect of our research compared to the reviewed literature lies in the inclusion of an expert panel, which is typically not associated with systematic literature reviews; however, its absence limits the adaptability of the findings to the local management culture. In order to formulate practical recommendations for Hungarian business leaders, it is essential that practicing professionals triangulate results obtained from other sources (Chikán et al., 2006), thereby ensuring that both theoretical grounding and practical relevance are simultaneously realized (Balaton, 2011).

Semi-structured interviews were conducted, which allowed the emergence of previously unknown information and the exploration of new topics, as this format does not rigidly adhere

to pre-defined questions (Molnár, 2010). Theoretical saturation (Constantinou et al., 2017) was reached after 10 interviews. Expert sampling was employed in the selection of interviewees. Regarding the expert sample, it was a key criterion that the participants possess several years of managerial and DS implementation experience. We aimed for a diverse sample, including:

- small, medium, and large organizations;
- organizations with low, medium, and high levels of digital maturity;
- private companies and public sector institutions;
- Hungarian and foreign-owned organizations;
- male and female respondents;
- younger and older respondents;
- middle and senior managers.

Table 4: Characteristics of the interviewees

#	Position	Organiza- tion size category**	Digital maturity of the organization	Sector	Majority owner- ship	Gender	Age range [year]	Manage- ment level
1	Legal Director	Medium	High	Information, communication	Hungarian	Female	25–35	Senior Manager
2	CFO	Medium	High	Information, communication	Hungarian	Female	35–45	Senior Manager
3	Consultant/ IT Manager	Small	Low	Public administration	Hungarian	Male	35–45	Middle Manager
4	Financial Manager	Small*	Low	Education	Hungarian	Female	35–45	Middle Manager
5	Records Management Lead	Large	Medium	Education	Hungarian	Male	35–45	Middle Manager
6	Office Manager	Large	Medium	Manufacturing	Hungarian	Female	35–45	Middle Manager
7	HR Manager	Medium*	Medium	Manufacturing	Foreign	Female	35–45	Middle Manager
8	Department Head	Small*	Low	Public administration	Hungarian	Female	45–55	Middle Manager
9	Board Member	Medium	High	Professional, scientific and technical activities	Foreign	Male	35–45	Senior Manager
10	Project Manager	Medium*	Medium	Manufacturing	Foreign	Female	35–45	Middle Manager

\* Part of a large corporate group

\*\* According to Article 3 of Act XXXIV of 2004 on Small and Medium-sized Enterprises and the Support of Their Development, regardless of dependency relationships, which are indicated with a separate asterisk (\*).

Source: own construction

### **III. 3. Results**

#### **III. 3.1. Success factors of digital solution implementation based on the literature**

##### **Technological factors**

System quality – being influenced by a variety of technical characteristics such as reliability, integration, flexibility, and scalability - is one of the most cited success factors (see e.g., Yeoh and Koronios, 2010; Vallurupalli and Bose, 2018). To maintain competitiveness in the digital era, businesses must ensure continuous operations, real-time data availability, and enable agile data access (Bajgoric and Moon, 2009). Adequate data quality (Loh & Koh, 2004) facilitates the quick and efficient preparation of reports (May et al., 2013).

It is also important that the system is not overly complex (Sharma et al., 2023) and that it is flexible (May et al., 2013) and modular (Peng et al., 2018). Schlegel et al. (2024) highlight the importance of ensuring data security. If issues are anticipated in this area, management may decide against implementing the DS, and the corporate IT department could potentially block the project. Poba-Nzaou et al. (2008) emphasize that, to achieve the expected benefits, it is important for the organization not to select an immature system.

##### **Technology - organization fit**

*Answering business needs.* A key challenge in IT system implementation is identifying the gaps between the system's generic functionality and the organization's specific requirements (Soh et al., 2000). While technical challenges contribute to failures, they are not the primary cause (Davenport, 1998). Instead, the biggest obstacles are rooted in business-related issues, as companies often struggle to align the technological demands of an enterprise system with their actual business needs. It can also be problematic if the vendor's understanding of the organization's needs is based on a network of companies it has access to, rather than being tailored to the specific requirements of the organization (Williams et al., 2013).

*Business case.* A well-defined business case must be established, outlining clear objectives and key success factors (de Búrca et al., 2005). Vallurupalli and Bose (2018), Yeoh and Koronios (2010), and Schlegel et al. (2024) also highlight the importance of a well-established business case and a clear assessment of benefits. Gotthardt et al. (2020) also highlight that the benefits of a DS should be evaluated from a business perspective rather than solely from an IT standpoint.

*Organizational readiness.* A successful DS implementation requires an organization to assess its structural, technical, organizational, and cultural maturity (Soh et al., 2000; Ngai et al.,

2008), as well as its overall organizational (Gargeya and Brady, 2005) or enterprise readiness (AL-Shboul, 2019), and to be aware of its organizational capabilities (Ain et al., 2019). It should select a product that is compatible with its current systems and organizational structure (Raymond & Uwizeyemungu, 2007) and is aligned with its (technology) readiness (Xie et al., 2014).

*Harmonizing the business and the DS.* During the lengthy IT system implementation process, software and user requirements often evolve, requiring professionals implementing the package to continuously adapt and make adjustments (Ehie & Madsen, 2005). Packaged software frequently fails to align with an organization's specific needs and business processes. As a result, companies must either modify and customize the software (Quiescenti et al., 2006), which is expensive and has high maintenance costs, or restructure their business processes to fit the system (Aloini et al., 2007). On the other hand, de Búrca et al. (2005) highlight the importance of process adaptation: business processes should be assessed and restructured as needed to fully leverage the new technology. While the study of Reijers and van der Aalst (2005) concludes that organizations preferred implementing a WF system that supported the existing processes rather than a significantly improved version, the authors point out that this might not be the best approach: merely automating a traditional "paper-based" process may not be the most effective approach to reduce lead and service times.

### **Management competence**

*Change management.* Successful system implementation should be managed as a broad organizational change initiative rather than merely a software installation (Yusuf et al., 2004). This approach integrates technology, tasks, people, structure, and culture, ensuring transparency and enabling early risk identification, mitigation, and prevention. In order to minimize the resistance to change, it is crucial to have a strong top management support (Loh and Koh, 2004). Top management support refers to management's willingness to engage actively in the project, allocate sufficient resources to the project, and address political conflicts effectively (Bansal and Agarwal, 2015). Managers should not only support the initiative, but they should also provide the necessary resources for organizational transformation.

By addressing all relevant aspects of the implementation, resistance to change can be minimized or even eliminated (Momoh et al., 2010). Vallurupalli and Bose (2018) draw attention to the key role of project champions who can help understand user needs and concerns better.

Convincing employees and management about a DS implementation can be a challenge (Schlegel et al., 2024). In order to reduce or minimize resistance to change, managers should focus on enhancing the perceived value of the management information system adoption by emphasizing the transformation advantages from the employees' perspectives (Alzahrani et al., 2021). Foshay and Taylor (2014) also highlight the importance of „winning the hearts and minds" of users. Some other authors (see e.g., Schlegel et al, 2024; Gotthardt et al., 2020) also draw attention to actively involving all affected employees, management, and stakeholders at an early stage.

A Proof of Concept (PoC) can serve as an effective change management tool, assisting in convincing management and relevant stakeholders (Gotthardt et al., 2020; Schlegel et al., 2024). A PoC should summarize the expected benefits, the data needed for the project, and the selected processes and tasks to be solved by the DS. The first automated process and the PoC can act as a catalyst for broader adoption. As the research of Schlegel et al. (2024) highlights, the very first process being automated in a company has to be impactful: it has to work well, create a “wow-effect”, and convince stakeholders.

*Project management.* Appropriate project management, including project preparation/planning, quality management, communication management, project monitoring, and control, is inevitable for success (Bansal and Agarwal, 2015). Kamdjoug et al. (2020) highlight the problems caused by poor project management: the project lacked a formal plan, the team selection was biased, project progress was not monitored, key success factors were undefined, and no framework was in place to assess the project outcomes.

According to Kamdjoug et al. (2020), it is of key importance to choose the right consultants and manage the client–consultant relationships and interactions. Consultants and vendors have a key role in IT system implementation due to their potential for long-term relationships with the organization (Ifinedo, 2011). Thus, managers should maintain a good relationship with them and facilitate effective knowledge transfer from external sources within the industry by supporting initiatives such as help desks, mentoring programs, and retraining workshops for the users of the system (Alzahrani et al., 2021). Bintoro et al. (2015) also highlight the importance of managing interactions between actors. According to the case study of Williams et al. (2013), the organization faced challenges due to the lack of communication and collaboration between the vendor (or IT consultants), in-house IT governance, and the project managers. Pishdad and Haider (2013) also draw attention to the importance of establishing a strategic partnership with vendors and having ongoing support throughout the project. Schlegel et al. (2024) point out the

importance of ensuring collaboration among the different parties involved, particularly between internal and external stakeholders, as they often have varying perspectives and levels of expertise. Consultants have a solid understanding of the technology, but they are not familiar with the specific business processes. On the other hand, the organization, in the best case, knows its processes well, but has limited knowledge of the technology.

Due to strategic and situational differences between parent companies and their subsidiaries, some level of conflict is inevitable during the management information system implementation in the case of a multinational company. Conflicts are caused by differences in culture, legal environments, processes, and business sizes, divergent strategic goals, inconsistencies, and a lack of trust. This parent-subsidiary conflict plays a crucial role in shaping both the implementation process and its outcomes, and has to be successfully managed (Gavidia, 2016).

*Knowledge management.* Knowledge management involves multiple elements: successful DS implementation requires that the organization has sufficient knowledge management capabilities (Hung et al., 2010), can create, retain, and exploit knowledge effectively (Finnegan & Willcocks, 2006), facilitate knowledge sharing (Jones et al., 2006), and enable efficient knowledge transfer (Wang et al., 2007). De Búrca et al. (2005) point out that firms should learn from past implementation challenges. It is important to have a project closing meeting, summarize and document the project and the lessons learned, so that later, when preparing for a similar project, they can be reviewed. Lamberton et al. (2017) highlight that creating a dedicated Center of Excellence for the DS can play a crucial role in the successful implementation and can ensure knowledge sharing.

In order to ensure a thorough understanding of the management information system implementation and its impact, a comprehensive training for management and employees at all levels is essential (Schlegel et al., 2024). A structured and systematic training is needed, which involves exposing managers to practical examples of the management information system and significant business process change implementations (Momoh et al., 2010).

A lack of education and training leads to delays, confusion, and potential failure of the implementation (Pishdad and Haider, 2013). Users have to be properly trained to effectively use the DS (Davenport, 2000). This not only enhances organizational performance but also improves user satisfaction and motivation and creates buy-in for the change. Therefore, top management must be fully committed to investing sufficient resources in education and end-user training (Pishdad and Haider, 2013).

Inadequate training of end-users and not having a clear training course plan present a significant problem (Kamdjoug et al., 2020), as employees may struggle to operate and maintain the system once it is deployed. As Koh et al. (2006) point out, human factors can pose a major obstacle, particularly for small and medium-sized enterprises (SMEs). According to their case study, many employees lacked proper training on how to use the ERP system, and some were unfamiliar with computers.

Table 5: Success factors in the implementation of digital solutions based on the literature review

Success factor	Items	Reference*
Technological factors	System quality and performance	Kumar et al. (2002)
	• Data/ information quality	• Loh and Koh (2004)/ Ram and Corkindale (2014)
	• User–system interaction quality/ Perceived ease of use	• Agourram (2009)/ Lin and Rohm (2009)
	• Quick, efficient reports	• May et al. (2013)
	Low complexity	Sharma et al. (2023)
	Data security	Tung and Turban (1996)
	Flexibility/ modularity	May et al. (2013)/ Peng et al. (2018)
	System maturity	Poba-Nzaou et al. (2008)
Technology - organization fit	Answering business needs	Soh et al. (2000)
	• DS and business strategy, objectives alignment/ Integration with the firm’s resources and strategy/ Having a good business plan/ Vision	• Loh and Koh (2004)/ Jones (2012)/ Loh and Koh (2004)/ Sarkis and Sundarraj (2003)
	Business case	Tung and Turban (1996)
	• Perceived usefulness/ Perceived benefits/ Perceived value/ Integration into the daily operations	• Chuang and Lin (2013)/ Al-Okaily et al. (2023)/ Alzahrani et al. (2021)/ Tung and Turban (1996)
	• Minimizing (implementation and maintenance) costs	• May et al. (2013)
	Organizational readiness/ Technology readiness	Gargeya and Brady (2005)/ Xie et al. (2014)
	• Organizational structure/ Decentralized or centralized setup	• Raymond and Uwizeyemungu (2007)/ Nandi and Kumar (2016)
	• Organizational resources/ organizational capabilities	• Raymond and Uwizeyemungu (2007)/ Ain et al. (2019)
	• Technological capabilities/ IT infrastructure/ IT resources/ IT department competencies	• Aruldoss et al. (2014)/ Ain et al. (2019)/ Newby et al. (2014)/ Badewi et al. (2018).
	• Appropriate business and legacy systems/ Fit with parent, allied organization systems/ Partner fit	• Joia (1998)/ Kumar et al. (2002)/ Norton et al. (2013)/
	• Minimal redundancy	• May et al. (2013)
	• Product and vendor fit and trust	• King and Burgess (2006)
• Cultural fit/ Cultural change readiness/ Readiness for change	• Boersma and Kingma (2005)/ Saade and Nijher (2016)/ Kamdjoug et al. (2020)	

	<ul style="list-style-type: none"> <li>• (Top) management innovativeness/ Firm innovativeness/ Organizational learning climate</li> </ul>	<ul style="list-style-type: none"> <li>• Hung et al. (2010)/ Newby et al. (2014)/ Ain et al. (2019)</li> </ul>
	<ul style="list-style-type: none"> <li>• Industrial characteristics</li> </ul>	<ul style="list-style-type: none"> <li>• Chen (2009)</li> </ul>
	<ul style="list-style-type: none"> <li>• Firm's growth stage</li> </ul>	<ul style="list-style-type: none"> <li>• Chen (2009)</li> </ul>
	Harmonizing the business and the DS	Agourram (2009)
	<ul style="list-style-type: none"> <li>• Customization/ Sound system configuration</li> </ul>	<ul style="list-style-type: none"> <li>• Loh and Koh (2004)/ Zhu et al. (2010)</li> </ul>
	<ul style="list-style-type: none"> <li>• Set up of an application management function within the organization</li> </ul>	<ul style="list-style-type: none"> <li>• Reijers et al. (2016)</li> </ul>
	<ul style="list-style-type: none"> <li>• Process adaptation/ Business process reengineering/ Business process management/ Limited redesign of processes</li> </ul>	<ul style="list-style-type: none"> <li>• de Burca et al. (2005)/ Loh and Koh (2004)/ Zabjek et al. (2009)/ Reijers et al. (2016)</li> </ul>
	<ul style="list-style-type: none"> <li>• Integration with other IS and modules/ Successful migration</li> </ul>	<ul style="list-style-type: none"> <li>• Giachetti 2004)/ Vathanophas (2007)</li> </ul>
	<ul style="list-style-type: none"> <li>• Integration of people and DS</li> </ul>	<ul style="list-style-type: none"> <li>• Gunasekaran and Ngai (2007)</li> </ul>
	<ul style="list-style-type: none"> <li>• Closing design-reality gaps</li> </ul>	<ul style="list-style-type: none"> <li>• Hawari and Heeks (2010)</li> </ul>
Management competence	Change management	Kumar et al. (2002)
	<ul style="list-style-type: none"> <li>• Strong (top) management support/ (Top) management commitment/ Vertical advocacy/ Transformational leadership</li> </ul>	<ul style="list-style-type: none"> <li>• Loh and Koh (2004)/ Osarenkhoe and Bennani (2007)/ Dong (2012)/ Elkhani et al. (2014)</li> </ul>
	<ul style="list-style-type: none"> <li>• Fault-tolerant leaders</li> </ul>	<ul style="list-style-type: none"> <li>• Alzahrani et al. (2021)</li> </ul>
	<ul style="list-style-type: none"> <li>• Top management involvement</li> </ul>	<ul style="list-style-type: none"> <li>• Garrido-Moreno and Padilla-Meléndez (2011)</li> </ul>
	<ul style="list-style-type: none"> <li>• Company-wide support</li> </ul>	<ul style="list-style-type: none"> <li>• El Sawah et al. (2008)</li> </ul>
	<ul style="list-style-type: none"> <li>• Actively involving employees/ Technology discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Joia (1998)/ Alzahrani et al. (2021)</li> </ul>
	<ul style="list-style-type: none"> <li>• Proof of Concept/ Business process simulation</li> </ul>	<ul style="list-style-type: none"> <li>• Gotthardt et al. (2020)/ Leyer and Hollmann (2014)</li> </ul>
	<ul style="list-style-type: none"> <li>• Quick wins</li> </ul>	<ul style="list-style-type: none"> <li>• Hutter et al. (2018)</li> </ul>
	<ul style="list-style-type: none"> <li>• Project champions</li> </ul>	<ul style="list-style-type: none"> <li>• Loh and Koh (2004)</li> </ul>
	<ul style="list-style-type: none"> <li>• Reducing or minimizing resistance to change/ Fostering positive attitudes / Fostering a reward system considering innovation</li> </ul>	<ul style="list-style-type: none"> <li>• Joia (1998)/ Mullins and Cronan (2021)/ Joia (1998)</li> </ul>
	<ul style="list-style-type: none"> <li>• Gaining user and manager's satisfaction/ Managing user perception and acceptance/ User support</li> </ul>	<ul style="list-style-type: none"> <li>• Kamhawi (2008)/ Vathanophas (2007)/ Maditinos et al. (2011)</li> </ul>
	<ul style="list-style-type: none"> <li>• Managing expectations/ Realistic expectations/ Realistic target</li> </ul>	<ul style="list-style-type: none"> <li>• Joia (1998)/ Chuang and Shaw (2008)/ Lameijer et al. (2024)</li> </ul>
	<ul style="list-style-type: none"> <li>• Managing workarounds</li> </ul>	<ul style="list-style-type: none"> <li>• Malaurent and Avison (2015)</li> </ul>
	<ul style="list-style-type: none"> <li>• Project partners' commitment</li> </ul>	<ul style="list-style-type: none"> <li>• Loh and Koh (2004)</li> </ul>
	Project management	Loh and Koh (2004)
	<ul style="list-style-type: none"> <li>• Communication/ Managing the interaction and collaboration</li> </ul>	<ul style="list-style-type: none"> <li>• Loh and Koh (2004)/ Bintoro et al (2015)/ Ioannou and</li> </ul>

between stakeholders/ Bottleneck handling/ (Horizontal) coordination	Papadoyiannis (2004)/ Joia (1998)
• Managing the client–consultant relationships/ Establishing a strategic partnership with vendors and having an ongoing support/ Vendor support	• Williams et al. (2013)/ Pishdad and Haider (2013)/ King and Burgess (2006)/
• Managing parent–subsidiary conflicts	• Chen (2009)
• Defining the implementation strategy/ Clear roles and responsibilities	• Garg and Garg (2014)/ Loh and Koh (2004)
• (Realistic) plan/ Measurable goals/ Preset targets	• Joia (1998)/ Saade and Nijher (2016)/ Schlegel et al. (2024)
• Budget reliability	• Chuang and Shaw (2008)
• Schedule reliability/ Adherence to schedule	• Chuang and Shaw (2008)/ Kumar et al. (2002)
• Project management teams/ Balanced teams/ Effective teamwork	• Françoise et al. (2009)/ Norton et al. (2013)/ Loh and Koh (2004)
• Involving subject matter experts/ Involving external consultants	• Gallagher and Gallagher (2012)/ Wang and Chen (2006)
• Performance evaluation/ Project monitoring	• Françoise et al. (2009)/ Loh and Koh (2004)
• Project sponsor	• Haug (2012)
• Testing and troubleshooting	• Wickramasinghe and Gunawardena (2010)
• Comprehensive post-implementation plan	• Allen (2008)
Knowledge management	Finnegan and Willcocks (2006)
• Building a knowledge environment	• Drummond et al. (2017)
• Managing DS skills, abilities, capabilities, competencies, and absorptive capacity	• Loh and Koh (2004)
• Center of Excellence	• Lamberton et al. (2017)
• Learning from past mistakes	• de Búrca et al. (2005)
• Training	• Tung and Turban (1996)
• Experienced and competent project leader and team	• Loh and Koh (2004)
• Competent consultants/ Service quality of consultants/ Learning from consultants	• Wang et al. (2007)/ Tsai et al. (2011)/ May et al. (2013)
• Service quality of the vendor/ References of the vendor	• Tseng (2016)/ Baki and Çakar (2005)

\*1st appearance among the articles examined.

