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CONTENTS

INTRODUCTORY NOTE

Many people see digital transformation as just another buzzword, however it certainly increased interest in IT related matters of everybody, especially of managers of companies in highly disrupted industries. It is becoming more and more evident that digital transformation is not only about new technology, but first of all about the realization of major changes in business models, processes, organizational structures, culture and strategy. While scholars and practitioners mostly pay attention to digital transformation at the level of a single company, it applies various levels, such as societies, industries, economies, organisations and individuals. The purpose of this special issue is to present the results of recent research on digital transformation in its broader context.

The first paper in the special issue is a provocative viewpoint paper. The authors argue that the term digital transformation is over-hyped and has been used in a very similar way in various fields, e.g. business process management, to attract management attention. The paper identifies conceptual changes that have emerged in the last decade, as these changes have to be considered if companies want to approach digital transformation strategically. On the other hand, it also emphasizes that management can use the hype to generate the needed 'organizational energy' to implement the changes.

The next paper presents an overview of digital transformation in Hungarian companies from the perspective of strategy, technology and digital innovation capabilities with special emphasis on the objectives of digital transformation and the role of IT departments. The research is part of an ongoing research, in which IT-related practice of Hungarian organizations is explored on a yearly basis since already 2009. The authors discover, among other finding, that a moderate-strong demand for digital transformation is present in Hungarian companies, but the consciousness and perception of how technology will change the nature of business varies across industries.

The third paper is about broader effects of digital transformation. The authors analyse various aspects of Industry 4.0 through the leans of customers, companies and industry as a whole. They present the potentials of Industry 4.0 based on their framework with special attention on construction industry.

Also the fourth paper examines the impact of digital technology and innovation on societies and industries. The authors investigate how companies in creative and cultural industries had to adapt their business models in light of evolving consumer preferences. Through the case study of an independent cinema in Scotland, the paper analyses how independent cinemas can transform their delivery in light of the challenges posed by digital disruption, and more specifically, whether this has to focus entirely on digitalisation.

The fifth paper studies possible approaches to digital transformation through the design and development of contemporary information systems. Recent research shows that user-

oriented data-driven approaches could be suitable. The paper aims to provide a brief overview of the main concepts and research directions and to define the setup and context for the proposed user-oriented data-driven information systems development framework.

The last paper studies different approaches to digital transformation that are present in large and medium-sized companies. Six differently successful organizational patterns were discovered. The most successful identified pattern is the business–IT partnership approach, where top management and the IT department are responsible for the digital transformation, and the CIO is an orchestrator and a member of top management. However, this is not the only possible successful approach for digital transformation.

This issue is the result of contributions from wide group of authors, reviewers and technical editors. We are sincerely grateful to everyone for their time and effort.

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Digital Transformation – The Hype and Conceptual Changes

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ABSTRACT: *Digital transformation (DT) is attracting increased attention; many papers and special issues focus on various aspects of DT. Still, DT often serves solely as a repackaging of previously existing ideas. Our paper argues that the term is over-hyped and has been used to rebrand various fields to attract management attention. However, this alone cannot explain the reasons for such an immense rise in the popularity of the concept. To understand the underlying motives for current DT adoration, our paper aims to identify conceptual changes that have happened in the last decade. These changes have to be considered if companies want to strategically approach DT and use the hype to acquire the needed 'organizational energy' to implement the changes.*

Key words: *digital transformation, employee engagement, customer process management, instant gratification, attention span, marginal costs*

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1 INTORDUCTION

In recent years, digital transformation (DT) has become an extensively hyped topic in various industries (Agarwal et al., 2010) and business-oriented areas (Majchrzak et al., 2016; Kane et al., 2015). New digital technologies affect companies and their customers. Customers rely on a wide range of mobile, social, and other interactions, and companies use innovative tools to transform their processes, business models, and value propositions for customers (Berman, 2012). The experts in this area argue that management concepts are changing as companies apply digital strategies to transform products, processes, and organizational structures (Matt, Hess, & Benlian, 2015). Moreover, DT should expand beyond companies and support value creation in extended supply chains. On the wave of DT, partners should be able to shorten processing times, remove unnecessary activities, and improve productivity, leading to higher operational excellence than ever before (Bowersox, Closs, & Drayer, 2005).

Lately, DT has been widely researched in academia and increasingly implemented in companies (Skog, Wimelius, & Sandberg, 2018). However, DT is an ongoing process and

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is nothing new per se. Therefore, a cornerstone is needed for companies to understand DT—why it is so popular and what has really changed. Several recent reviews acknowledge that modern DT practices are building on existing schools of thought and are partly 'old wine in new bottles' (e.g., Pihir et al., 2019; Riasanow et al., 2019; Kane et al., 2019). Those reviews attempt to identify what is new but fall somewhat short, as they present well-known factors such as identification of ecosystem, business models, digital innovation (Riasanow et al., 2019), the importance of people/workforce (Kane et al., 2019; Eden et al., 2019), and the consideration of digital technologies for changing products, services, or processes (Pihir et al., 2019).

