CORVINUS UNIVERSITY of BUDAPEST

Doctoral School of Business and Management

THESIS SUMMARY

Borbála Szedmák

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

Supervisor:

Tamás Mészáros, CSc

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I. 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,[1] 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.

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).

[1] 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.

- 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.

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:

I. 1. The erosion of dynamic capabilities (Chapter II. 2.)

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 (Teece, 2021).

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.

I. 2. Drivers and barriers of digital solutions (Chapter II. 4.)

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.

I. 3. Success factors of digital solution implementation (Article 1)

While digital solutions offer several benefits, 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.

I. 4. The relationship between digital development and export activity of Hungarian SMEs (Article 2)

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. The increasing digitalization of the global economy enables SMEs to internationalize and scale up (Stallkamp & Schotter, 2019; North &

Lorenzo, 2020). Internationalization of SMEs (Losoncz & Nagy, 2020), and the use of digital technologies and their benefits among SMEs (Szabó et al., 2020) have been widely researched. However, identifying the connections between them remains a research gap.

I. 5. Digital transformation of public services: The case of the document management application (Article 3)

Digital transformation of public service delivery has been on the agenda in the past few decades (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).

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 (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).

II. Research questions and methods

II. 1. The erosion of dynamic capabilities, conceptual framework (Chapter II. 2.)

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. 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 conceptual framework is supported by three cases of Fortune 500 companies.

II. 2. Drivers and barriers of digital solutions, systematic literature review (Chapter II. 4.)

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, thus allowing other researchers to replicate and build upon the research process and findings (Briner and Denyer, 2012; Jesson et al., 2011). 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.

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 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, an additional 55 publications were included that were not part of the original search results but were relevant to our research question.

II. 3. Success factors of digital solution implementation, systematic literature review, and qualitative research (Article 1)

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 10 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, 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.

II. 4. The relationship between digital development and export activity of Hungarian SMEs, quantitative research (Article 2)

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.

II. 5. Digital transformation of public services: The case of the document management application, mixed methods (Article 3)

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.

III. Research results

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.

III. 1. The erosion of dynamic capabilities (Chapter II. 2.)

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. This chapter defines the phenomenon of dynamic capability erosion and introduces a conceptual framework for dynamic capability erosion.

1. 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. 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.
2. 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.

III. 2. Drivers and barriers of digital solutions (Chapter II. 4.)

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.

1. 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).
2. 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.

III. 3. Success factors of digital solution implementation (Article 1)

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.

1. 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.
2. 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.

3. 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.
4. 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.
5. 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.

III. 4. The relationship between digital development and export activity of Hungarian SMEs (Article 2)

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.

1. 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.
2. 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).
3. 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.

III. 5. Digital transformation of public services: The case of the document management application (Article 3)

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.

1. 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.

2. 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.
3. The analysis of the longitudinal dataset highlights that the project enhanced the transparency and efficiency of government services: case closing times have significantly decreased.
4. 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.
5. 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.
6. In line with some previous studies (e.g., Hammerschmid et al., 2023), 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.
7. 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 1: Summary of the research

	Chapter II. 2.	Chapter II. 4.	Article 1	Article 2	Article 3
Research method	Conceptual paper	Systematic literature review	Systematic literature review and qualitative research	Quantitative research	Qualitative and quantitative research
Theoretical background	Dynamic capabilities	Digital solution implementation	Digital solution implementation	Digital solutions Internationalization of SMEs	Digital transformation of public services
Research questions and hypotheses	**RQ:** How do dynamic capabilities erode?	**RQ:** What are the drivers and barriers of digital solutions?	**RQ:** What are the success factors of digital solution implementation?	**RQ:** What is the relationship between digital development and export activity of Hungarian SMEs? • Which digital solution helps SMEs' internationalization? **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 digital solutions and systems than those that do not plan to expand to foreign markets.	**RQ 1:** What are the antecedents, goals, results, and effects of the digital transformation of public services? **RQ 2:** What are the efficiency gains of the project? **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.

				Hypothesis 5: 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.	
Data collection	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
Sample size	N/A	n=246	Literature review: n=246; interviews: n=10	n=316	Expert interviews: n=24; dataset: n=1324
Results	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	**Hypothesis 1:** Accepted for ERP. **Hypothesis 2:** Accepted for ERP, workflow, BI. **Hypothesis 3:** Accepted for ERP. **Hypothesis 4:** Accepted for ERP, CRM, software robot, workflow, document management system, BI. **Hypothesis 5:** Accepted for workflow, document management system, BI, and specific systems.	Antecedents, driving forces, and effects of the project are identified **Hypothesis 1:** Accepted. **Hypothesis 2:** Accepted. **Hypothesis 3:** Partially accepted (electronic transactions are more efficient than paper-based transactions, but not inherently so). **Hypothesis 4:** Accepted.

IV. Conclusions and recommendations

IV. 1. Understanding the cases from a dynamic capability perspective

In the following, I discuss through the two cases (SMEs' internationalization and the 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 (Tarutė & 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).

IV. 2. Overarching conclusions for reaching Management 4.0

1. 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 – organization/ culture fit, and management competencies lead to competitive advantage.

2. 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.

3. These solutions have become the new foundations of strategy as they provide an opportunity for 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.

4. 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.

5. 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.

6. 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.
7. 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.
8. 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.
9. 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.
10. 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.

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VI. Own publications in the topic

VI. 1. Publications closely related to the topic

Journal articles

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VI. 2. Publications related to the topic in a broader sense

Journal articles

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