Source: own construction

### III. 3.2. Results of the qualitative research

#### Technological factors

System unreliability and slowness can cause significant problems. *"We can work from home via VPN, but it is much slower than being at the office. I also get frustrated when I have to*

*approve something because it is slow, since a poorly functioning technological solution was chosen; I prefer to do these tasks when I am at the office. This would definitely annoy an average user"* (Interviewee 8). It is a fundamental expectation that technology works smoothly and the system does not freeze. Of course, even if the system sometimes freezes, the process might still be faster than manual execution by a colleague. However, today's users want everything immediately and tolerate delays poorly - especially the younger generation.

Entering the hype curve at the wrong point can also cause problems: *"Our expectations for the technology must be aligned with its maturity level; otherwise, disappointment will be the result"* (Interviewee 9).

Meeting the technological requirements is, of course, only the preliminary step; it is considered *"very basic"* (Interviewee 5) and *"obviously not the ultimate goal"* (Interviewee 3). However, success requires the proper regulation of data accessibility, defining user levels, and assigning permissions.

### **Technology – organization fit**

When it comes to meeting business needs, it is important to distinguish between the "as is" and "to be" states. *"It is essential to know the processes: the company and colleagues should know their own processes to explain what they want, rather than just describing how things currently work"* (Interviewee 8). Process thinking in management appeared in the 2000s; before that, companies thought in terms of structures, roles, and tasks. *"Many companies still struggle with this today"* (Interviewee 8). A fundamental challenge of functional organizations is functional egoism, that is, the tendency of organizational units to operate primarily in line with their own objectives. *"But to survive, we have to cooperate and work together"* (Interviewee 9). This process-oriented approach must be supported by digital solutions (DS).

When addressing business needs, perseverance and a solution-oriented mindset are essential, starting from the software selection phase. *"For instance, we did not have electronic filing, and it took time to convince management that a document management system was needed, since—as a small company—it was difficult to find software that was cost-effective yet suitable for us: one that helps us comply with legal requirements while also reducing the administrative burden"* (Interviewee 4). When assessing and defining needs, it is worthwhile to create a roadmap: think through what else the chosen solution could be useful for beyond the selected area.

A common pitfall when choosing the right system is that salespeople promise everything, but during implementation, it turns out the system does not work exactly as sold; additional development is needed, increasing costs. *"I often see that a skilled salesperson manages to sell the product, and then the organization is trying to make use of what is already in place, even if it requires significant effort to make it meaningful."* (Interviewee 3). It often happens that part of the annual budget remains unspent, which would otherwise be lost if not used within the given year. In such cases, departments sometimes embark on implementing a digital system. While this may resemble an impulse purchase, it can nevertheless lead to real results: if the organization invests the effort to actually use the system, it can understand both its potential and its limitations, which can drive genuine progress. As Interviewee 9 put it: *"System implementation may not have been planned, but if we are persistent enough, it can indeed take us to the next level"*. Another challenge is that leading digital systems are typically not developed with the specific needs and limited resources of Hungarian SMEs in mind. As a result, organizations are often required to build themselves around the chosen solution. However, given the rapid pace of technological change, this approach also raises significant difficulties.

Our interviewees confirmed the importance of having a business case summarizing expected benefits and goals. The aim of DS implementation can be cost reduction, increasing efficiency, workload reduction, faster administration, fewer phone calls, shorter processes, easier searchability, etc. *"It is important that what is introduced is useful, accelerates the process, and provides a good experience for the user"* (Interviewee 7).

The DS must contribute to achieving the initial project goals, such as speeding up processes and completing tasks faster or with fewer human resources. *"I buy technology to create business value with it"* (Interviewee 9).

An important business requirement regarding system implementation is simplification and the ability to extract more accurate data. *"For example, we have factory units in several parts of the country, and sending documents through an electronic system is much easier than on paper"* (Interviewee 4). However, data accuracy can become an issue if the system is not provided with reliable data. Fortunately, nowadays a variety of solutions are available to extract data even from handwritten invoices - although it remains essential to define appropriate validation algorithms.

## Management competence

The critical importance of change management was also emphasized by our interviewees. The introduction of a new technology is an occasion for organizational change and can fundamentally reshape existing power dynamics. Colleagues sense this, which is why resistance may occur. *"Managing this resistance is crucial for project success"* (Interviewee 5). Involvement can serve as an effective tool for managing resistance. *"When we introduced a document management solution a few years ago, one of the strongest resisters was the person on whom the entire database depended. By involving them in the decision-making process, within a few months, we managed to transform their attitude so much that now they come up with independent ideas, and sometimes I have to tell them to slow down because we can't keep up with this pace"* (Interviewee 1). It is also important to emphasize training, and it is worthwhile to tailor the user manual to the company's processes, supplementing it with concrete examples and descriptions. The success of involvement and the appropriate change management strategy depend largely on the degree of resistance. *"In the best-case scenario, a stakeholder can be convinced by rational arguments; however, if someone has conflicting interests, then no matter how many arguments I present, they will deliberately oppose the initiative simply because it does not serve their personal interest. An individual approach must be found for everyone – that is the true art of change management"* (Interviewee 9).

Establishing a performance evaluation system that explicitly supports change can also foster willingness to adapt. If a "why should I bother, I'll get paid anyway" type of mentality prevails within the organization, the project is bound to fail.

A typical characteristic of Hungarian corporate culture is that *"if we have a negative experience with a system implementation, we are less willing to try again"* (Interviewee 9), which is a critical barrier to overcome. Changes often fail not because of employee resistance but due to middle managers. *"My area's human resource needs were significantly underestimated, so after joining the organization, one of my first steps was to expand my team. Meanwhile, studying digital solutions, I saw that other companies significantly reduced human resource needs with the solution I planned to introduce. The question is whether I should push this project or not, because I would have to let go of recently hired colleagues"* (Interviewee 5). The main question in this situation is whether the manager can offer career perspectives for them, for example, by involving them in process improvement or digitalization initiatives in other areas. Unfortunately, the Hungarian SME sector often is not at this level of maturity: *"This is a dream-like approach that sounds very good, but the Hungarian SME sector does not think this way"*

(Interviewee 2), and employees often do not want to do something different. *"Someone who has drawn the same lines in the same checkered notebook for 10 years will find it very hard to step out of it"* (Interviewee 9).

Our interviewees emphasized that no change is successful without project champions, who 'push' the change through the organization: *"There were times when I was the only one still believing in the project, and I even had to convince the person who assigned me the task to continue. Today, we can hardly imagine our daily work without this solution"* (Interviewee 5).

Agility is also a key success factor to highlight. It is important not to build an overly complex system in the first step, but to create a prototype that has the requested functionalities and allows for testing and modifications. *"We have more and more projects where the client tells us what they want, we think we understand the needs, and based on that, we prepare a prototype – for example, we map what the client requested in an MS Form. However, after a few months of use, it turns out that we had gone in the wrong direction, and the actual needs were different from those originally expressed"* (Interviewee 3). This is the classic pitfall of robust system implementations: the system is overengineered, with so many fields added that it no longer supports daily operations. This, in turn, can lead to workarounds, and then *"a new colleague does not understand why a particular field contains the value it does"* (Interviewee 3).

Project management also emerged as a key factor in the interviewees' responses. *"Communication must work; often, it is necessary to translate from Hungarian to Hungarian between the parties"* (Interviewee 6). It is also essential that the project manager has adequate authority: *"If the project manager has no real power over the project participants, structural problems often turn into personal conflicts, which significantly reduces the chance of success"* (Interviewee 9).

When assessing processes and defining the "to be" state, a common pitfall can be that the organization can only think through the operation within the current framework. This is why external experts need to be involved, who have seen many processes and many systems, because they can think of alternative solutions based on that. *"It is also important to recognize when the consultant/project coordinator is not coordinating the project properly, which can even endanger the success of the project"* (Interviewee 8). It is especially advantageous if the external expert implements a solution that their own organization also uses/develops, as they better understand the details, obstacles, and pitfalls. *"In recent years, we have developed*

several AI-based solutions for our own use and then brought them to market. Knowing every detail of the system helped enormously with commercialization” (Interviewee 1).

Dependence on the parent company often imposes a significant barrier to digital developments, considerably slowing them down. “We have to wait several years for the headquarters’ approval if we want to implement a digital solution” (Interviewee 7). “As a general rule, we cannot apply local solutions because they do not match the group’s systems. Since it turned out there would be no capacity to implement the central solution for five years, they finally approved the introduction of the local solution, but it was a big fight” (Interviewee 10). For successful implementation, it is important to manage the relationship between the parent company and its subsidiaries and to address any conflicts that may arise between them.

Table 6: Summary of Hungarian specificities and issues supplementing international research based on the literature review and qualitative research results

Category	Most emphasized elements	Hungarian contextual factors	Issues supplementing international research
Technological factors	System quality and performance	Insufficient technological conditions often cause problems; workarounds are common	Entry at an inappropriate point of the hype cycle
Technology-organization fit	Meeting business needs Business case	Process thinking is often lacking in many Hungarian companies, which complicates DS implementation  Leading DSs are typically not developed for the needs of Hungarian SMEs	Conflicts between sales and implementation  Considering resource constraints, it is difficult to find a solution that also meets business requirements
Management competence	Project champions PoC (Proof of Concept) Managing client-consultant relationships Managing parent-subsidiary conflicts Training	Few leaders are capable of and willing to drive digital transformation  Low willingness to change The “why should I bother, I’ll get paid anyway” mentality is common and can undermine projects  Negative experiences with system implementation reduce willingness to try again  In foreign-owned companies, decisions regarding internal IT implementations are typically made outside Hungary	Changes often fail not because of employee resistance but due to middle managers  Difficult to provide career perspectives for those whose work is replaced by the DS  Experiential learning: it is advantageous if the external expert implements a solution that their own organization has also used or developed, as they are then more familiar with the details, constraints, and potential pitfalls

Source: Own construction

## **III. 4. Discussion**

### **III. 4.1. Theoretical contributions**

Our research categorized the critical success factors for DS implementation into three key areas: technology, technology–organization alignment, and management competence. Although numerous previous studies have summarized success factors either focusing on individual systems or on digital transformation as a whole (see e.g., Heuermann et al., 2024), the present study examines DSs comprehensively— by using a systematic literature review and qualitative interviews—to define the key factors and complement them by highlighting characteristics specific to the Hungarian context.

Previous systematic literature reviews (e.g., Barbieri et al., 2023; Al-Assaf et al., 2025; Ain et al., 2019) typically highlighted individual, organizational, and technological factors as critical success factors. In contrast, the present study emphasizes the importance of organizational alignment: the key to success lies in ensuring that the system fits the organization's capabilities and requirements. Moreover, regarding individual and organizational factors, our study highlights the importance of management: it is not the existing capabilities but management competence that is crucial, as gaps in capabilities can be compensated through effective management either before or during the implementation process.

In addition to defining the key success factors, our research complements them by highlighting characteristics specific to the Hungarian context. Hungary generally lags behind in digitalization; however, there are forward-looking initiatives in which products with AI functionalities have been developed initially for internal use and later brought to market.

Among the success factors for DS implementation, our qualitative research supports the importance of technological factors in line with the literature (Yeoh & Koronios, 2010; Vallurupalli & Bose, 2018). However, our interviewees emphasized that meeting these expectations represents only the “minimum level” and is insufficient by itself.

Regarding the technology - organization fit, our respondents stressed the importance of answering business needs and having a well-grounded business case (e.g., Kamdjoug et al., 2020). They highlighted the importance of distinguishing between the “as-is” and “to-be” states: when defining business needs, it matters whether the focus is on the current or the desired future state for system implementation. Our qualitative research also draws attention to the importance of process thinking, which is often still lacking in Hungarian business practices.

Our interviews reveal that leading DSs often do not align with the needs and resources of Hungarian organizations.

In terms of management competence, our respondents emphasized the importance of change management, consistent with the literature (Yusuf et al., 2004). Resistance to change emerged as a key theme, and one effective means of addressing it can be the involvement of stakeholders. (Schlegel et al., 2024). Vallurupalli and Bose (2018) highlight the role of project champions, which is particularly critical in the context of domestic companies: the digital maturity of Hungarian firms is generally low, and often the mindset and willingness necessary for transformation are missing, with incentive systems not supporting change. Managers typically do not consider digitalization as a priority, pay insufficient attention to it, and do not participate actively. Negative experiences and failures of previous system implementations further reduce the willingness to embrace change. Enthusiastic project champions, like our interviewees, often drive implementation even in the absence of formal support, driven solely by their personal conviction and commitment, which in turn pushes the organization forward. Project management (Ali & Miller, 2017) and training (Tung and Turban, 1996) also emerged as key factors in the interviews. Our respondents also confirmed the significance of Proof of Concept (Schlegel et al., 2024): rather than attempting to build an overly complex system, it is advisable to proceed incrementally with continuous user testing. The importance of managing conflicts between parent and subsidiary companies (Gavidia, 2016) was also supported by our interviewees: parent company dependency often poses significant obstacles to digital developments, considerably slowing them down.

The interviews complementing the systematic literature review also highlight several issues of international interest that are not addressed in the literature but significantly influence success, making them worthy of investigation in future studies. Regarding technology, it is important to have realistic expectations, taking the system's maturity into account, and adopt the system at the appropriate stage of the hype. Our analysis also points to tensions between sales and implementation: it is crucial that the technology can genuinely meet the requirements promised by sales. The interviews emphasize that changes often fail not due to employee resistance but because of middle management, which must also be addressed by using change management tools. Furthermore, regarding the client-consultant collaboration (Bintoro et al., 2015), our research highlights the importance of experiential learning in: it is advantageous if the consultant implements a product/digital solution they have used or developed, as this provides deeper knowledge of its details, limitations, and potential pitfalls.

### **III. 4.2. Management implications**

The implementation of DSs is a long and challenging process. To ensure its success, based on our research results, the following steps are recommended:

1. Stakeholders must believe in and agree on the necessity of implementing DSs. If a “we have gotten by without it so far” mindset dominates, the organization’s disadvantage will continually grow.
2. While the role of project champions is critical, appropriate top management support and commitment are also crucial.
3. Effective communication must be emphasized: the entire organization must clearly understand the need for change.
4. Managers need to assess the maturity level of the technology they are acquiring and set realistic expectations. Disappointments are likely with newly released solutions on the market.
5. The DS must be selected considering the organization’s needs and resources: there is no universal solution that brings the expected benefits to every organization. Conducting an organizational audit to assess needs and possibilities is important for selecting and implementing the appropriate DS, and it also helps ensure stakeholders agree that the implementation of DSs is necessary and unavoidable.
6. Developing management competence is crucial, which requires digital transformation manager training programs.

### **III. 5. Summary**

By identifying and interpreting the success factors (and main pitfalls) of digital solution implementation, the article provides guidance for organizations navigating digital transformation. Building on previous systematic literature reviews, this study highlights the importance of organizational alignment. While earlier analyses focused on individual systems, the present article develops an overarching meta-model of DS implementation success factors. Our research places greater emphasis on the significance of technology–organization alignment and management competencies for successful implementation, rather than on organizational and individual capabilities, as we argue that these can be addressed through the managerial practices and mechanisms detailed in the study.

A limitation of our study is that we examined 6 DSs within the ‘Business, Management and Accounting’ discipline. As a direction for future research, it would be worthwhile to investigate

success factors for other, newly emerging solutions and systems, as well as to explore how artificial intelligence (AI) integrates into DSs and how this affects success factors. Currently, we are at the early stage of the hype cycle, so there is insufficient experience to determine AI-specific success factors; however, this is likely to become an important focus in the future. Another potential research avenue is to examine how the success factors for DS implementation relate to the success factors of digital transformation.

## IV. The relationship between digital development and export activity of Hungarian SMEs<sup>3</sup>

### Abstract

Digital transformation has resulted in significant changes in the economy and society as well as in the life of companies. New technologies are accelerating globalization, but many small and medium-sized enterprises (SMEs) are lagging behind in internationalization. The objective of this article is to analyze the relationship between digital maturity (i.e., the application of digital systems) and export activity among SMEs. Domestic and international literary sources have typically discussed the internationalization of SMEs and the use of digital corporate technologies in SMEs separately. As a new approach, this paper amends the existing literature with the analysis of the interrelationship between the two areas. The authors tested their research hypotheses through a questionnaire-based survey comprising 316 SMEs. One of the most important conclusions of the report is that the use of most digital systems constitutes the major driving force in internationalization: those companies that plan to accede to external markets are more likely to apply digital systems than those already present abroad and/or those not intending to appear in foreign markets.

Journal of Economic Literature (JEL) codes: F20, L10, M15, M16, O19.

*Keywords:* small and medium enterprises, internationalization, exports, digital transformation, digital systems.

### IV. 1. Introduction

In recent decades, modern digital technologies have brought about significant changes for actors in society and the economy (individuals, companies, decision-makers). Digital transformation – regardless of industry and company size – greatly transforms the operation of organizations (Szabó & Hortoványi, 2021). The use of new digital technologies has become particularly important in all economic areas to support and optimize internal corporate processes and integration with e-business activities. However, these digital solutions are primarily used by large companies and are used to a much lesser extent by small and medium-sized enterprises (Tutunea, 2012).

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<sup>3</sup> **Author contributions:** Roland Z. Szabó: Conceptualization, Formal analysis, Investigation, Methodology, Supervision; **Borbála Szedmák:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing; **Anna Tajti:** Formal analysis, Investigation, Writing – original draft, Visualization

Digital transformation creates new opportunities for companies if they can adapt to technological, economic, and social changes and renew their organizations. Otherwise, it affects them more as a threat and danger (Hortoványi et al., 2020). As Szalavetz & Somosi (2019) pointed out in their research based on success stories, digitalization can bring many benefits to companies (for example, it can improve their competitiveness) and create significant new value (Szalavetz, 2021). However, attention has to be paid to the downsides and challenges as well. All managers find it difficult to adapt to dynamically changing technological conditions. However, SMEs are much more vulnerable to changing conditions than their larger competitors (Tutunea & Rus, 2012). At the same time, the contribution of SMEs is extremely important to the growth of GDP, foreign trade, and job creation. Their competitiveness is of paramount importance both at the national and international levels (Prasanthi & Rao, 2019). More than 99% of enterprises operating in Hungary are small and medium-sized, and SMEs provide employment opportunities for nearly two-thirds of those employed in the business sector.