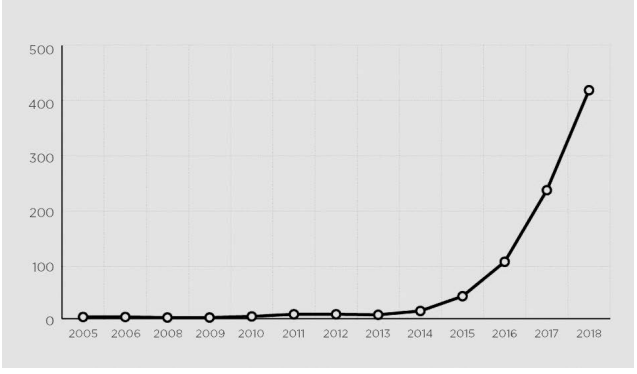
The contrast between the recent DT hype and the fact that its main tenets have been known for decades prompt crucial research questions: (1) What are the reasons for the extreme increase in the popularity of DT in research and practice? (2) Which (if any) conceptual changes in the last decades have contributed to the importance of DT? We analyse the conceptual changes over the last decade, focusing on the nullification of marginal costs, decrease in attention, increase in the need for instant gratification, and the ability to measure customers' and employees' actions.

The rest of the paper is structured in five sections. In Section 2, we summarize the roots of DT as a concept, give several historical examples of transformation, and outline reasons for the popularity of DT. In Section 3, we identify the conceptual changes, followed by a discussion in Section 4. We discuss limitations and further research possibilities in Section 5.

2 THE POPULARITY OF DIGITAL TRANSFORMATION

Recently, DT has gained immense popularity. These days, one cannot go to any professional event without hearing about the importance of DT. The same applies to the academic community, with numerous papers emphasizing the usefulness and relevance of DT for organizations in the current business environment (Matt, Hess, & Benlian, 2015; Hess et al., 2016; Hoberg, Krcmar, & Welz, 2017). Lately, there has been a surge in published papers – while only 7 papers on DT were published in the Web of Science Core Collection in 2013, the number increased to 418 in 2018 (Web of Science, 2019) (see Figure 1). Respectable journals' special issues covering DT have already been or will be published soon (Demirkan, Spohrer, & Welsher, 2016; Majchrzak, Markus, & Wareham, 2016; Economic and Business Review, 2018).

Figure 1: *The number of papers on digital transformation listed in Web of Science*



Source: Clarivate Analytics, 2019; own analysis.

The first indices of DT can be found in Bharadwaj (2000). She researched IT capability and firm performance, pointing out that the impact of digital technologies on business processes is crucial for organizations to survive in an emerging digital economy. This led to one of the earliest explicit mentions of DT (proposed by Bauer) linking the revolution in information technology (IT) to DT within dentistry, e-commerce (Bauer & Brown, 2001), and health services in rural America (Bauer, 2002).

Many papers have been published emphasizing the vital changes that DT can bring to businesses (Rouse, 2005; Morgan & Page, 2008; Shah & Siddiqui, 2006; Liu, Chen, & Chou, 2011). Literature offers many definitions reflecting various aspects of DT. For example, Solis, Lieb, and Szymanski (2014) defined it as a realignment, development, or investment in new technologies to change business models and engage both customers and employees more efficiently. Henriette, Feki, and Boughzala (2015) describe DT as an organization's ability to optimize business performance by building on rapid technological innovations based on digital technologies. Moreover, DT is a driver to transform business operations, products, processes, organizational structures, management concepts, and supply chains (Trkman, Budler, & Groznik, 2015; Matt, Hess, & Benlian, 2015). While the definition of DT has not been clear in the past (Chew, Semmelrock-Picej, & Novak, 2013) the general consensus now affirms that DT can be understood as the use of modern digital technology to change key business elements, including business models, strategies, business processes, organizational structures, organizational culture (Erjavec et al., 2018), customer experience, and streamlining operations (Reis et al., 2018). Furthermore, Stolterman and Fors (2004) describe DT as a digital technology phenomenon bringing changes not only to business but to all aspects of our lives; some studies claim that it is affecting the whole human identity (Nagy & Koles, 2014).