Technological developments have led to the exponential expansion of international communication and information networks, thereby reducing barriers to international trade and increasing opportunities for the globalization of business activities. These changes create an environment in which internationalization becomes more feasible and potentially more attractive for small and medium-sized enterprises (Pett et al., 2004; Hortoványi, 2016). The increasing digitalization of the global economy enables small and medium-sized enterprises to internationalize and scale up (Stallkamp & Schotter, 2019; North & Lorenzo, 2020).

There is no consensus among experts on the definition of globalization and internationalization (Welch & Luostarinen, 1988; Al-Rodhan & Stoudmann, 2006). Both concepts can be defined in a narrower and broader sense. Based on a review of several definitions, Al-Rodhan & Stoudmann (2006, p. 5) interpret globalization as "a process that encompasses the causes, course, and consequences of transnational and transcultural integration of human and non-human activities". Internationalization is "the process of increasing participation in international operations" (Welch & Luostarinen, 1988, p. 36), during which the company's activities extend to countries other than the home country (McCole et al., 2010). In connection with internationalization, it is important to emphasize the bidirectionality, i.e., internationalization includes both "outward" and "inward" (export and import) growth (Welch, 1988; Freeman et al., 2013). During internationalization, the basic unit remains the nation, while globalization refers to the transformation of economies previously understood at the national

level into a global economy (Daly, 1999); thus, globalization can be interpreted as a more advanced and complex form of internationalization (Dicken, 1992).

Although the barriers to international business, which historically favored large companies with the necessary resources, have been significantly reduced, many SMEs still lag behind in terms of both competitiveness and internationalization. Therefore, it is essential to understand which factors have a significant correlation with the foreign market activity of SMEs, and how SMEs engaged in export activities differ from their competitors operating only in domestic markets.

Many experts have already examined the internationalization, more specifically, the export activity of SMEs. More recently, in addition to the export of goods, the export of services has also been investigated (Losoncz & Nagy, 2020), and there has been a large number of research results on the use of digital solutions and their benefits among SMEs (Szabó et al., 2020). Each of these is an important area on its own and is becoming even more important nowadays. Therefore, it is essential to map the connections and correlations between internationalization and the usage of digital solutions. This is a research gap in the domestic and international literature. While there is significant research on the internationalization of multinational or transnational companies, the internationalization of SMEs, despite their great economic weight, is considered a less researched, still relatively new area.

In order to fill these research gaps, the present study examines the relationship between the usage of digital solutions and internationalization among domestic SMEs. The digitalization of business administration processes and back-office functions is a less explored area compared to the digitalization of production processes. In this study, we focus on those digital solutions that facilitate the digitalization of business administration processes. These include document management systems, ERP<sup>4</sup>, CRM<sup>5</sup> and workflow systems<sup>6</sup>, industry-specific systems, BI<sup>7</sup> systems and software robots<sup>8</sup>. The aim is to explore new and novel connections and draw conclusions.

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<sup>4</sup> ERP: enterprise resource planning, but used as a corporate management system. Integrated business process management software that covers multiple organizational units; collects, stores, manages, processes, and interprets data generated in different areas at the company or group level, and enables real-time access to data.

<sup>5</sup> CRM: customer relationship management. A strategy that includes all of a company's interactions with potential and existing customers, including all related data and workflows, and the automation of repetitive tasks.

<sup>6</sup> Workflow system: helps electronically manage, record, and integrate individual work phases, i.e., it provides a structured, logical organization of the work phases and appropriate support.

<sup>7</sup> BI: business intelligence. A set of methods for improving the decision-making process using fact-based systems. It is based on obtaining and processing the information necessary for decisions.

<sup>8</sup> Software robot: Automation of – often back-office – activities, processes which can be standardized and are repetitive, monotonous.

There are several forms of internationalization (Nagy 2020). This study deals with only one aspect of internationalization, namely exports. We did not extend the empirical investigation to other areas relevant to the topic, such as the digitalization of companies integrated into international value chains, and the relationship between international acquisitions and mergers and digital development.

The article first reviews the literature on digital solutions and the internationalization of SMEs. Based on this, the hypotheses of our research are defined. Then the methodology and the company sample used in the research are presented, followed by a discussion of the results interpreted in the context of the reviewed literature. The study concludes with a summary and a conclusions section, and a list of references.

## **IV. 2. Literature review and research hypotheses**

### **IV. 2.1. SMEs entering the international market**

Literature on internationalization is quite extensive and has been on the research agenda for a long time. However, research on the internationalization of SMEs is still relatively new compared to that of multinational corporations.

As Vakhal (2020) emphasizes, entering the international market is a significant stage in the development of SMEs. In the internationalization process, SMEs have to face much greater financial, informational, and managerial resource constraints than multinational corporations, which pose significant obstacles to internationalization (Németh, 2020). The internationalization of SMEs is also made more difficult by external obstacles (such as laws and regulations), which is why SMEs internationalize at a lower rate than large corporations (Hollenstein, 2005).

The most common way of entering international markets is through direct or indirect exports, and for most companies, this is the first step towards internationalization (Hollensen, 1998; Albaum et al., 1998). Johanson & Vahlne (1977) also identify direct or indirect exports as the first stage of internationalization in the widely known and applied Uppsala model. SMEs often choose export as a form of entering foreign markets, as it is a relatively low-risk option, does not require large capital or investments, and exit is relatively easy (Deresky, 2000).

A company's export activity can be stimulated by "push" and "pull" factors. For example, the decline of the domestic market, regulatory constraints, excess capacities, or managerial proactivity can act as push factors, while attractive foreign market opportunities, growth prospects, partnerships, and information and communication and technological developments

can act as pull factors and help companies enter international markets (Éltető & Udvari, 2018). According to Leonidou (2004), the factors hindering exports can be internal (functional, informational, and marketing) and external (procedural, governmental, and environmental).

However, the driving forces of SMEs' internationalization may differ from those of multinational companies. One of the main drivers of SMEs' internationalization is the increased demand for their products in foreign markets: SMEs that initially trade only domestically are attracted to the external market by the demand in foreign markets. Another major motivation for SMEs to internationalize is risk sharing: when entering a new market, risks are shared, as economic downturns often do not occur simultaneously in different markets (Gustavsson & Lundgren, 2006). Langseth & O'Dwyer (2016) identified four forces that facilitate internationalization among SMEs: technology, the perception of entrepreneurial actors/global vision of owner-managers, knowledge of foreign markets, and the strength of network ties. Albaum et al. (1998) also found that SMEs often enter foreign markets when the domestic market becomes saturated and they can no longer achieve their strategic goals domestically. There is, therefore, a close connection between companies' export motives and their core objectives.

#### **IV. 2.2. Digital solutions and the foreign market activities of SMEs**

As a general trend, digitalization influences the internationalization process of companies in terms of the availability of resources, the acquisition of skills and competencies, and the opportunities for learning and knowledge development in foreign markets (Coviello et al., 2017). The use of digital technologies offers new opportunities for SMEs to enter and succeed in foreign markets (Hervé et al., 2020a).

Due to general resource constraints, the use of versatile and cost-effective digital systems is of paramount importance for SMEs, which facilitate interactions with customers and partners and enable them to learn about international markets. These digital systems, therefore, have a positive impact on the internationalization of SMEs by transmitting international market knowledge (Pergelova et al., 2018).

Digital systems help map foreign markets and assess local demand characteristics, which facilitates the customization of products by taking into account the specificities of these markets. They can also support international trade activities through international marketing and advertising strategies. Digital technologies can also enhance information about competitors. In addition, they not only support internal functions but can also strengthen

commercial relationships by strengthening relationships with customers, suppliers, and distributors (Cassetta et al., 2020).

According to several authors, the potential benefits of using digital systems for SMEs are significant because these systems reduce the constraints on internationalization due to company size. For example, the direct and indirect effects of various information and communication technologies (primarily in the areas of marketing, communication, networking, and resource planning) can improve the financial and operational performance of SMEs, thereby they can gain an efficiency advantage (Tarutė & Gatautis, 2014). By embedding digital technologies in organizational innovations, SMEs gain a competitive advantage, which also promotes export growth (Pini et al., 2018). By creating new information, marketing and sales channels, as well as by reducing costs related to geographical distance and market entry, digital systems can contribute to overcoming barriers of SMEs' internationalization, and to mitigating the disadvantages of SMEs in this area compared to large transnational corporations and born global companies (Reuber & Fischer, 2011).

With the help of digitalization, SMEs are able to enter the international market faster (Lee et al., 2019). The increasing digitalization of corporate functions allows management to make successful strategic decisions in foreign markets, thereby contributing to the deepening of internationalization (Hervé et al., 2020b).

According to Westerlund (2020), internationalized SMEs are 87 % more likely to use enterprise resource planning (ERP) systems and 35 % more likely to use customer relationship management (CRM) systems than their domestic competitors. ERP and CRM systems provide better connections with customers and suppliers, and enable both customer relationships and business processes to be monitored and managed more effectively. The usage of these systems not only reflects the company's digital development but is also crucial for the internationalization of companies (Neubert, 2018).

Electronic document management systems, used for the creation, usage, and storage of documents (such as e-mails and other formats, PDF, PowerPoint, Word files, Excel spreadsheets, etc.), help structure, optimize, and use data (Rosa et al., 2019). These document management systems contribute greatly to reducing transaction costs and improving the efficiency of information exchange between a company and its international customers, suppliers, and partners, which can facilitate internationalization (Pini et al., 2018).

The importance of workflow and process technologies is growing today, as a collaboration between geographically distant people and computer systems requires the convergence of communication and software tools, providing a framework for large-scale collaboration (Cichocki et al., 2012). In this way, IT tools such as workflow systems contribute to the vertical integration of companies' activities, and thus to internationalization (Rao, 2001).

The use of software robots is an essential component of robotic process automation (RPA). However, according to Suri et al. (2017), the majority of companies use software robots only to a limited extent in automating business processes. Furthermore, it is difficult to quantify tangible savings and determine the costs of implementation.

Overall, previous findings in the literature generally show that digital systems and solutions facilitate the internationalization of SMEs. The following research hypotheses arise from all of this:

- **Hypothesis 1:** The more important export is for the continuous operation of an SME, the more likely it is to use digital systems and solutions.
- **Hypothesis 2:** The more important exports are expected to be in the operations of an SME in three years, the more likely it is to use digital systems and solutions.
- **Hypothesis 3:** SMEs that are already present in a foreign market use digital solutions and systems to a greater extent than those that do not plan to enter a foreign market.
- **Hypothesis 4:** SMEs that plan to enter a foreign market use digital solutions and systems to a greater extent than those that do not plan to enter a foreign market.
- **Hypothesis 5:** SMEs that plan to enter a foreign market use digital solutions and systems to a greater extent than those that are already present in a foreign market.

### **IV. 3. Methodology**

#### **IV. 3.1. Sample characteristics**

We aimed to test the hypotheses and explore the relationships between phenomena; therefore, we used a quantitative survey as an empirical research methodology (Sukamolson, 2010). Data were gathered between 18 May and 1 June 2021. The sample consists of companies in Hungary; the selection criterion was a turnover of at least 1 million EUR, which was met by 20,500 companies in the Hungarian population. A questionnaire was sent by email to each of these

companies, and 335 valid responses were received, representing a response rate of 1.63% which is double the 0.8 % value usual for similar surveys.

Based on the definition of Article 3 of Act XXXIV of 2004, 5.7 % of the companies included in the research are large companies, 19.4 % are medium-sized, 60.3 % are small, and 14.6 % are micro-enterprises. In accordance with the research topic, by filtering out large companies, 316 micro, small, and medium-sized enterprises (hereinafter: SMEs) were included in the study sample (Table 7).

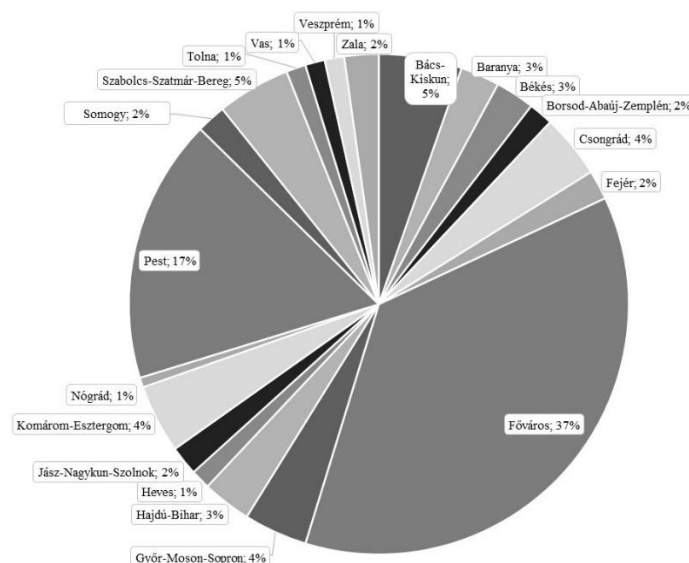
Table 7: Responding companies by size category

Classification	Staff headcount	and	Turnover (EUR)	or	Balance sheet total (EUR)	N	%
Large enterprise	250 ≤	and	50 000 000 <	or	43 000 000 <	19	5,7%
Medium enterprise	< 250	and	≤ 50 000 000	or	≤ 43 000 000	65	19,4%
Small enterprise	< 50	and	≤ 10 000 000	or	≤ 10 000 000	202	60,3%
Micro enterprise	< 10	and	≤ 2 000 000	or	≤ 2 000 000	49	14,6%

Source: Own compilation based on survey data.

We also examined the distribution of the sample from a geographical point of view (Figure 4). Responses to the questionnaire were received from all over the country. The responses to the questionnaire also reflect the geographical structure of the Hungarian economy: Budapest and Pest counties play a key role (37% and 17 % shares, respectively).

Figure 4: Distribution of SMEs in the sample by location



Source: Own compilation based on survey data.

We also examined the demographics of the respondents representing the companies; their gender, field of expertise, years of work experience, position, number of years spent at the current workplace, and number of years spent in the current position at the current workplace were analyzed.

79.6 % of the respondents in the sample are male, and 20.4 % are female. As Table 8 shows, the majority of them hold CEO/founder positions, but the proportion of those working in production, sales, marketing, and finance is also significant. A smaller proportion of respondents work in logistics and product development.

Table 8: Distribution of respondents in the sample by area of operation

<b>Function</b>	<b>Number of people</b>	<b>%</b>
<b>CEO / founder</b>	172	54,4%
<b>Logistics</b>	13	4,1%
<b>Finance</b>	30	9,5%
<b>Sales and marketing</b>	38	12,0%
<b>Product development</b>	6	1,9%
<b>Production</b>	57	18,0%
<b>Total</b>	<b>316</b>	<b>100,0%</b>

Source: Own compilation based on survey data.

The vast majority of respondents, 86.3%, are senior managers or owners, while 10.2% hold middle management positions, only 1.6% are lower-level managers, and 1.9% do not hold any management position. (Table 9).

Table 9: Distribution of respondents by management position

<b>Position</b>	<b>Number of people</b>	<b>%</b>
<b>I am a senior manager/owner</b>	271	85,8%
<b>I am a middle manager</b>	33	10,4%
<b>I am a lower-level manager</b>	5	1,6%
<b>Not in a management position</b>	7	2,2%
<b>Total</b>	<b>316</b>	<b>100,0%</b>

Source: Own compilation based on survey data.

Respondents have an average of 29 years of work experience, have been working at their current workplace for an average of 18 years, and have been in their current position at their current workplace for an average of 16 years. The mean values for the work experience of the people in the sample are shown in Table 10.

Table 10: Central indicators and standard deviations of the variables characterizing the work experience of the respondents in the sample

	<b>Mean</b>	<b>Variance</b>	<b>Median</b>	<b>Modus</b>
<b>Work experience (in years)</b>	29,0	10,2	29	30
<b>Number of years spent at current workplace</b>	18,1	9,9	18	30
<b>Number of years spent at current workplace, in current position</b>	16,0	9,8	15	10

Source: Own compilation based on survey data.

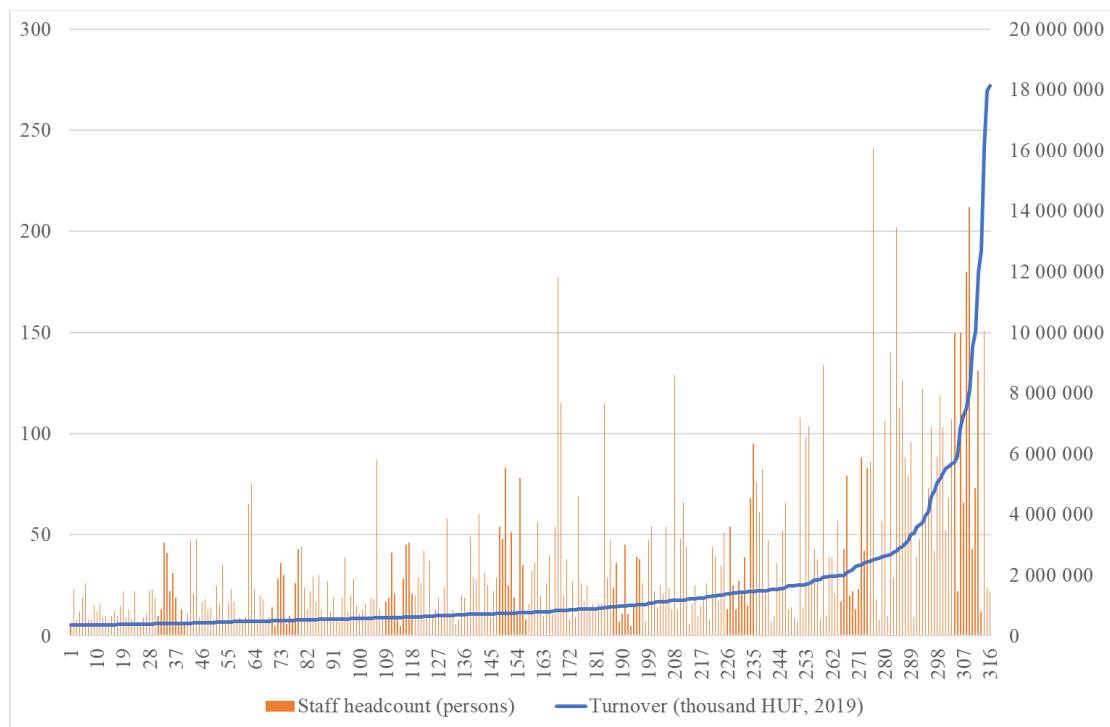
The enterprises in the sample employ an average of approximately 36 people, have an average turnover of 1,523,065 thousand forints, and have achieved an after-tax profit of 109,080 thousand forints. As can be seen from the data in Table 11, the median values for both headcount, turnover, and after-tax profit are significantly below the average, which indicates that the distribution of these variables is strongly left-skewed. Figure 5 shows the distribution of SMEs in the sample by turnover and headcount. There are more companies with lower turnover and fewer companies with higher turnover in the sample. Companies with higher turnover generally also have larger headcounts.

Table 11: Central indicators and variance of the size of the SMEs in the sample

	<b>Mean</b>	<b>Variance</b>	<b>Relative variance</b>	<b>Median</b>
<b>Staff headcount (persons)</b>	35,9	37,3	1,0	22
<b>Turnover (thousand HUF)</b>	1 523 065	2 291 421	1,5	774 182
<b>Profit after tax (thousand HUF)</b>	109 080	205 168	1,9	63 108

Source: Own compilation based on survey data.

Figure 5: Distribution of SMEs in the sample by revenue (HUF) and staff headcount



Note: In the figure, the companies in the sample are arranged in ascending order based on turnover, and the headcount data for each observed company is shown.

Source: Own compilation based on survey data.

#### IV. 3.2. Methods used in measurement and data analysis

Internationalization, and in particular export orientation, was measured with the following questions and variables:

1. Is the company planning to enter the international market? (2: we are currently present in international markets; 1: we are not present, but we plan to be present within three years; 0: we are not present, and we do not plan to be present within three years)
2. How important is export for the company? (1: not important at all, 5: very important)
3. How important could export be for the company in three years? (1: not important at all, 5: very important)

Usage of digital solutions was measured with the following question:

1. Which of the following digital solutions does your company use? (Does not use/ Uses domestically developed/ Uses foreign developed.)

After compiling the database, cleaning and coding the data, the database was filtered to ensure that the sample included only companies relevant to the research, i.e., SMEs.

Afterwards, we measured the relationship of each question block with the variables measuring the importance of exports and presence in foreign markets using Spearman's correlation,

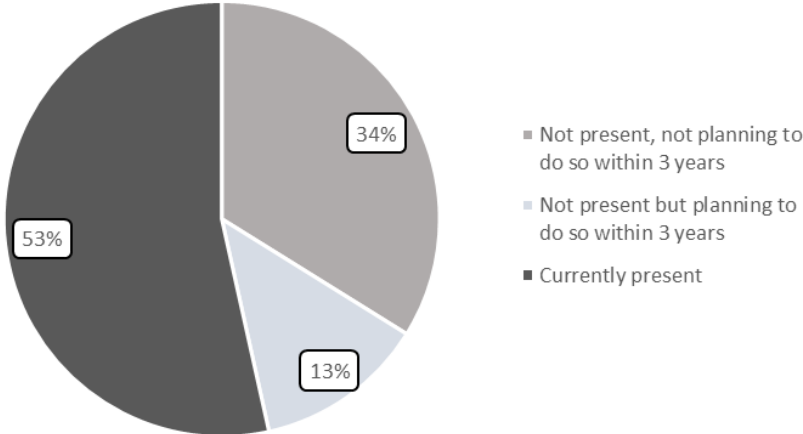
comparison of means, and Scheffe's post hoc test, based on which we accepted or rejected our hypotheses. Data filtering and analyses were performed using IBM Statistical Package for Social Sciences (SPSS) software.

**IV. 4. Results**

**IV. 4.1. Internationalization of SMEs: the importance of exports**

As shown in Figure 6, more than half of the SMEs in the sample (168 companies) are already present on the international market, 13 % (40 companies) are not yet present but plan to enter the international market within three years, while 34 % (108 companies) are not present on the international market and do not plan to do so within three years.

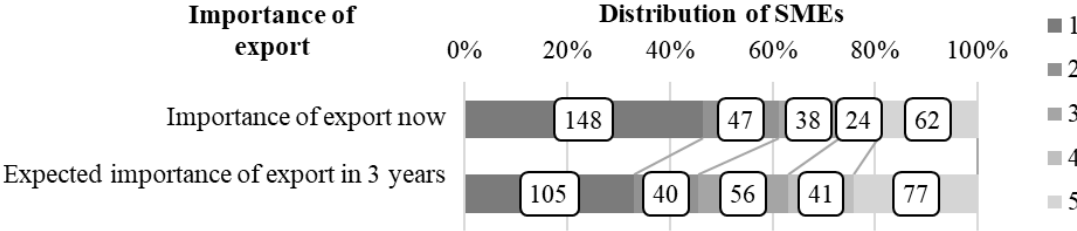
Figure 6: Distribution of SMEs in the sample by international market presence



Source: Own compilation based on survey data.

As can be seen in Figure 7, for 46 % of the SMEs in the sample, export is not important at all (category 1) at the moment. According to the respondents, this proportion is expected to decrease to 32 % in three years. Only 20 % of the SMEs stated that export is currently very important to them (category 5), but 24 % expect that export will be very important for their company in three years. In terms of the importance of export in three years, the frequency of categories 1 and 2 is lower, while the frequency of categories 3, 4, and 5 is higher compared to the current importance of export. Therefore, as a general trend, exports are expected to become more important for SMEs in three years than they are now.

Figure 7: Importance of exports now and three years from now for the sampled SMEs

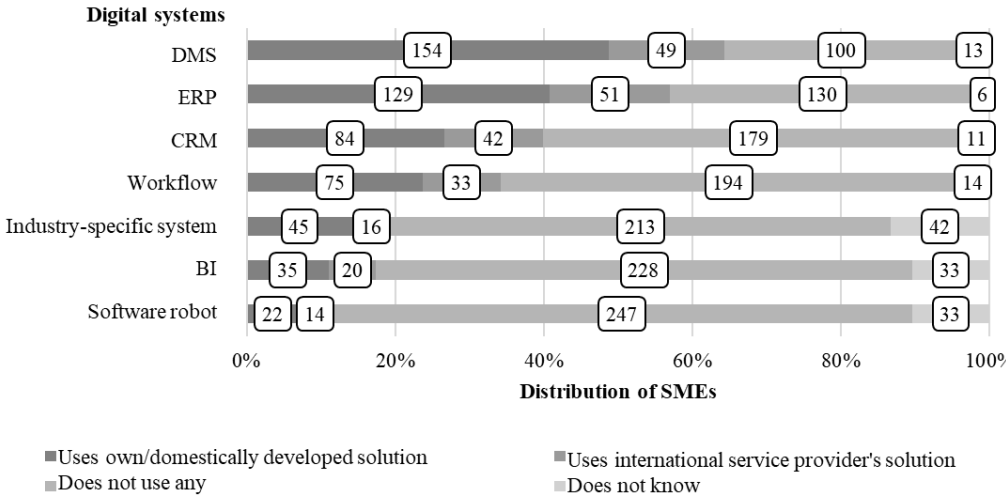


Source: Own compilation based on survey data

**IV. 4.2. Digital systems and solutions**

The variables in the question block related to the use of digital systems and solutions have three options: the company does not use the given system/solution, or uses a domestically or foreign-developed one. Among the sampled SMEs, document management systems (DMS) are used by most (64%), followed by ERP and then CRM systems. Software robots are used by only 11%, representing the smallest proportion. In the case of all systems, there are significantly more companies that use their own or domestically developed solutions than those that use foreign ones (Figure 8).

Figure 8: Digital system usage



Source: Own compilation based on survey data

After recoding variables measuring digital solution usage into dummy variables, the relationship between the recoded variables and two variables measuring the importance of export (currently and in three years) was analyzed using Spearman correlation, and the relationship between digital solution usage and presence in the foreign market was analyzed

using variance analysis and Scheffe's post hoc test. A comparison of the results of these analyses is shown in Table 12.

According to the results of the Spearman correlation, the more important export is for a company currently, the more likely it is to use an ERP system, and the more likely it is to use a foreign-developed one. The more important exports are expected to be for a company in three years, the more likely it is to use ERP, workflow systems, and BI. Accordingly, hypothesis 1 is accepted in 1 case out of the 7 digital solutions, and hypothesis 2 is accepted in 3 cases.

Based on Scheffe's post hoc test, it can be concluded as a general trend that companies that plan to enter a foreign market within three years use various digital solutions and systems to a greater extent than those that are already present in a foreign market or that do not plan to enter a foreign market within three years, except the ERP system (which is used to a greater extent by companies present in a foreign market than by those that do not plan to enter a foreign market). Companies that plan to enter a foreign market within three years rely to a greater extent on domestically developed ERP, CRM, and BI, as well as foreign-developed workflow systems, than the other two groups, and have implemented foreign-developed BI systems and industry-specific systems to a greater extent than companies that do not plan to enter a foreign market. In addition, companies that are present in a foreign market use a foreign-developed ERP system to a greater extent than the other two groups, and use a foreign-developed CRM system to a greater extent than those that do not plan to enter a foreign market. Based on this, hypothesis 3 is accepted in only 1 case out of the 7 cases, while hypothesis 4 is accepted in 5 cases, and hypothesis 5 is accepted in 4 cases.

Table 12: The relationship between the use of digital tools and internationalization

		Spearman's correlation		Scheffe's post hoc test <sup>a</sup>
		Importance of export now	Importance of export expected in 3 years	Presence in foreign market
<b>ERP system</b>	Use	0,117*	0,169**	2>0
	Domestic	0,029	0,104	1>0; 1>2
	Foreign	0,110*	0,081	2>1; 2>0
<b>CRM system</b>	Use	-0,071	0,037	1>0
	Domestic	-0,160**	-0,046	1>2; 1>0
	Foreign	0,101	0,109	2>0
<b>Workflow system</b>	Use	0,051	0,119*	1>0; 1>2
	Domestic	0,061	0,117*	
	Foreign	-0,007	0,019	1>0; 1>2
<b>Document management system (DMS)</b>	Use	-0,025	0,043	1>0; 1>2
	Domestic	0,043	0,068	
	Foreign	-0,090	-0,037	
<b>Software robot</b>	Use	0,013	0,086	1>0
	Domestic	-0,033	0,018	1>0

	Foreign	0,060	0,110	
	Use	0,066	0,131*	1>0; 1>2
<b>BI rendszer</b>	Domestic	0,054	0,113	1>0; 1>2
	Foreign	0,032	0,058	1>0
	Use	0,015	0,066	1>2
<b>Industry-specific system</b>	Domestic	-0,002	0,029	
	Foreign	0,028	0,070	1>0

*Notes:*

\* The correlation is significant at the  $p < 0.05$  level

\*\* The correlation is significant at the  $p < 0.01$  level

<sup>a</sup> The post-hoc test is significant in all cases, at the  $p < 0.05$  level

0: Not present in the international market, and does not plan to do so within three years.

1: Not present in the international market, but plans to enter the foreign market within three years.

2: Currently present in the international market.

## IV. 5. Discussion

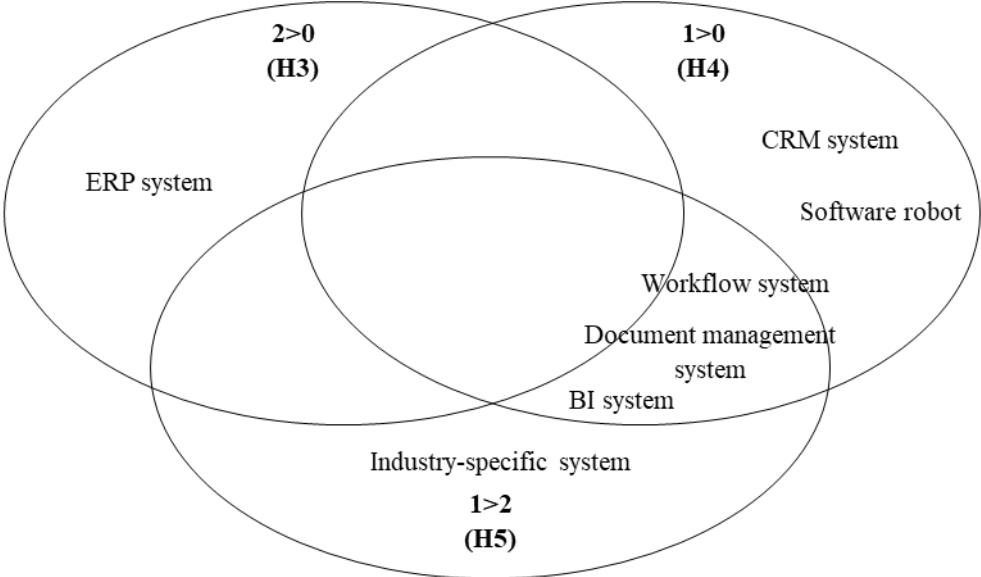
The literature emphasizes the (potential) benefits of using digital systems for the internationalization of SMEs. These benefits may be even more significant for SMEs than for large companies, precisely because they play a significant role in overcoming the constraints of company size (Reuber & Fischer, 2011; Taruté & Gatautis, 2014; Pergelova et al., 2018; Cassetta et al., 2020). The results of our empirical research partly agree with this general assumption and partly contradict it.

Only in the case of the ERP system was hypothesis 1 accepted, according to which the more important export is for the company, the more likely this system is to be used. In addition, SMEs for which export is expected to be more important are more likely to use workflow and BI systems in addition to ERP, so hypothesis 2 was accepted in 3 out of 7 cases.

Digital systems facilitate more efficient and effective operations, thereby contributing to improving the competitiveness of companies. Organizations that successfully implement digital transformation can gain a significant competitive advantage and focus on higher-value-added activities. The analyzed systems enable transparent and standardized business processes based on clear responsibilities and authorities; they facilitate the preparation of various reports, optimize production, and minimize errors (Szalavetz 2019). They also prevent the loss of data or information. The systems provide SMEs with financial and efficiency advantages in marketing, communication, networking, and resource planning in foreign markets (Taruté & Gatautis, 2014). These systems can help SMEs in their internationalization efforts by providing important information about the international market and connections with foreign customers, suppliers, and partners (Pergelova et al., 2018; Cassetta et al., 2020). Therefore, it is possible that in many cases SMEs prepare for entering the international market or expanding their international activities earlier by implementing and using digital systems. This could potentially

explain why the use of several digital systems is significantly associated with the expected importance of export in three years than with the current importance.

Figure 9: The relationship between the usage of digital systems and solutions and internationalization based on the hypotheses



- 0: Not present in the international market and does not plan to be present within three years.
- 1: Not present in the international market, but plans to enter the foreign market within three years.
- 2: Currently present in the international market.

Source: Own compilation based on survey data.

The Venn diagram (Figure 9) summarizes the sub-variables for which hypotheses 3, 4, and 5 can be accepted. Only the ERP system was used by a significantly higher proportion of SMEs already present in the international market than those not planning to enter the international market in the next three years. Thus, hypothesis 3 can be accepted in only 1 case out of the 7 sub-variables, which confirms the result of (Westerlund, 2020) that internationalized SMEs are much more likely to use an ERP system than domestic SMEs. Hypotheses 4 and 5 are accepted in several cases. In line with the results of this correlation, it can be concluded that most digital solutions that companies introduce when planning to enter the international market are a driving force of internationalization.

We also asked respondents whether they use their own/domestically developed or foreign digital systems, if any. Based on Table 12, in the case of ERP, CRM, software robots, and BI systems, companies planning to internationalize within three years use their own or domestically developed solutions to a greater extent than domestic companies not planning to internationalize, and except for software robots, this is even true in comparison with companies

already present in the international market. In the case of workflow, BI, and industry-specific systems, companies planning to internationalize rely on foreign-developed solutions to a greater extent than domestic companies that do not plan to internationalize.

#### **IV. 6. Summary, conclusions**

The fourth industrial revolution and the spread of modern digital technologies have brought about significant changes in the economy, society, and the operation of companies. New technologies accelerate globalization and internationalization, but many SMEs are lagging behind in the field of internationalization. This study aimed to explore the connections between the digital development and internationalization of domestic SMEs, or more precisely, to examine the relationship between digital system usage and internationalization in the case of domestic SMEs. While both areas have received considerable research attention individually, their integration represents a novel approach – it is a research gap in both international and domestic literature. Within this, it is also novel that we examined the digitalization of business administration processes and back-office functions in detail.

Numerous theories have been developed to describe and explain the internationalization of companies, and several have identified the driving forces and barriers of internationalization. The driving forces of the internationalization of SMEs may differ from those of large companies. According to the results of previous research, the use of digital systems and solutions generally facilitates the foreign market activities of SMEs. Based on these, we developed the research hypotheses for domestic SMEs.

We tested the hypotheses empirically among 316 domestic SMEs, using a questionnaire survey. According to the results of our research, the more important export currently is for an SME, the more likely it is that it already uses an ERP system. The more important export is expected to be for an SME's operations in three years, the more likely it is to use ERP, workflow, and BI systems. As a general trend, companies that plan to enter a foreign market within three years rely on various digital solutions and systems to a greater extent than those that are already present in a foreign market and/or those that do not plan to enter a foreign market within three years. ERP systems are an exception to this.

The results suggest that the use of most digital solutions is a driving force of export activities. These solutions are often implemented by companies when planning to enter the international market. Based on the lessons learned from the results, conclusions can be drawn as to which companies will successfully enter the international market based on their digital development.

The conclusion that digital development is higher in the case of companies planning to export than in the case of companies already exporting is also considered novel from a scientific point of view, i.e., certain digital investments aim to overcome competitive disadvantages. While companies already exporting are "comfortable" regarding digitalization and focus on developing their existing ERP systems, companies that were not previously present in export markets want to increase their competitiveness with a number of innovative digital solutions. In other words, in a broader sense, digitalization is redefining global competitiveness.

From a business management perspective, suggestions can be made for companies wishing to export: the introduction of which digital systems and solutions can be a success factor in entering the international market. From a practical point of view, it can be considered a novel result that the use of ERP systems is significant for both companies that are already exporting and those that intend to enter the export market. Also novel is the finding that the usage of workflow, document management, BI, and industry-specific systems represents a new growth platform for companies that were not present in foreign markets at the time, but intend to internationalize in the near future.

One of the tools for increasing export activity is the usage of digital solutions and the implementation of more competitive corporate operations, required and enforced by these systems. Unfortunately, the digital development of domestic companies – especially SMEs – is low, which is a risk factor regarding their internationalization: their export capacity might remain limited as well. Moreover, it has also been clearly demonstrated that companies that only focus on the domestic market digitalize even less, which is a trap. This threatens to lose their markets over time, as digitally more mature companies might outperform them in their existing markets – even in the near future. These are new aspects that economic policy makers need to consider, i.e., helping organizations' transition toward a digital operation is important to stimulate export activity.

The limitation of our study is that only SMEs operating in Hungary were included in the sample. In the future, it would be worthwhile to examine the relationship between internationalization and digitalization in the case of SMEs in an international context.

The impact of sector affiliation and ownership structure on the digital maturity and foreign market activities of SMEs can be identified as a further research direction. It would also be worth expanding the research to analyze additional aspects of digital development and internationalization.

## V. Digital transformation of public services: The case of the document management application<sup>9</sup>

### Abstract

The article examines digital transformation in the public sector, focusing on its implementation and impact. A key milestone in Hungary's municipal digitalization is analyzed through a case study on the document management system of the Application Service Provider. Based on longitudinal data from over 3,000 municipalities, findings show that digital transformation delivers significant value to citizens and shortens administrative lead times. It enhances transparency, comparability, and efficiency in public administration. The study also emphasizes that adopting new technologies, standardizing processes, and centralizing IT management are critical factors in achieving these efficiency gains and modernizing public sector operations.

*Keywords:* public management, efficiency, digital transformation, centralization, transparency

### V. 1. Introduction

Digital transformation of public service delivery has been on the agenda in the past few decades (Dunleavy et al., 2006; Hao et al., 2020). However, moving toward a “true digital public administration” has only recently become crucial—partly as a result of the COVID-19 pandemic (Mergel et al., 2023; Moser-Plautz & Schmidhuber, 2023). As a result of the rapid advancement of information and communication technologies (ICTs), governments worldwide have progressively embraced various e-government features over the past few decades. Digital transformation outside the public sector is constantly reshaping citizens' expectations regarding the necessity for public administrations to provide high-value, real-time digital services (Mergel et al., 2019). Although many governments have not achieved their objective of digitizing all public services and administrative processes, there has been a notable increase in the adoption of new digital technologies, resulting in significant changes within public sector organizations (Enang et al., 2020; Gil-Garcia et al., 2018).