The potential of DT has not gone unnoticed by established organizations. Gartner, a world-leading technology research and advisory company, has recognized DT as one of the best future opportunities for business' ecosystems (Gartner, 2017). DT is perceived as the most important factor in almost every industry and business aspect, as well as among managers around the globe (Bughin & Van Zeebroeck, 2017). Companies are spending more money than ever before to catch up with the digital environment (Solis, Li, & Szymanski, 2017), and many authors have used DT to explain advancements or changes in various industries, such as newspaper (Karimi & Walter, 2016), textiles (Chen, Jaw, & Wu, 2016), banking (Liu, Chen, & Chou, 2011), and many others (Westerman et al., 2012). Driven by digital technologies, companies strive to build personal relationships and provide better customer experiences through more efficient interactions and user-friendly services and products (Fitzgerald et al., 2014).

According to the literature, DT is an unprecedented and hastily growing disruption (Bughin & Van Zeebroeck, 2017) that adapts to rapid changes, changes society and business, and helps expand new markets (Gimpel & Röglinger, 2015; Parviainen et al., 2017). Furthermore, it is important to the customer experience (Trkman et al., 2015), since it alters producer-consumer relationships (Piccinini, Gregory, & Kolbe, 2015), places value on consumer co-creation in the current digital economy (Potts et al., 2008), and shifts the paradigm from a customer-centred to an everyone-to-everyone economy (Berman & Marshall, 2014). DT also helps companies build new business models (Collin et al., 2015) and innovative business ecosystems (Selander, Henfridsson, & Svahn, 2010), and changes the mindsets of organizations, their executives, employees, and customers (Kane et al., 2015).

However, none of the claims above are particularly new. The fact that companies need to continuously innovate and that IT plays a crucial role has been known for decades (Nolan, 1995), as using IT undoubtedly changes products and services and their deliverance (Furr & Shipilov, 2019).

From a cynical viewpoint, DT may be considered a management fad (see Abrahamson, 1996) or as the reincarnation of past IT-enabled change initiatives with new outfits. As business process management (BPM) seems to be losing interest, DT may be seen as a new buzzword to capture renewed interest from managers, consultants, and software companies (Klun & Trkman, 2018, Reis et al., 2018). Technology is always changing, and as emphasized by Schumpeter (1942), creative destruction is at the heart of this continuous mutation, which is necessary for the sustainability of businesses. Economic action functions in a constant loop fed by new consumers' novel systems of transportation, production methods, markets, and organizations. Hammer (1990) summarized the main ideas of rapidly changing technologies as ever-shorter product life cycles, glacially paced product development, and the importance of customer experience. Even 200 years ago, the labour masses were destroying machines and factory buildings, worrying about being replaced by automated production lines (Jones, 2013).

For all that, from the conceptual perspective, such disruption by DT is nothing new. Innovations resulting from a combination of existing technologies have always transformed industries and economies (Arthur, 2009). Take electricity, for example, or warfare and the invention of gunpowder and machine guns. By the same token, the world has seen massive disruptions influencing businesses in the last 250 years; for instance, the prevalence of rail travel at the beginning of the 18th century encouraged big investments into railway infrastructure (Perez, 2002). Similarly, Guttenberg's printing machine transformed the whole scribing industry, enabling a much faster dissemination of knowledge. An even older case is an advanced road system that significantly changed the trading and communications of the Romans, which led to a bloom of art, culture, military, political, and economic development (Carreras & de Soto, 2013). One further example is the ice trade, which employed an estimated 90,000 people in the USA in the 19th century, while Norway exported one million tons of ice every year; these jobs were lost with the introduction of refrigerators. The Pony Express is another such disrupted industry example. It had an innovative business model with a novel value proposition (fastest mail service), which was also technology-enabled (e.g., with special lightweight saddles) and had a strong network of partners. It closed after 19 months due to the emergence of the telegraph.

In summary, new technologies are being developed, and customer preferences are changing (Solis et al., 2017); but this has been the constant state of affairs over the last 140 years or so, and no industry is immune to it (Downes & Nunes, 2013). On top of that, these changes are small compared to what is not changing (Mintzberg, 2017).

If the concept is not new, why do we need a new term? It seems that DT is an overused term invented by IT professionals and consultants to reach CxO levels. This rebranding is partly a consequence of the fact that BPM has focused mainly on investigating process modelling and the use of process models to improve the understandability of the processes (Klun & Trkman, 2018), leading to a lack of attention by top management (Reis et al., 2018).

DT can represent a new opportunity for IS experts to work with top management. Executives are turning to IT experts and recruiting them as board members (McAfee & Brynjolfsson, 2008). Consequently, the roles of CIOs and IT departments have lately gained great importance (Manfreda & Indihar Štemberger, 2018). The need for new, fancier titles has emerged, and many companies have named CDOs (chief digital officers) as members of top management (Horlacher & Hess, 2016; Singh & Hess, 2017).