The trends toward digital transformation have evolved based on the premise that utilizing digital platforms for various public service activities and processes can lead to improved service

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<sup>9</sup> **Author contributions:** Borbála Szedmák: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing; László Varga: Conceptualization, Data curation, Investigation; Roland Z. Szabó: Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization.

quality, effectiveness, and efficiency (Mergel et al., 2023). Governments are constantly adapting their operational models to enhance service delivery, increase efficiency, effectiveness, transparency, and interoperability, and increase citizen satisfaction. The e-government literature extensively explores how digitalization has improved the efficiency and effectiveness of public service delivery (Aminah & Saksono, 2021; Margetts & Dunleavy, 2013; Scholl, 2022; Westerman et al., 2011), however, according to some scholars, the expectations in connection with the potential benefits of digital government are unrealistic (Alshehri & Drew, 2010). The outcomes frequently tend to be modest, and it is often challenging to produce visible impacts, especially in the short term (Y.-Q. Zhu & Kindarto, 2016; Ziemba et al., 2016).

Although the topic of digital government has been receiving much scholarly attention, there is a need for more empirical studies, especially focusing on the evaluation of service performance (Hanisch et al., 2023; Panagiotopoulos et al., 2019; Tangi et al., 2020; B. Zhu et al., 2024). The efficiency gains resulting from digital transformation in the public sector are often not quantified and are not examined in the long term (Gabryelczyk, 2020), particularly not in the Central and Eastern European region (CEE) (Dan & Pollitt, 2015).

Moreover, further research is necessary to comprehend the differences among digital transformation strategies in various countries and to understand the specifics of digital transformation projects in the public sector in order to develop a comprehensive theory of digital transformation, focusing on public administration (Mergel et al., 2019).

This study fills these research gaps by conducting a longitudinal analysis of a successful digital transformation project in the public sector. We have examined a milestone in the digital transformation of the Hungarian municipality system. Although the paper does not encompass the digital transformation of the entire public sector, it monitors the comprehensive transformation of a key pillar.

As a single case study, we have studied the impacts of the document management application provided by the Application Service Provider (ASP). Our conclusions are derived from a longitudinal analysis of the case numbers, case types, and case administration times of over 3000 municipalities, encompassing the period of 2017–2022. Furthermore, we have also conducted 24 expert interviews in order to identify the antecedents, goals, results, and effects of the project.

We have found that the digital transformation of the public administration system enhances the pace of transactions. The case illustrates how the complex interplay of the implementation of new technology, standardized processes and practices, and centralized IT management can lead to efficiency gains. Electronic transactions can be more efficient than paper-based transactions; however, not instantly: it takes a few years of learning to achieve efficiency gains. According to our results, the digital transformation of the public administration system also enhances paper-based transactions: the processes were transformed and optimized, which had a positive effect not only on the electronic but also on the traditional, paper-based cases.

The study is structured as follows. After reviewing the literature on the digital transformation of public services and formulating our hypotheses based on previous research findings, we define the research gaps and how our research fills them. Afterward, we introduce the methodology used, and then we present the results of the analysis regarding the hypotheses. In the discussion, we summarize the main steps—i.e., the “recipe” – for a successful digital transformation project in the public sector, and compare our results to the previous findings. Finally, we outline some further research areas.

## **V. 2. Theoretical background**

### **V. 2.1. Digital transformation of public services**

The advent of the Industrial Revolution 4.0 and rapid digital innovation has urged governments to leverage technology to enhance public services and the quality of administrative functions in order to enhance societal well-being (Salgues, 2018). Digital transformation beyond the public sector is reshaping citizens’ anticipations regarding governments’ capacity to provide high-quality, instantaneous digital services (Clarke, 2020). In reaction to these evolving expectations, governments are altering their operational paradigms to enhance the delivery of public services and increase efficiency, effectiveness, transparency, interoperability, and citizen satisfaction (Mergel et al., 2019). While increasing efficiency is a key motive for public sector digitalization, IT systems are often just copies of paper-based processes (Bergmann, 2021). Bergmann (2021) highlights that public–private partnerships may be a solution to achieve real efficiency gains. The importance of partnerships between digital governments and private technology companies is also highlighted by Margetts and Dunleavy (2024).

According to Aminah and Saksono (2021), e-government includes employing ICT to deliver government services to citizens and businesses with greater effectiveness and efficiency. It represents the integration of ICT into governmental operations, and delivering government

services through the utilization of information technology in order to enhance the performance of government institutions and services (Rodríguez Domínguez et al., 2011; Westerman et al., 2011). In order to successfully digitalize the public sector, it is of key importance to have sufficient organizational awareness of digital preservation and to dedicate change agents (Dorner, 2009). It is also essential to achieve organizational and cultural changes inside the government sector and behavioral shifts in the case of the actors of the society (Margetts & Dunleavy, 2002).

Information technology has brought several changes and advancements to public management. Technological advancements have prompted improvements in government service performance, aiming for greater efficiency, transparency, accountability, accessibility, and citizen participation (United Nations, 2016). More and more governments are embracing e-government as a strategy to bolster development efforts, and to achieve simplicity and automation in routine tasks and enhanced responsiveness in services provided for citizens (Dunleavy et al., 2006). Digital transformation within the public sector entails adopting novel approaches to collaborating with stakeholders, establishing fresh service delivery frameworks, and forging innovative forms of relationships (European Commission, 2013).

Digital-era governance (a term defined by Dunleavy et al., 2006) means a set of complex changes centered around IT. It entails the reintegration of functions into the government domain, embracing holistic and needs-driven structures, and digitalizing administrative procedures. The three main principles in detail are the following:

- **Reintegration:** Instead of decentralization, highlighted by New Public Management (NPM), reassembling many of the components that NPM divided up into distinct corporate hierarchies and shifting the responsibility for integrating public services into consumable packages to citizens and other civil society actors represent the key opportunities for utilizing digital-era technological opportunities. Key components of reintegration include the rollback of agencification, joined-up governance (JUG), re-governmentalization, reinstating central processes, radically squeezing production costs, reengineering back-office functions, procurement concentration and specialization, and network simplification.
- **Needs-based holism:** Processes have to be reengineered from end-to-end, and unnecessary steps, and costs have to be cut. Key components of needs-based holism include client-based or needs-based reorganization, one-stop provision, interactive and

“ask once” information-seeking, data warehousing, end-to-end service reengineering, and agile government processes.

- Digitization changes: In order to exploit productivity gains from the enhanced use of IT and related organizational changes, opportunities for transitioning to fully digital operations have to be seized. As the authors highlight, an important step toward digitalization is when organizations are able to shift from having the authoritative document on paper to electronically storing the documents. Key components of reintegration include electronic service delivery, new forms of automated processes—zero touch technologies (ZTT), radical disintermediation, active channel streaming, facilitating isocratic administration and co-production, and moving toward open-book government.

Public sector digitalization aims to enhance the satisfaction of users (Mergel et al., 2019) and create enhanced public value (Scupola & Mergel, 2022). Public value means the citizens’ expectations of the government and public services (Scupola & Mergel, 2022). In terms of e-government, it means improving efficiency, and services provided to citizens, and enhancing social values by focusing on inclusion, democracy, and transparency (Twizeyimana & Andersson, 2019). It includes the following categories (Panagiotopoulos et al., 2019; Scupola & Mergel, 2022; Twizeyimana & Andersson, 2019):

- Citizen value: Improving interactions with citizens,
- Economic value: Cost savings and time gains, resulting from greater administrative efficiency,
- Administrative value: Better public service delivery,
- Societal value: Better transparency.

According to Scupola and Mergel (2022), public sector digitalization in Denmark resulted in fewer government expenditures, increased efficiency, cost-effectiveness, time savings (economic value), improved data coherence and data sharing among different authorities, common platform, easier compliance with regulations (administrative value), more satisfied customers (societal value), one-stop-shop, better services with quality standards, transparency (citizen value).

**Hypothesis 1: Digital transformation of the public administration system results in significant efficiency gains.**

In connection with e-governance or digital governance, recentralization is highlighted by several authors. In line with some previous studies (e.g., Ibrahim, 2022; Margetts & Dunleavy, 2013), Hammerschmid et al. (2023) find that ICT reinforces recentralization, by analyzing digitalization strategies of eight European countries (Estonia, France, Germany, Italy, the Netherlands, Norway, Spain, and the United Kingdom). The example of India also supports the need for centralization in connection with digitalization: a centralized ICT-based infrastructure improved the speed of transactions in the case of the Government of India and its states (Kompella, 2017). While centralized ICT systems foster integration and result in centralized power and control, paradoxically, they also enable more flexibility and decentralization (Allen et al., 2001). According to Peled (2001), new information and communication technologies strengthen central power, but at the same time, they also help diffuse bureaucratic power. Centralization leverages economies of scale, which result from maximizing the potential of technologies that drive output growth at a faster rate than costs. Centralization keeps operations in line with protocols and standards. If operations are highly centralized, implementing a centralized IT system is both feasible and likely beneficial (King, 1983). (Re)centralization allows instantaneous data access for decision-making, and ensures reliability and security (Evaristo et al., 2005).

**Hypothesis 2: A centralized ICT-based infrastructure enhances the pace of transactions.**

Hanisch et al. (2023) emphasize that digital governance goes further than digitalizing the existing analogue mechanisms: digital governance includes new forms of organizing, and creating, and capturing value. IT is not enough in itself to achieve change; processes, people, policies, and leadership have to be changed in order to digitally transform the public sector. It is essential to view digital transformation as a holistic organizational approach rather than simply a shift toward online forms or the transition from analogue to digital public service delivery (Mergel et al., 2019). Technologies are becoming powerful tools for administrative reforms in the public sector; however, they are just one element of the complex system: it is also important to make adjustments to the business processes, organizations, and structures, which directly affect the deployment of technologies (Gil-Garcia et al., 2022). In terms of government transformation, digital transformation does not only mean the adoption of new technological tools: it is a comprehensive approach that can be characterized by change across all organizational aspects (Tangi et al., 2021). The scope of digital governance is more than just the usage of ICT in the public sector: it facilitates transformational changes in the operation and business processes of governments (Scholl, 2022). To reflect this comprehensive approach,

Haug et al. (2023) use the term digitally induced change instead of digital transformation in order to highlight that technology lays the foundations for transformative endeavors, but the primary effort and transformative potential are within the organizations themselves.

The relationship between information technology and business process reengineering (BPR) is twofold. On the one hand, information technology enables business process reengineering: the assistance of information systems is needed for the success of a BPR project (Grover et al., 1995). On the other hand, BPR is often needed for the success of the implementation of an IT system. The introduction of technological innovations must be preceded by an organizational transformation in order for the desired efficiency gains to be achieved. Organizational innovation indirectly supports technological innovations by providing a favorable ecosystem (Damanpour & Evan, 1984). To fully harness the potential of digitalization, outdated processes should be replaced with newly designed and optimized digital workflows (displacement), rather than simply layering digital tools over existing analogue systems (Marienfeldt et al., 2024). Electronic transactions are more efficient than paper-based transactions, but only if the processes and services are fully digital, linked up with identification systems, payment systems, etc., and there are no additional inhibiting factors, such as human intervention.

According to Davenport (2005), the benefits of business process standardization (BPS) surpass those anticipated from BPR, as BPS allows organizations to share processes more effectively. BPS offers better monitoring opportunities and improved communication and coordination, as it ensures the uniformity of processes across organizations (Wüllenweber et al., 2008). BPS can greatly enhance process performance, especially in service industries that benefit from economies of scale (Bharadwaj et al., 1993). Münstermann et al. (2010) also highlight that the positive effects of BPS on process time, cost, and quality are strongest in the case of service firms. Standardization improves process performance, reduces cycle-time and process costs, leads to improved process quality, reduces the probability of mistakes, helps react to changes (e.g., regulatory changes), makes processes transparent, and helps benchmarking—as a result of common key performance indicators (Münstermann et al., 2010).

The benefits of BPS are highlighted in the case of the public sector as well. It allows governments to centralize functions through shared services (Kubicek & Cimander, 2009), shortens service lead times, and allows multiple public services to share the same process, resulting in additional cost savings (Mukherjee et al., 2021). Standardizing processes and making them available as a shared resource across public service agencies can unlock significant value through economies of scale (Mukherjee et al., 2019).

Although digitalization can enhance efficiency through repeated and rule-based transactions and can improve transparency, it is not a solution that can cure all problems: it is important to find the right measures and complement automated governance with analogue governance to overcome its weaknesses. Digital transformation requires a complex change in business operations that affects both new (electronic-based) and traditional (paper-based) transactions.

**Hypothesis 3: Electronic transactions are inherently more efficient than paper-based transactions.**

**Hypothesis 4: Digital transformation of the public administration system also enhances paper-based transactions.**

### **V. 2.2. Research gaps**

Although digital services within the public sector are considered to be among the most vital elements of the administrative system's reform and the topic has received much scholarly attention (Hao et al., 2020; Ma & Zheng, 2018), there is a need for more empirical studies, particularly in the evaluation of service performance, and there is limited evidence indicating that digital services have resulted in accelerated development (B. Zhu et al., 2024). Hanisch et al. (2023) also highlight the question of how organizations can take advantage of digital governance as a further research field. There is little empirical evidence about the outcomes of digital transformation in the public sector (Panagiotopoulos et al., 2019; Tangi et al., 2020), and further research is needed in order to understand public value creation through digital transformation (Mergel et al., 2019). Efficiency gains as a result of digital transformation are not sufficiently quantified in the public sector. While previous research has pointed out that small and large firms have different opportunities and potentials in connection with digital transformation (Horváth & Szabó, 2019), this issue has not been investigated in the case of the public sector.

Furthermore, additional investigation is needed to understand the differences between different countries' digital transformation strategies, and what a specific digital transformation project within public administrations looks like in order to develop a comprehensive theory of digital transformation in the public sector (Mergel et al., 2019). Our study contributes to this goal by introducing a nationwide example of successfully digitalizing government services in the CEE region.

According to Gabryelczyk (2020), it is a further research direction to explore and understand the effects of public governance digitalization in the long term. We aim to contribute to the

research field by providing a longitudinal analysis of the digital transformation of the public administration system, with special attention to the main public services offered by municipalities.

There is also little knowledge of how public value is created through digital transformation in governance (Scupola & Mergel, 2022). Our study shows a great example of how public value can be created (and measured) by digitalizing the main public services offered by municipalities. The article aims to contribute to the investigation of the mentioned research gaps by introducing a successful case for digitalizing a country's municipality system, and providing empirical evidence for the efficiency gains resulting from it, and measuring these gains. Although the paper does not encompass the entire digital transformation of the public sector, it monitors the comprehensive transformation of a key pillar which could be a role model for other large-scale digital transformations in the public sector.

### **V. 3. Methods**

The article introduces the case—as a single case study— of the document management application of the Application Service Provider (ASP), a nationwide effort to digitalize the public sector at the level of the municipalities. The study uses mixed methods in order to triangulate the sources (Jack & Raturi, 2006). In the frame of qualitative research, document analysis was performed. Three studies—created by the Hungarian State Treasury and the National Infocommunications Services Company (NISZ)—were analyzed about the digital transformation of the public sector in Hungary. These include:

- A feasibility study about the implementation,
- A system review (municipal ASP 2.0),
- And a study on the operating model of the regional IT application service centers.

Besides analyzing these documents, 24 semi-structured expert interviews were also conducted between February and May, 2024 about the project, its antecedents, goals, the structure of the application service center, and the results and effects of the project. Appendix 1 summarizes the interview guidelines. The predefined set of questions helped us guide the conversation toward the areas and issues we wanted to address (Qu and Dumay 2011). At the same time, semi-structured interviews offered us flexibility to explore new topics by not strictly adhering to pre-prepared questions.

Interviewees (Table 13) included managers and officials of organizations creating and maintaining the ASP, namely the Ministry of Interior, the Ministry of National Economy, the

Hungarian State Treasury, the National Infocommunications Services Company (organizations of the central public administration), municipalities, consultants and technology providers. As a sampling strategy, we used a comprehensive sample (Miles and Hubermann 1994): we interviewed all key stakeholders. Appendix 2 introduces the coding system used for the analysis of the interviews.

Table 13: Details of interviewees

<b>Interviewee ID</b>	<b>Role</b>	<b>Overall work experience (in years)</b>	<b>Gender</b>
1.	technology provider	15+	male
2.	technology provider and central public administration	30+	male
3.	technology provider	15+	male
4.	consultant	20+	male
5.	technology provider	15+	male
6.	central public administration	15+	male
7.	technology provider	15+	male
8.	central public administration	20+	male
9.	consultant	25+	male
10.	technology provider	35+	female
11.	technology provider	20+	male
12.	technology provider	10+	female
13.	technology provider and central public administration	10+	female
14.	technology provider	20+	male
15.	municipality	20+	male
16.	technology provider	15+	male
17.	technology provider	20+	male
18.	technology provider	20+	male
19.	technology provider	25+	male
20.	technology provider	25+	male
21.	technology provider	15+	female
22.	consultant	45+	male
23.	consultant	20+	male
24.	consultant	35+	male

Source: own construction

In order to empirically measure the effects of the nationwide project, quantitative analysis was performed as well. The measures used are the following:

- The number of cases,
- Efficiency gains, measured by case closing time, referring to the speed of completing a service (Chan et al. 2021; Kim et al. 2006; Voghouei & Jamali, 2018).

A case refers to any public issue or responsibility which is assigned to local authorities for regulation and administration in the interests of the local population and businesses. Such matters typically include urban planning, local transport, waste management, local economic development, education at the municipal level, and social services. One case may include many documents, if the citizen has several questions, or if incomplete documents are returned to customers several times. In these cases, the citizen and the municipality are sending each other several documents back and forth, but all these documents belong to one case.

All measures were analyzed in the case of paper-based, electronic, and hybrid file (document) types. In order to fill the research gap defined by Gabryelczyk (2020), a longitudinal dataset was used for the period of 2017–2022. We have followed the digital transformation of 1324 entities (aka tenants) (meaning more than 3000 municipalities).

According to previous studies, size matters in the case of digital transformation (Horváth & Szabó, 2019). SMEs are typically less prepared for new technologies (Smit et al., 2016), have fewer financial resources (e.g., McMahon, 2001; Mittal et al., 2018), and experience, and also face capacity constraints in terms of digitalization (Kennedy & Hyland, 2003). In contrast, MNEs have better resources and capacity, thus far greater opportunities to invest in new technologies than SMEs (Dangayach & Deshmukh, 2005). Based on these studies, we used the size of the entities as a control variable:

- small entities: under 10,000 cases/year,
- medium-sized entities: between 10,000 and 49,999 cases/ year
- large entities: 50,000 cases or more/year.

According to these categories, our sample includes 1,132 small, 181 medium-sized, and 11 large entities.

The data obtained was analyzed using descriptive analysis techniques.

#### **V. 4. Results**

Although municipalities have the same tasks in terms of public accounting and local taxation, regulated by legislation, in the past, there was no common IT solution for supporting them. All municipalities were struggling to develop their isolated solutions for a specific area, which resulted in not only very costly, heterogeneous operations, but also made it hard to oversee their actual financial status.

By recognizing this problem, the central public administration decided to develop a central IT application platform, namely the Application Service Provider (ASP) to standardize and

support local governments' internal operations and offer them the needed electronic administration services free of charge.

#### **V. 4.1. The need for an integrated digital solution**

In the last decade, local governments applied for public funding and spent billions of HUF in Hungary on the construction and development of their IT systems and electronic administration. The results of the implemented programs affected approximately 20% of the local governments and 65–70% of the Hungarian population. Municipalities with a larger population and wealthier resources were successful in using the funds, while the municipalities of smaller settlements were only able to take advantage of the opportunities to a limited extent.

Although there was no framework to ensure the efficient use of resources, several successful pilots were created. At the same time, the assessment of the results is mixed, because fragmented solutions were created, as a result of which local governments reached very different levels of e-government administration maturity. The development of the back-office applications of local governments did not proceed at the desired pace either; they remained mostly heterogeneous and partly outdated. Furthermore, registers were fragmented, and municipalities still lacked interoperability. Moreover, most of the services implemented within the framework of the developments reached only the second level (initiating a case) and the third level (bilateral interactive communication with the municipality) of the service levels defined by the EU; a significant number of local governments faced challenges with achieving the fourth level (implementation of full-scale digital administration, including electronic payments). Finally, the maintenance and operation costs of the implemented systems in many cases clearly exceeded the budgets of the local governments.

The majority of local governments concentrate their resources on performing their mandatory tasks, so concerning e-government administration solutions, their resources only allowed them to create their own websites. Websites are usually one-way communication channels that fulfil just the basic level of e-government services in the case of the majority of local governments. Electronic submission of downloaded forms was possible only in some larger municipalities. Various modern IT solutions—integrated document management systems, group work support, electronic administration, workflow support, etc.—only occurred occasionally.

Based on the above experiences, it is clear that individual subsidies in the domestic local government system do not ensure the efficient use of resources. Centrally developed integration and interoperability standards are needed in order to avoid fragmented developments, and it is

also necessary to ensure that the applicable solutions can be financed in the long term by municipalities.

#### **V. 4.2. The Hungarian municipal ASP – A central, shared service for municipalities**

The demand for the dissemination of technical quality standards, the requirement for optimal investment, and operating resource utilization raised the need for the introduction of the municipal ASP and its nationwide expansion by 2018.

By applying the principle of shared services, using resources efficiently, and ensuring sustainable operation, the municipal ASP makes it possible to modernize fragmented and outdated technology applications and supports interoperability. It supports local governments in performing their tasks and internal operations, thus it increases the internal operational efficiency of local governments with the help of modern IT solutions and related organizational development; simplifies and unifies their reporting obligations; and helps provide unified municipal electronic administration services.

The municipal ASP supports the central public administration in monitoring the resource management of local governments with modern tools and methods, which contributes to the timely recognition of possible financial risks and the preservation of the solvency of the local government subsystem, and it also helps centralize the municipal reporting system.

As a result of the municipal ASP, parallel institution building can be avoided, as applications are provided centrally. On the other hand, local governments have gained a prominent role in providing public administration services: citizens and businesses can access municipal and central administration services locally, in a one-stop shop.

The long-term goal is for municipal ASP to increase the performance of public administration, in order to achieve faster administration and better customer service, contribute to the development of the e-economy, strengthening Hungary's competitive position, attracting investors, and creating new jobs, and increasing digital literacy and providing equal opportunities for the disadvantaged.

By establishing modern, integrated, and cost-effective, state-of-the-art IT support services both for the municipalities and their customers, this development was a significant step in the governmental digital transformation roadmap to achieve the e-government state. Thanks to the services offered by the municipal ASP, not only is the internal operation of municipalities digitally transformed, but it has also become possible for citizens and businesses—as the clients of local governments—to manage their cases electronically, regardless of location, 24 h a day.

The municipal ASP is a modular, integrated system, which consists of the following main subsystems for supporting the related business operations and processes:

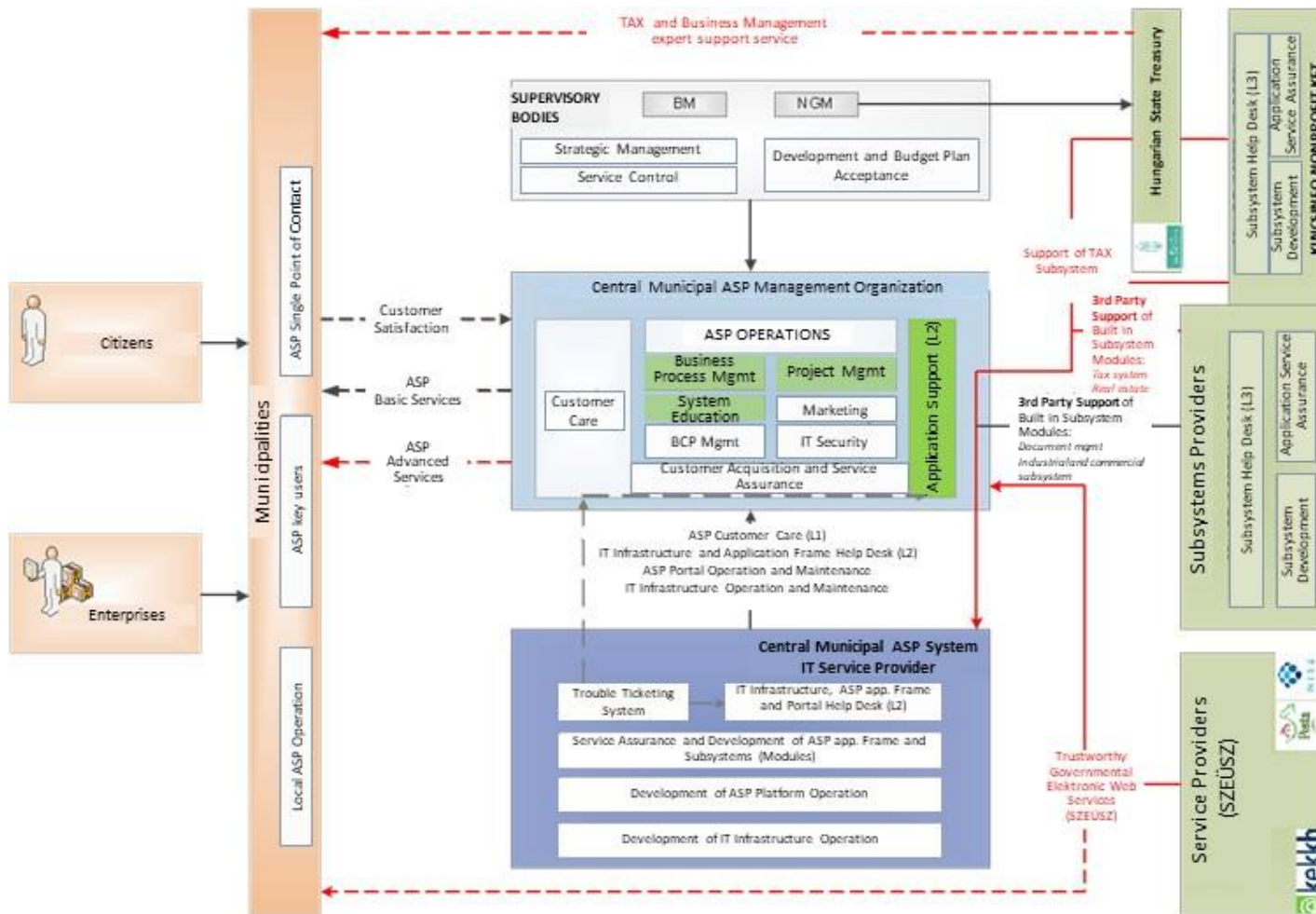
- management system
- real estate system
- municipal tax system
- document management system
- municipal portal system
- industrial and commercial system.

#### **V. 4.3. Organizational and operational model of the municipal ASP**

The Hungarian State Treasury (hereafter Treasury) has been designated as the operator of the municipal ASP Center, while the IT operation is assigned to the National Infocommunications Services Company (hereafter NISZ). The application operation of the individual subsystems of ASP – according to the type of the system - is shared between the Treasury and NISZ, and is supplemented by the support of third-party vendors.

The top-level state responsibility of ASP operation is shared between the Ministry of Interior (hereafter BM) and the Ministry of National Economy (hereafter NGM). The tasks and responsibilities of the organizations directly involved in the operation of ASP are shown in Figure 10.

Figure 10: The tasks and responsibilities of the organizations directly involved in the operation of ASP



Source: own construction

The ASP Center is responsible for the long-term, sustainable operation and nationwide expansion of the municipal ASP. The management of the ASP Center is provided by the Hungarian State Treasury, while the IT background is provided and operated by NISZ, which is also responsible for providing (together with other governmental central organizations) electronic access to central administration records and related electronic services (SZEÜSZ).

The Management Organization is responsible for providing municipal ASP services at an expected quality level, supports operations management, prepares the necessary supervisory decisions, as well as supervises the organizations taking part in operating the system. The ASP Management Organization is the most important, central element of the ASP system: it manages all the other organizations (affiliated ASP tenant municipalities, IT Service Providers, organizations operating specific subsystems, public administration bodies, and supervisory bodies) participating in providing ASP services.

The IT Service Provider operates the framework of the ASP, the data center, and the IT network infrastructure that ensures the operation of the municipal ASP Center.

The BM, as the supervisory body of NISZ, and the NGM, as the supervisory body of the Treasury, are directly responsible for ensuring the long-term sustainability of the municipal ASP by securing the necessary operational and legal environment and by providing strategic management and decision-making support.

The basic purpose of the Municipal ASP is to provide appropriate standardized, shared central services to its clients, i.e., municipalities, and through them, to the clients of the municipalities as well. Most of the ASP operation tasks are covered by the ASP Center, however, the participating ASP tenant municipalities also have a role in the smooth service operation. By joining the ASP, certain service management and service support tasks should be carried out by local municipalities, and the following roles must be designated: official representative, ASP contact person, key user(s), and local IT operator(s).

The organizations providing SZEÜSZ and public registry services appear as background service providers in the ASP operation model. (The use of these services is determined by legislation.) Our analysis focuses on the document management subsystem of ASP, as this was the pioneer and most successful application

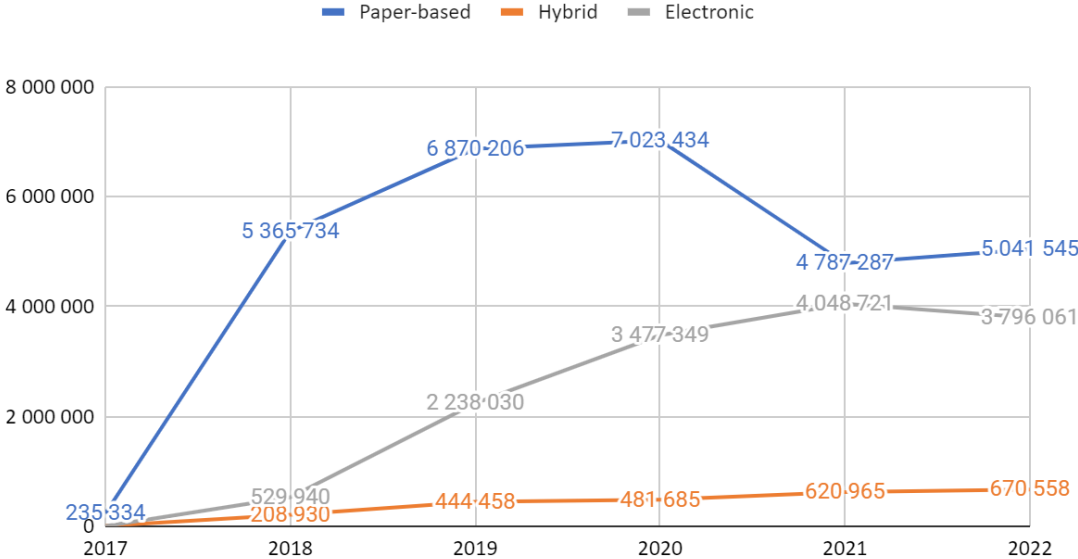
#### **V. 4.4. Empirical evidence for the success of the municipal ASP**

Our analysis (Figure 11) shows that most municipalities switched to using the system within 1 year, but by 2019, almost every one of them had started to use the document management

application, which means 1,324 tenants (It means over 3,000 municipalities because small settlements and districts are incorporated into one tenant).

The number of cases continued to increase until 2019, and then—due to COVID-19—it decreased significantly. The reason for this is that the deadline for several expiring permits and licenses has been automatically extended, thus new cases did not have to be opened.

Figure 11: Number of case file types

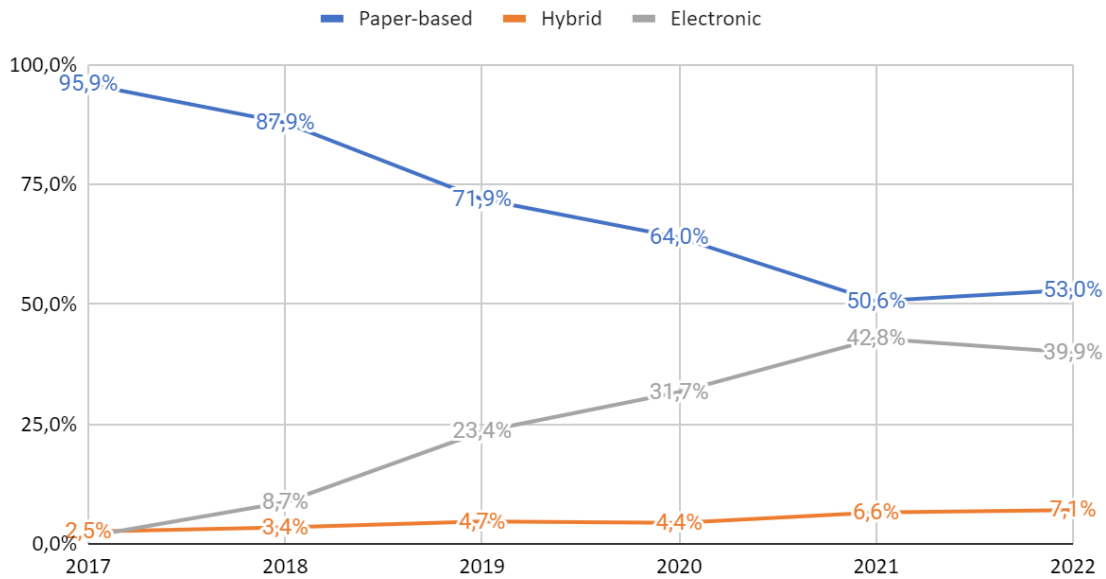


Source: own construction

Electronic administration is gaining an ever-increasing role, by 2021, almost 50% of the cases have become electronic. By 2022, the number of electronic cases slightly dropped. It is a question of whether this is just a temporary stabilization period or the boundary of digital transformation in the case of Hungarian municipalities.

The spread of digitalization was also supported by the pandemic: the increase realized in 2020 and 2021 in favour of electronic case numbers is clearly visible (Figure 12). Using electronic services is in the best interest of citizens as it makes administration easier and faster. The pandemic accelerated this shift.

Figure 12: Ratio of case file types



Source: own construction

Our interviewees highlighted the efficiency gains as a result of introducing the document management application. The application supports municipalities in performing their tasks in a standardized and optimized way, as processes and tasks were optimized before introducing the application by considering municipalities' opinions and best practices as well. As a result, municipalities' internal operational efficiency has increased, and the time needed to handle cases has drastically decreased. Municipalities were required to join the ASP according to a predefined schedule, ensuring that efficiency gains appeared country-wide.

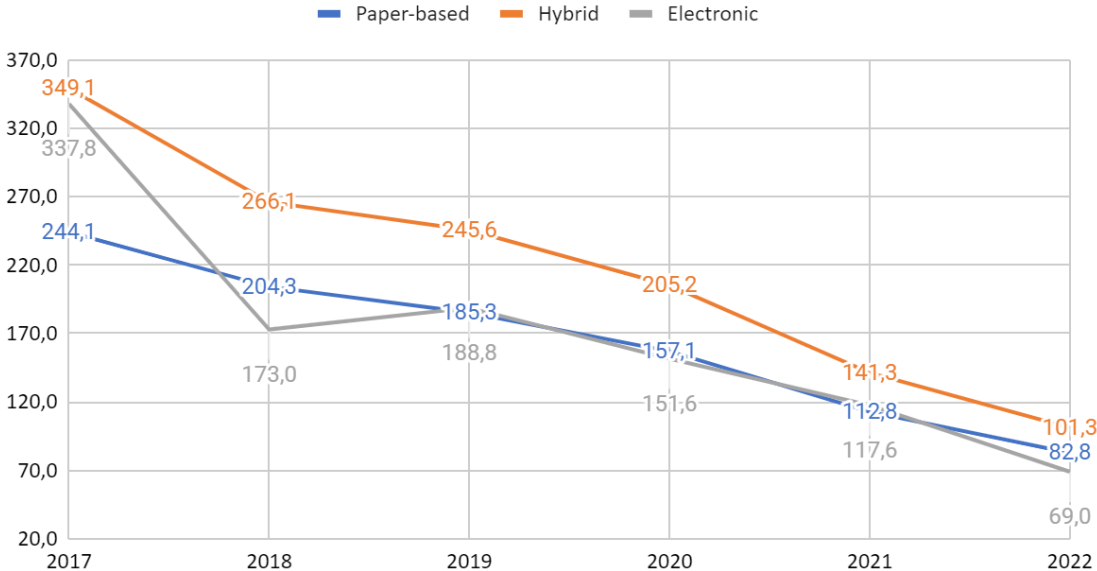
The efficiency of the system is also shown by the fact that the administration time (case closing time) has been radically reduced. This supports **hypothesis 1**: Digital transformation of the public administration system results in significant efficiency gains, and **hypothesis 2**: A centralized ICT-based infrastructure enhances the pace of transactions.

The trend of the decreasing case closing time can be observed in the case of not only the electronic but also the paper-based case numbers. Thus, digital transformation and related process development, standardization, and transparent performance encouraged the entire organization to manage cases faster. This supports **hypothesis 4**: Digital transformation of the public administration system also enhances paper-based transactions.

In connection with the electronic cases, the learning curve is clearly visible: in the beginning, in 2017, closing time in the case of electronic cases was even longer than in the case of paper-based cases, but in 2022, it was already 13.8 days faster on average (Figure 13). In the

beginning, digitalization caused additional tasks, but shortly after, quick wins were realized, as several processes were optimized and managed digitally, by using the document management application. Then, the co-evolution of paper-based and electronic cases can be observed. After the processes were optimized and set up, it became evident that electronic cases are faster. It partly supports **hypothesis 3**: Electronic transactions are inherently more efficient than paper-based transactions. This is true if the processes and services are fully digital, linked up with identification systems, payment systems, etc., and there are no additional inhibiting factors, such as human intervention. It took a few years of learning to achieve this state. It does matter when we analyze the speed of managing (electronic) cases: in the case of the municipal ASP, it took a learning period of 5 years for electronic cases to become faster, i.e., more efficient than paper-based transactions.

Figure 13: Average case closing time (days)



Source: own construction

Our analysis also points out that organizational size matters in the case of digital transformation: larger organizations have more potential benefits (Table 14). In the case of small municipalities, the speed of transactions was higher in the beginning (2017) in the case of paper-based, hybrid, and electronic cases as well, compared to large municipalities. However, in 2022, the opposite can be observed: large municipalities manage cases faster.

Table 14: Average case closing time (days) in the case of small, medium and large municipalities

	Paper-based			Hybrid			Electronic		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
<b>2017</b>	238	249	1 034	345	350	1 419	240	386	1 497
<b>2018</b>	193	233	268	243	305	339	171	176	187
<b>2019</b>	174	190	240	231	245	308	162	170	314
<b>2020</b>	148	156	217	202	208	209	137	131	248
<b>2021</b>	114	112	109	142	141	139	103	98	201
<b>2022</b>	87	79	75	107	96	101	74	71	51

Source: own construction

**V. 5. Discussion and conclusion**

**V. 5.1. Steps for successfully digitalizing the public sector**

Based on the success of the municipal ASP, the following recommendations can be defined for how to drive change and digitally transform the public sector. First, an *initial challenge* is needed. It was necessary to ensure that the municipalities operate transparently and in accordance with the legal regulations. It was not possible without digital technologies. However, digital technologies were expensive, thus only the larger municipalities could afford them, and they had the urge to function properly. Second, it is of key importance to *lobby*. Technology providers lobbied the government for the entire sector to work with their software in order to achieve transparency. In return, the provider could give its technology cheaply to the state, and the state was able to give the services for free to the municipalities. Thus, the financial challenge was defeated. A *strategic partnership* has also to be formed. Representatives of the main institutional stakeholders serving as change agents formed a strategic coalition to lead the digital transformation of the municipalities. Furthermore, *having a vision* is also essential. The vision of digital municipalities was a centralized platform with different applications that help municipalities operate transparently and follow the legal requirements. Moreover, *change agents* have to be mobilized. In the case of the ASP project, pioneer change agents were the technology providers which developed applications to the ASP, and pioneer users, i.e., the first municipalities that used the applications and served as success stories for roll-out. Finally, *continuous growth* has to be ensured. The document management application was downloaded by 1,377 users by the end of the first year (2016). The number of cases (including electronic, paper-based, and hybrid cases), managed by the document management application, increased from 245,333 to 8,219,490 between 2017 and 2022. Based

on the success of the document management application, further applications were implemented on the ASP.

Our case provides a great example of the importance of change agents (Dorner 2009) and achieving organizational and cultural changes and behavioural shifts in the case of all stakeholders (Margetts and Dunleavy 2002).

### **V. 5.2. Efficiency and recentralization**

Through the municipal ASP, the Hungarian government enhanced the transparency and efficiency of government services (Aminah & Saksono, 2021; Mergel et al., 2019). Delivering government services through the utilization of information technology improved the performance of government institutions and services (Westerman et al., 2011): case closing times have decreased significantly. In line with Hammerschmid et al. (2023), we found empirical evidence for the continued importance of the key feature—namely, efficiency—of NPM in the digital era.

Although Hungary has a different socio-economic background and lags behind Denmark in terms of different indices measuring digital maturity, such as the DESI index, the digital transformation of the public administration system in Hungary have similar results as the Danish case example (Scupola & Mergel, 2022). The municipal ASP led to increased efficiency and time savings (economic value), a common platform, improved data coherence and data sharing, compliance with regulations (administrative value), more satisfied customers as a result of reduced case closing times (societal value), better services and transparency (citizen value). For citizens, i.e., customers, administration is a hassle: their goal is to get their cases arranged and closed as fast as possible, without a lot of interactions and long hours spent in government offices. From this perspective, digital services provide value for them as digitalization accelerates administration time.

While our data support that electronic transactions are more efficient than traditional, paper-based transactions, we cannot state that electronic transactions (i.e., e-government or digital government) are instantly more efficient: a learning period is needed in order to achieve efficiency gains. Although it requires a few years of learning, our analysis also shows that larger organizations have more potential benefits due to economies of scale. This is in line with previous studies (Dangayach & Deshmukh, 2005; Horváth & Szabó, 2019; Kennedy & Hyland, 2003; McMahon, 2001; Mittal et al., 2018; Smit et al., 2016).

In terms of digitalization, it is a crucial milestone for many organizations to transition from utilizing physical files and documents to electronic document management, and printing paper copies when necessary (Dunleavy et al., 2006). Our case shows a great example of exceeding this step of digital maturity: Hungarian ASP includes not only electronic document management; in this case, the whole workflow is digitally driven.

Although the key components of digital-era governance (Dunleavy et al., 2006) refer to the central, national governance system, many of them appear in the case of the municipal ASP. Rollback of agencification happened through the mergers of municipalities, and central processes were (re)established by having one central system for all municipalities. Back-office functions were reengineered: the legacy system of paper copies was replaced by electronic workflows. In our case, not only did the back-office functions change, but new opportunities opened up for the front office, too: citizens can easily submit their requests through an easy-to-navigate interface. Procurement concentration can also be observed: all municipalities have to use either the applications provided in the frame of ASP, or they can use other systems, but in this case, these other systems must have exactly the same functions. In the latter case, municipalities are also responsible for finding and buying these other systems. Based on the fact that the municipal ASP resulted in more than 90% growth in terms of efficiency, it can also be assumed that it contributed to radically reducing process costs. However, this is an area which requires further analysis.

In terms of needs-based holism, client-based reorganization, one-stop provision, interactive and “ask once” information seeking, and data warehousing can also be observed in the case of the nation-level digital governance services in Hungary. Citizens can easily access all services through one interface, and their data is centrally stored. ASP represents an end-to-end service reengineering and is a great example for achieving agile government processes as well: legal compliance is an essential feature.

Digitization changes can be widely observed in the case of the ASP. These changes include electronic services delivery (ESD), centralized, state-directed IT procurement, radical disintermediation (by making it possible for citizens and other stakeholders to directly connect to state systems), and a citizen-centered approach. However, some of the digitization changes defined by Dunleavy et al. (2006) do not appear in our case example. e.g., instead of active channel-streaming, workflows are the same no matter whether the “customer” started the process online or offline. Furthermore, the municipal ASP does not include new forms of automated processes, e.g., “zero-touch technology” (ZTT), either. It can be a future

development stage; however, it is a question of to what extent digitalization is desirable in the public sector. According to Hanisch et al. (2023), augmented forms will be superior, where analogue and digital forms will co-exist and overcome each other's shortcomings.

In line with some previous studies (Hammerschmid et al., 2023; Ibrahim, 2022; Margetts & Dunleavy, 2013), our case also highlights the importance of (re)centralization in connection with digitalizing the main public services offered by municipalities: one central system was established for all municipalities. Just like in India (Kompella, 2017), a centralized ICT-based infrastructure improved the speed of transactions in Hungary, too. At the same time, this centralized ICT system enables decentralization for municipalities (Allen et al., 2001). The case study shows how centralization can keep operations in line with protocols and standards, leverage economies of scale (King, 1983), ensure reliability, and provide instant data access (Evaristo et al., 2005). The document management application helps strengthen central power and diffuse bureaucratic power at the municipality level (Peled, 2001).

### **V. 5.3. Digital governance goes further than digitalizing the existing analogue mechanisms**

As Hanisch et al. (2023) and Merger et al. (2019) highlight, digital governance includes new forms of organizing, and creating value: IT is not enough in itself to achieve change; processes, people, policies, and leadership have to be changed. Our case provides an example of how the processes were transformed as a result of digitalization: the aspiration for a digital government positively impacted the paper-based processes and cases as well. It was not only a shift from analogue to digital services; it was rather a holistic and comprehensive approach that incorporated the optimization of all processes, as described by Mergel et al. (2019), Tangi et al. (2021), Haug et al. (2023) and Gil-Garcia et al. (2022). As Scholl (2022) and Grover et al. (1995) highlight, the digitalization of the public sector facilitates and enables transformational changes in the operation and business processes. According to Dunleavy et al. (2006), technology itself does not transform organizations; rather, it is how organizations operate and utilize technology that alters work practices. This could be observed in the case of the municipal ASP.

Our study shows the importance of organizational transformation (Damanpour & Evan, 1984), business process reengineering and standardization (Bharadwaj et al., 1993; Davenport, 2005; Marienfeldt et al., 2024; Mukherjee et al., 2019, 2021; Münstermann et al., 2010; Wüllenweber et al., 2008) in connection with implementing a technological innovation and achieving the expected efficiency gains. In the case of the ASP project and specifically, the document

management application, the standard processes were defined by the related laws on a high level, but the standards on the municipality level were missing: these high-level regulations had to be broken down and standard processes guiding the operations of municipalities had to be defined. Process reengineering was necessary in the case of most municipalities in order to get rid of old practices and achieve legal compliance, and operate effectively and efficiently. A centralized IT system helped keep operations and processes in line with the laws and standards and offered the benefits of the scale of economy (King, 1983). Without an IT system, a lot of auditors would have been needed to audit the processes. An IT system can enforce that municipalities follow the pre-defined processes and standards. Thus, the analyzed project shows how the implementation of new technology, standardized processes and practices, and centralized IT management together can lead to improvements in the processing time of cases.

#### **V. 5.4. Further research directions**

The very same activities and initiatives may not be working in different contexts. It would be important to analyze the cultural differences between municipalities and identify the barriers to using the municipal ASP, especially the document management application. There might be some municipalities that are counter-interested in transparency. How can we overcome these barriers and cultural differences and motivate the municipalities which are currently performing poorly in terms of digitalization? It would be an interesting further research avenue to analyze and compare the cases of the best and worst-performing municipalities.

Based on the fact that the municipal ASP resulted in more than 90% growth in terms of efficiency, it can also be assumed that it contributed to radically reducing process costs. However, this is an area which requires further analysis. e.g., how has the number of employees of the municipalities changed? As a result of digitalization, their workload decreased; however, it is a question of whether it appears in terms of costs as well.

According to Hanisch et al. (2023), it is important to find the right measures in terms of digitalization: it is unlikely for automated governance to emerge as the sole dominant form. Instead, the prevailing mode of governance is likely to evolve toward augmented forms, blending analogue and digital approaches to complement each other and address their respective shortcomings. From this perspective, it would be interesting to analyze the case types within the document management application, and - based on the case numbers and the complexity of the cases - investigate which case types should be fully automated and which should be handled by humans. What are the barriers to fully automating the processes?

As previously discussed, digitalization reinforces centralization. However, it is also important to find the right balance between centralization and decentralization. It would be a further research area to investigate in the case of which case types it would be preferable to handle the cases in a decentralized way versus in a centralized way. e.g., as a future step, those cases that occur rarely could be handled by a central specialist.

The case study approach usually has limitations and potential contextual constraints regarding the generalizability of the findings; thus, it is recommended to investigate the research questions in the case of other countries' municipal systems. On the other hand, although local government systems vary greatly across countries, inefficiencies stemming from decentralized operations can be observed in many cases. Institutional backgrounds are different from country to country, but a lack of human, financial, and technical resources, higher administrative costs, etc., can limit the ability of municipalities to effectively deliver public services under decentralized conditions (see e.g., Faguet, 2004). While municipalities are decentralized by nature, our case highlights that (re)centralizing some administrative functions can resolve these inefficiencies.

## **VI. Summary of the results of the dissertation**

Digital transformation is not just a technological shift but also a social and economic challenge that drives all players of the economy to take action. Companies that successfully implement digital transformation - not only in production but also regarding business administration processes - can achieve a significant competitive edge, concentrate on higher value-added activities, and enhance operational efficiency. The Fourth Industrial Revolution is a key research topic in management sciences, yet many questions in the field of management remain unresolved. In my doctoral dissertation, I aimed to explore the role of digital solutions in strategy. I analyzed this question in two distinct contexts: the internationalization of SMEs and the digitalization of a municipality system, by relying on the theoretical foundation of dynamic capabilities.

### **VI. 1. Result of the conceptual framework, literature review, and the articles**

#### **Chapter II. 2. – The erosion of dynamic capabilities**

The literature on dynamic capabilities is extensive, yet the phenomenon of capability erosion remains largely unexplored, presenting a significant research gap. While much attention has been given to the development and evolution of capabilities, there is limited academic focus on their decline. Understanding variations in capability levels is essential for explaining differences in firm performance: investigating the erosion of dynamic capabilities could provide valuable insights into performance heterogeneity among firms. This chapter defines the phenomenon of dynamic capability erosion and introduces a conceptual framework for dynamic capability erosion. The framework explains why previously well-functioning companies go bankrupt, and helps us detect the signs of failure in advance, i.e., if an organization is unable to prevent an unwanted change or shape the environment accordingly, react to the change, and rebuild, replace the eroded or devaluated ordinary capabilities, or adjust the business model accordingly.

The framework highlights that the strength of an organization's dynamic capabilities has to be evaluated relative to the unwanted change it encounters. By introducing the concept of the relative strength of dynamic capabilities, the study redefines the basics of measuring dynamic capabilities: dynamic capability scales have to be viewed dynamically, in the light of the given challenge.

## **Chapter II. 4. – Drivers and barriers of digital solutions**

I defined the term Management 4.0 as the usage of technologies and systems that help management and business administration processes, decision-making, operations, and back-office functions in the digital age. These solutions have become the new foundations of strategy as they provide an opportunity for the strategic apex to control the organization directly, thus influencing the business model and organizational structure of the company. I analyzed the drivers and barriers of the implementation of digital solutions by systematically reviewing 191 scientific articles published in Scimago Q1 journals, related to the field of management, complemented by 55 other fundamental articles. The main drivers are institutional pressures, creating value for the customer/ enhancing customer satisfaction, enhancing decision-making, improving knowledge management, productivity, and efficiency, and strategic factors (such as enhanced innovation, competitiveness, adaptability to change, agility, future growth, improved effectiveness, and internationalization). The barriers are related to human resources, financial resources, and profitability, organizational factors (such as unreadiness for change, lack of organizational resources, complexities of the cooperation between humans and digital solutions, imitability, fear of transparency), and technological concerns.

### **Article 1 – Success factors of digital solution implementation**

By identifying and interpreting the success factors (and main pitfalls) of digital solution implementation, the article provides guidance for organizations navigating digital transformation. Although numerous previous studies have summarized success factors either focusing on individual systems or on digital transformation as a whole (see e.g., Heuermann et al., 2024), the present study takes a comprehensive view of digital solutions — by using a systematic literature review and qualitative interviews—to define the key factors and complement them by highlighting characteristics specific to the Hungarian context.

Based on the systematic literature review of 246 scientific articles, the paper identifies the three comprehensive success factors of digital solution implementation: technological factors, technology – organization fit, and management competence. Previous systematic literature reviews (e.g., Barbieri et al., 2023; Al-Assaf et al., 2025; Ain et al., 2019) typically highlighted individual, organizational, and technological factors as critical success factors. In contrast, the present study emphasizes the importance of organizational alignment: the key to success lies in ensuring that the system fits the organization's capabilities and requirements. Moreover, regarding individual and organizational factors, our study highlights the importance of

management: it is not the existing capabilities but management competence that is crucial, as gaps in capabilities can be compensated through effective management either before or during the implementation process.

The qualitative research emphasizes the crucial role of project champions, process orientation, and experiential learning in the success of digital solution implementations in the Hungarian context. Drawing on the analysis of 10 expert interviews, Hungarian contextual factors are also analyzed, which hinder digital solution implementations: insufficient technological conditions often cause problems, and workarounds are common; process thinking is often lacking in many Hungarian companies, which complicates the implementation of digital solutions; leading digital solutions are typically not developed to meet the needs of Hungarian SMEs; few leaders are capable of and willing to drive digital transformation; change readiness is generally low; the common mindset of “why should I bother, I’ll get paid anyway” can undermine projects; if a system implementation fails, organizations are often less willing to try again; in foreign-owned companies, IT implementation decisions are typically made outside of Hungary.

The interviews complementing the systematic literature review also highlight several issues of international interest that are not addressed in the literature but significantly influence success, making them worthy of investigation in future studies. Regarding technology, it is important to have realistic expectations, taking the system’s maturity into account, and to adopt the system at the stage of the hype cycle that best balances technological maturity and initial market momentum. Our analysis also points to tensions between sales and implementation: it is crucial that the technology can genuinely meet the requirements promised by sales. The interviews emphasize that changes often fail not due to employee resistance but because of middle management, which must also be addressed by using change management tools. Furthermore, our research highlights the importance of experiential learning in client-consultant collaboration: it is advantageous if the consultant implements a product/digital solution they have used or developed, as this provides deeper knowledge of its details, limitations, and potential pitfalls.

## **Article 2 - The relationship between digital development and export activity of Hungarian SMEs**

This article examined the relationship between the adoption of digital solutions and export activity among SMEs. Previous research has addressed the topic of SMEs’ internationalization and their usage of digital technologies as separate topics. As a novel approach, this study

bridges the gap by analyzing the interconnection between these two areas. The research hypotheses were tested through a questionnaire-based survey of 316 SMEs. One of the key findings is that the adoption of digital systems serves as a major driver of internationalization. Specifically, companies planning to expand into foreign markets use digital solutions more compared to those already operating internationally or those with no intention of entering foreign markets. However, there are differences between digital solutions. While companies already exporting tend to be more "comfortable" regarding digitalization by focusing on improving their existing ERP systems, firms planning to enter international markets seek to enhance their competitiveness through various solutions (BI, workflow, document management systems, industry-specific systems).

Based on our research results, the more important export currently is for an SME, the more likely it is that it already uses an ERP system. The more important export is expected to be for an SME's operations in three years, the more likely it is to use ERP, workflow, and BI systems.

### **Article 3 - Digital transformation of public services: The case of the document management application**

Although digital government has attracted significant scholarly attention, several authors call for empirical studies, particularly for evaluating service performance. The efficiency gains from digital transformation in the public sector are often neither quantified nor examined over the long term. Additionally, further research is needed to examine the specific characteristics of public sector digital transformation projects. The article explores the antecedents, goals, and results and effects of a nationwide digitalization project in the public sector. Furthermore, the study quantifies its efficiency gains, too. The conclusions are drawn from document analysis, 24 expert interviews, and the analysis of a longitudinal dataset for the period of 2017-2022, including 1324 entities, meaning more than 3000 municipalities.

A main driver was the necessity to ensure that the municipalities operate transparently and in accordance with the legal regulations. It was not possible without digital technologies. However, digital technologies were expensive, thus only the larger municipalities could afford them, and only they were motivated enough to function properly. Municipalities were struggling to develop their isolated solutions, which resulted in not only very costly, heterogeneous operations but also made it hard to oversee their actual financial status. As a result of these fragmented solutions, local governments reached very different levels of e-government administration maturity, municipalities lacked interoperability, and the handling of

citizens' cases was not efficient. A centrally developed platform and interoperability standards were needed in order to avoid fragmented developments. According to the case, the main steps for a successful digital transformation project in the public sector include having an initial challenge, successful lobbying, forming a strategic coalition, having a vision (in this case, having a centralized platform with different applications that help municipalities operate transparently and follow the legal requirements), having pioneer change agents, and ensuring continuous growth.

The analysis of the longitudinal dataset highlights that the project enhanced the transparency and efficiency of government services: case closing times have significantly decreased. While our data support that electronic transactions are more efficient than traditional, paper-based transactions, we cannot state that electronic transactions (i.e., e-government or digital government) are instantly more efficient: a learning period is needed in order to achieve efficiency gains. The analysis also points out that organizational size matters in the case of digital transformation: larger organizations have more potential benefits due to economies of scale.

In line with some previous studies (Hammerschmid et al., 2023; Ibrahim, 2022; Margetts & Dunleavy, 2013), our case also highlights the importance of (re)centralization in connection with digitalizing the main public services offered by municipalities: one central system was established for all municipalities, which led to the previously mentioned benefits.

The article also highlights that digital governance goes further than digitalizing the existing analog mechanisms. As a result of digitalization, the processes were also transformed: the aspiration for a digital government positively impacted the paper-based processes and cases as well, i.e., the digital transformation of the public administration system enhanced paper-based transactions as well. It was not only a shift from analog to digital services; it was rather a holistic and comprehensive approach that incorporated the optimization of all processes.

Table 15: Summary of the research

	<b>Chapter II. 2.</b>	<b>Chapter II. 4.</b>	<b>Article 1</b>	<b>Article 2</b>	<b>Article 3</b>
<b>Research method</b>	Conceptual paper	Systematic literature review	Systematic literature review and qualitative research	Quantitative research	Qualitative and quantitative research
<b>Theoretical background</b>	Dynamic capabilities	Digital solution implementation	Digital solution implementation	Digital solutions Internationalization of SMEs	Digital transformation of public services
<b>Research questions and hypotheses</b>	<b>RQ:</b> How do dynamic capabilities erode?	<b>RQ:</b> What are the drivers and barriers of digital solutions?	<b>RQ:</b> What are the success factors of digital solution implementation ?	<p><b>RQ:</b> What is the relationship between digital development and export activity of Hungarian SMEs?</p> <ul style="list-style-type: none"> <li>• Which digital solution helps SMEs' internationalization?</li> </ul> <p><b>Hypothesis 1:</b> The more important export is for the continuous operation of an SME, the more likely it is to use digital systems and solutions.</p> <p><b>Hypothesis 2:</b> The more important export is expected to be for an SME's operations in three years, the more likely it is to use digital systems and solutions.</p> <p><b>Hypothesis 3:</b> SMEs that are already present in foreign markets use digital solutions and systems to a greater extent than those that do not plan to enter foreign markets.</p> <p><b>Hypothesis 4:</b> SMEs that plan to enter foreign markets use digital solutions and systems to a greater extent digital solutions and systems than those that do not plan to expand to foreign markets.</p> <p><b>Hypothesis 5:</b> SMEs that plan to enter foreign markets use digital solutions and systems to a greater extent digital solutions and systems than those already present in a foreign market.</p>	<p><b>RQ 1:</b> What are the antecedents, goals, results, and effects of the digital transformation of public services?</p> <p><b>RQ 2:</b> What are the efficiency gains of the project?</p> <p><b>Hypothesis 1:</b> Digital transformation of the public administration system results in significant efficiency gains.</p> <p><b>Hypothesis 2:</b> A centralized ICT-based infrastructure enhances the pace of transactions.</p> <p><b>Hypothesis 3:</b> Electronic transactions are inherently more efficient than paper-based transactions.</p> <p><b>Hypothesis 4:</b> Digital transformation of the public administration system also enhances paper-based transactions.</p>

<b>Data collection</b>	N/A	Web of Science database	Web of Science database and expert interviews	Survey of managers and top managers at Hungarian SMEs	Document analysis, expert interviews, longitudinal dataset
<b>Sample size</b>	N/A	n=246	Literature review: n=246; interviews: n=10	n=316	Expert interviews: n=24; dataset: n=1324
<b>Results</b>	Conceptual framework for the erosion of dynamic capabilities	Drivers and barriers of digital solutions are identified	A comprehensive metamodel for the success factors of digital solution implementation is identified, Hungarian contextual factors are determined, and suggestions for further research are articulated in selected topics in an international context	<p><b>Hypothesis 1:</b> Accepted for ERP.</p> <p><b>Hypothesis 2:</b> Accepted for ERP, workflow, BI.</p> <p><b>Hypothesis 3:</b> Accepted for ERP.</p> <p><b>Hypothesis 4:</b> Accepted for ERP, CRM, software robot, workflow, document management system, BI.</p> <p><b>Hypothesis 5:</b> Accepted for workflow, document management system, BI, and specific systems.</p>	<p>Antecedents, driving forces, and effects of the project are identified</p> <p><b>Hypothesis 1:</b> Accepted.</p> <p><b>Hypothesis 2:</b> Accepted.</p> <p><b>Hypothesis 3:</b> Partially accepted (electronic transactions are more efficient than paper-based transactions, but not inherently so).</p> <p><b>Hypothesis 4:</b> Accepted.</p>

Source: own construction

## **VI. 2. Understanding the cases from a dynamic capability perspective**

In the following, I discuss through the two cases (SMEs' internationalization and digital transformation of public services) how dynamic capabilities enable strategic goal achievement with the help of digital solutions.

### The relationship between digital development and export activity of Hungarian SMEs

SMEs with strong dynamic capabilities sense the advantages and the need to go global. When preparing for internationalization, they also sense the importance of improving their efficiency of information processing; thus, they implement digital solutions. The analyzed solutions enable transparent and standardized business processes based on clear responsibilities. They facilitate reporting, production optimization, and error minimization (Szalavetz, 2019) while also preventing data and information loss. In foreign markets, these systems provide SMEs with financial and efficiency benefits in areas such as marketing, communication, networking, and resource planning (Taruté & Gatautis, 2014). Moreover, they support SMEs' internationalization efforts by providing crucial market-related information and facilitating connections with foreign customers, suppliers, and partners (Pergelova et al., 2018; Cassetta et al., 2020). When entering foreign markets, SMEs need to ensure better documentation because they must comply with additional legal requirements, which digital solutions can also help with. Recognizing these factors, SMEs adopt and utilize digital solutions in advance when preparing to enter international markets. As part of seizing, they select the solutions that best support them and their strategic goal of internationalization. As the research results point out, ERP, workflow, and BI serve as a growth platform for companies that were not previously active in foreign markets but intend to expand internationally in the near future. Transformation refers to implementing these solutions and optimizing the business processes accordingly. It impacts the entire organization: when implementing a digital solution, organizations have to reassess their core business processes to ensure efficiency. Thus, implementation has a positive externality: it can also lead to more efficient operations in existing markets.

### Digital transformation of public services: The case of the document management application

Stakeholders - public administration bodies, supervisory bodies, IT service providers, and organizations operating specific subsystem applications - sensed the opportunities provided by technological advancements, citizens' pressure for more efficient public administration, and the problem of legal non-compliance: municipalities were not handling cases according to regulations, partly due to the overwhelming volume of cases. However, some municipalities

managed operations effectively, raising the question of how smaller ones could adopt similar solutions. Business actors saw potential opportunities in this situation. While small municipalities on their own did not have sufficient funds for such solutions, there was a potential in aggregating demand and creating a central platform, thus reducing costs to a tenth of the original expenses. Seizing refers to deciding to create a platform: establishing the Application Service Provider and adding the applications, and transformation means implementing them. According to the research results, the digital transformation of the public administration system leads to significant efficiency gains, and a centralized ICT infrastructure accelerates transaction processing. Electronic transactions outperform paper-based ones in efficiency, but this efficiency gain is not immediate; it requires a learning period of several years. Training and IT support were provided for them. Furthermore, digitalization positively impacts paper-based transactions as well, transforming and optimizing processes across both electronic and traditional formats.

Through the transformation of individual organizations – i.e., municipalities –, the entire Hungarian public administration system has undergone a successful transformation. Within a few years, all smaller entities that previously lacked such solutions were integrated, and even some (mostly bigger) entities that already had their own systems chose to join the platform. Thus, the implementation of a digital solution revolutionized a whole sector.

The implementation of IT systems depends on dynamic capabilities - specifically, the ability to sense opportunities, seize them, and successfully transform by overcoming the barriers and managing key success factors. Many implementation barriers are embedded in existing routines, and overcoming them requires changing old routines (i.e., dynamic capability “microfoundations”) and establishing new ones, which is driven by high-level, entrepreneurial (higher-order) dynamic capabilities: in the case of my research on SMEs, this high-level dynamic capability is internationalization, while in the case of my study on the digital transformation of the public administration system, it is creating a new business model (digitalized architecture).

### **VI. 3. Overarching conclusions for reaching Management 4.0**

Firstly, the dissertation highlights the strategic role of digital solutions: they can be the source of competitive advantage. The articles empirically support what Evans and Wurster (1977) predicted decades ago: “the new economics of information will precipitate changes in the structure of entire industries and in the ways companies compete”. The authors also highlighted that in many businesses, information is the foundation of competitive advantage - even when

acquiring it is inexpensive and the offering is entirely physical. Ultimately, competitive advantage rests on information and the systems that deliver it. My research complemented this result by highlighting the factors needed to successfully implement systems/ digital solutions. The critical success factors: technology, technology – organizational/ cultural fit, and management competencies lead to competitive advantage.

Digital solutions become relevant on the strategic level by helping organizations create, store, and manage data and information, thus transforming not only their daily operations but also influencing the business model and organizational structure of the company. It is a strategic imperative to successfully implement digital solutions: organizations that fail to do so risk falling behind or even disappearing as they cannot create as much value, operate efficiently, attract top talent, or expand internationally.

These solutions have become the new foundations of strategy as they enable the strategic apex to directly control the organization. An increasingly large organization can be managed with an increasingly smaller core, with authority concentrated at the strategic apex. This enables a large organization to operate in a structured and transparent manner, which was not feasible with traditional tools, allowing major transformations to be implemented through centralized management.

While the strategic relevance of some solutions – especially those enhanced by AI - has already been highlighted, my research points out that even the most fundamental solutions, such as document management systems, can contribute to competitive advantage as they are the data source forming the basis of corporate decision-making. Although such systems had the main function of supporting the daily operations, they have now become core organizational elements. Document management systems no longer function merely as a document management tool but rather coordinate the operations of the entire organization.

Secondly, as the role of digital solutions has increased, their implementation calls for greater attention, too. Research highlights that digital solution projects frequently fail to deliver expected benefits, largely due to their complexity and implementation challenges (Pishdad and Haider, 2013). Evidence shows that 70% of organizations reported no significant benefits from digital solution implementation (see e.g., Chatterjee et al., 2020) - an outcome that cannot be accepted given their strategic importance. This highlights the need to understand how implementation should be carried out effectively.

My research highlights that the implementation of digital solutions often takes years to (fully) materialize. It requires learning: acquiring new competencies is an integral part of the implementation process. It can take years to master certain aspects, and skills typically develop by using the system. My research also points out that increasingly, success depends more on managerial competencies rather than solely on technology, which is just a "minimum-criteria". In order to succeed, organizations have to exploit the business opportunities triggered by drivers and overcome the barriers.

Failures are particularly costly, as they may hinder or even stop further implementation efforts. Implementation failures may result in organizations falling behind and can lead to employee disappointment and decreased motivation. There is limited tolerance for poorly executed implementations. While earlier setbacks could be framed as part of a learning process, ongoing failures in the current context present significant challenges and can result in losing the competitive position. Taking this and the resistance to change into consideration, in many cases, it proves to be more effective to structure the organization around the digital solution itself than to attempt to reshape the workforce.

Thirdly, successful digital solution implementation is critical for successfully shaping the environment, reacting to changes, and rebuilding the business model. Otherwise, through several steps, dynamic and ordinary capabilities erode, and competitive advantage weakens or disappears.

Furthermore, my research shows that using AI can either be an individual initiative aimed at improving personal efficiency, or it can be embedded into the examined digital solutions as a feature that supports specific activities, automates or assists them, thus boosting the effectiveness and improving overall performance.

Finally, digital solution implementation has several implications for strategic frameworks.

- *Emergent Strategy vs Design School*. Organizations can capitalize on emergent opportunities only if their core systems function effectively with the help of digital solutions; otherwise, basic operational issues will consume attention. It is crucial to be able to exploit both deliberate (planned) and emergent strategies, and digital solutions are essential for this. As Ansoff (1991) warns, in rapidly changing markets, firms relying on emergent strategies risk being outpaced by more forward-thinking competitors. Digital solutions can enhance the speed of reaction, thus alleviating Ansoff's concerns.

On the other hand, digital solutions can help the realization of deliberate strategies by showing, e.g., deviations from the plan.

- *Positioning and Generic Strategies.* In order to achieve a competitive position, an appropriate solution has to be chosen that fits the distinct activities of the firm, and it should be embedded within the organization. Digital solutions can contribute to the realization of all three competitive strategies defined by Porter (1985). Cost advantage can be achieved as DSs streamline processes, enhance efficiency, thus reducing costs, and help eliminate unnecessary activities and expenses. DSs help differentiation and focus strategy by providing customer insights and information about the competitive landscape, and helping with personalization. As Porter highlights, in order to achieve competitive advantage, the gap must be increased between customers' willingness to pay and cost – digital solutions help organizations deliver increasing value with decreasing costs. These solutions also help organizations decide what (not) to do – which is "the essence of strategy", according to Porter (1996, p. 70).
- *Value-Based Strategies.* As described above, digital solutions can help organizations create added value. They can help raise buyers' willingness-to-pay for the firm's product by helping the organization meet customer needs better, faster, and cheaper (with lower transaction costs). By providing more information to suppliers and buyers or even integrating them, thus causing system lock-in, DSs can help lower suppliers' opportunity costs of providing resources to the firm, lower buyers' willingness-to-pay for competitors' products, and raise suppliers' opportunity costs of providing resources to competitors.
- *Resource-based view:* DS facilitates the optimal use of resources, which forms the basis for growth, and generates a wealth of information, which is also a resource. A properly implemented system that is embedded in the organization is a strategically valuable resource, too, as it fulfills the criteria of being valuable, rare (amongst rivals and potential rivals), imperfectly imitable, and non-substitutable. Although system security is an increasingly significant risk as systems can be hacked and knowledge can be stolen, threatening inimitability. However, properly adjusted systems may strengthen inimitability by raising causal ambiguity, as they help ensure that the link between resources, actions, and competitive advantage is unclear or difficult to understand. Since no one has a complete view of the system and each person possesses knowledge only

of their specific domain, the knowledge cannot be easily transferred outside the organization.

- *Dynamic capabilities.* The implementation of IT systems depends on dynamic capabilities: the ability to sense opportunities, seize them, and successfully transform by aligning the digital solution with the specific technological and organizational environment. Digital solutions can also enhance dynamic capabilities by improving organizations' sensing, seizing, and transforming capabilities.

#### **VI. 4. Future research directions**

Based on the research findings, several potential future research directions can be identified, as summarized in Table 16.

Digitalization is constantly creating opportunities and challenges that have to be investigated for scientific research to be able to provide managers with hands-on advice and have an impact on managerial practice. New digital solutions are appearing on the market. The adoption of artificial intelligence (AI) is also growing, and its influence on organizations, societies, and individuals is constantly increasing (Merhi, 2023). The fact that AI can perform several cognitive tasks and can imitate the decision-making processes traditionally performed by humans raises several questions. For example, what are the drivers, barriers, and success factors of AI-enhanced digital solutions? How can we ensure a smooth human-AI interaction and cooperation? What are the limits of digitalizing organizations' operations and business models? How does this influence organizations' competitiveness and strategic goal achievement? Empirical research, analyzing diverse organizations, should address these questions.

While organizations' digital transformation has accelerated, the failure rate of digital solutions' implementation is still high. Thus, it is of key importance to study this area, identify the reasons, and potential solutions.

In today's VUCA environment, dynamic capabilities (DCs) are becoming increasingly important. The question of how technological advancements impact dynamic capabilities also requires further research. What are the key dynamic capabilities in the digital era (digital dynamic capabilities, AI dynamic capabilities)?

Table 16: Future research directions

<b>Research sub-area</b>	<b>Future research directions</b>
<b>Drivers and barriers of the implementation of digital solutions</b>	<ul style="list-style-type: none"> <li>• Examining the questions in the case of new, emerging solutions, systems</li> <li>• Investigating how AI integration changes digital solutions</li> <li>• Analyzing how AI influences the drivers and barriers</li> </ul>
<b>Success factors of digital solution implementation</b>	<ul style="list-style-type: none"> <li>• Examining the success factors of the implementation of new, emerging solutions, systems</li> <li>• Investigate how AI integration affects the success factors</li> <li>• Exploring how the success factors for digital solution implementation relate to the success factors of digital transformation more broadly</li> <li>• Examining the previously mentioned suggestions for further research in selected topics in an international context</li> </ul>
<b>Dynamic capability erosion</b>	<ul style="list-style-type: none"> <li>• Testing the conceptual framework on a diverse set of organizations</li> </ul>
<b>The relationship between digital development and export activity</b>	<ul style="list-style-type: none"> <li>• Examining the relationship between internationalization and digitalization among SMEs in an international context.</li> <li>• Exploring the impact of industry affiliation and ownership structure on SMEs' digital maturity and foreign market activities.</li> <li>• Expanding the analysis to cover additional aspects of digital advancement and internationalization.</li> </ul>
<b>Digital transformation of public services</b>	<ul style="list-style-type: none"> <li>• Analyzing the cultural differences between municipalities and identifying the barriers to using the municipal ASP, especially the document management application.</li> <li>• Comparing the cases of the best and worst-performing municipalities.</li> <li>• Investigating cost savings. As a result of digitalization, employees' workload decreased; however, it is a question of whether it appears in terms of costs as well.</li> <li>• Analyzing the case types within the document management application and investigating which case types should be fully automated and which should be handled by humans. What are the barriers to fully automating the processes?</li> <li>• Investigating in which case types it would be preferable to handle the cases in a decentralized way versus in a centralized way.</li> </ul>

Source: own construction

Reflecting on my main research question (what the role of digital solutions in strategy is), the main future research direction is how to cope with the AI challenge. With the rise of Generative AI, the long-standing debate about the extent to which robots will replace human jobs has come to the forefront. AI solutions are already relevant at the strategic level, and are proving highly effective at replacing employees in middle management and other operational roles. This naturally leads to the more complex question: can they also replace top-level executives? While AI can certainly augment and even replace many aspects of managerial work, the unique dynamic capabilities of an organization, e.g., human capacity for entrepreneurial orientation -

the ability to envision and create a new future, rather than just optimizing the present - suggest that top leadership will remain a human domain for the foreseeable future.

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# Appendices

## Appendix 1.: Interview structure

1. What were the challenges the public sector and the municipalities faced before the ASP project?
2. What kind of previous solutions were implemented? How successful were these aspirations? Did they achieve the intended goals?
3. What were the goals of the ASP project?
4. Have these goals been met? What are the achieved benefits of the project?
5. What are the long-term goals of the project?
6. What is the structure of the ASP project?

## Appendix 2.: Coding system for qualitative analysis

Descriptive codes	Themes	Insights
no common IT solution for supporting municipalities	fragmented solutions	challenges to be solved
isolated solutions for a specific area		
municipalities lacking interoperability	financial inefficiency	
costly, heterogeneous operations		
hard to oversee municipalities' actual financial status		
different levels of e-government administration maturity	digitalization lag	
partly outdated back-office applications		
challenges with achieving full-scale digital administration	legal non-compliance	
municipalities not handling cases according to regulations		
billions of HUFs were spent on the construction of local governments' IT systems and electronic administration	financial investments	
tender programs affected just ~ 20% of local governments (bigger, wealthier municipalities)	individual subsidies not having a wide effect	antecedents: individual subsidies not leading to expected results
modern IT solutions only occurred occasionally	individual subsidies not ensuring the efficient use of resources	
maintenance and operation costs exceeded the budgets of the local governments		
centrally developed integration interoperability standards	technological goals	mid-term goals
technical quality standards		

optimal investment, and operating resource utilization	financial goals	
standardizing and supporting local governments' internal operations	standardization goals	
modernize fragmented and outdated technology applications	technological benefits	
support interoperability		
increases the internal operational efficiency		
simplifying reporting obligations	benefits for municipalities	
monitoring the resource management of local governments		achieved benefits
centralizing the municipal reporting system	benefits for central public administration	
access to municipal and central administration services locally, in a one-stop shop	benefits for citizens and businesses	
increasing the performance of public administration	faster administration and better customer service	
development of the e-economy	e-government	long-term goals
increasing digital literacy		
IT Service Provider		
Supervisory bodies		
Management Organization	structure of ASP	structure of ASP
Service providers		
Subsystem providers		