DT is also used as an umbrella term to brand works in other fields, such as open innovation or change management (Urbinati et al., 2018). This increased popularity means that DT is in real danger of becoming an 'all and nothing' term. Arguing that DT is all-encompassing and holistic (Kutzner, Schoormann, & Knackstedt, 2018) poses a danger of DT becoming a meaningless filler. In a way, DT follows the snake oil principle (see Sharma & Meyer, 2019) used by software vendors and consultants to boost sales.

Still, new names for old truths can be used to develop a strong 'getting everyone on board effect', regaining enthusiasm and common vision (Zhang et al., 2015). Given the above, DT is used to unite executive boards, middle managers, and employees in a common vision and terminology. Most importantly, the common term makes them more enthusiastic about forthcoming changes. The majority of employees that follow 'digital leaders' want to be engaged with digital-like organizations and will take advantages of digital opportunities offered by the companies (Kane et al., 2015).

Hence, organizations need to carefully consider if and how to tackle DT to avoid harming them. Abrahamson (1991) emphasized that innovations, as fads or fashions, are sometimes used to pave the way for the popularity of technologies that are not efficient or suitable for organizations and thus provide them with little utility, poor economic performance, and great competitive disadvantages. Therefore, companies must strategize judiciously to avoid deficiencies and maximize the benefits of implementing DT.

Building on Collins (2013), who showed that buzzwords are sometimes intentionally generated by people within specific businesses to boost hype, it is possible to conclude that DT (as related to current hype) could be considered a buzzword.

3 CONCEPTUAL CHANGES AND THEIR IMPLICATIONS

Still, the 'repackaging of existing concepts' and 'increasing enthusiasm' does not provide a full explanation for the popularity of DT. The underlying reasons at the conceptual level have to be investigated. We argue that the following changes at company or employee levels are the most important; companies need to understand the changes happening *to* and *in* individual employees, as they are the most important assets for an organization. By knowing their employees, managers can understand what employees expect from the company and find ways to motivate employees to perform their best, thus enabling a healthy work culture (Juneja, 2019). Anyway, the most important conceptual changes are provided and explained in the continuation.

First, big data analytics and advanced algorithms improve efficiency and productivity, enabling companies to produce and share numerous services and products with almost no marginal cost (Rifkin, 2014), and automatization allows some services to be free. The Internet has dramatically reduced the marginal costs of additional transactions (DaSilva & Trkman, 2014); a typical example is a social network in which an additional user or an additional visit from an existing user does not entail any marginal costs. Thus, many business and revenue models are possible. Facebook can rely on advertising, Cyworld on selling virtual goods, WeChat on mobile banking services, WhatsApp used to charge low subscription fees, and LinkedIn has a freemium model. Customers can co-create content, which further decreases or even nullifies the costs of content creation. To a certain extent, the negligibility of marginal costs applies to many older technologies (such as radio or

TV) as well, but the number and importance of those industries exploiting the Internet are much higher.

Second, people's attention spans are becoming increasingly limited in relation to smart devices and instant connectivity. Smartphone and tablet use has been proliferating and is estimated to reach 3 billion users by the end of 2019 (Statista, 2019). People spend more than 5 hours per day on their smartphones (Elgan, 2017) and check their mobile phones between 80 and 300 times per day (Asurion, 2019). This indicates that attention will be 'the oil of the 21st century' – companies will have to invest a lot of money to draw customer attention. Moreover, addiction by design will be needed as companies will need to exploit the addictive properties of their services or products to be successful (Van Belleghem, 2017). Considering the omnipresence of smartphones and all-around connectivity (especially the Internet of Things), companies are urged to carefully consider how to transform their businesses to obtain and retain the attention of their customers; they must learn to better engage their customers and increase their user experience, which will allow them to perform better than the competition.

Third, the need for instant gratification is stronger than ever, mostly due to a lack of attention span (see previous paragraph) and synchronous communication that enables prompt interaction with others (Ramirez Jr et al., 2008). This need could also be caused by a desire to avoid delay, uncertainty of what the future holds, deriving pleasure from short-term rewards, and discomfort from anticipating bad events (Heshmat, 2016). Many examples can be found in the digital world, such as likes and comments on Facebook, LinkedIn, and Yammer, and retweets on Twitter. ResearchGate motivates their users with gratifying ego boosts, such as RG score, achievements (e.g., reaching 50,000 downloads), and ratings (e.g., being the most-cited author in a department) (Meishar, 2017). Another example is the mobile application Runtastic, which is one of the most popular fitness apps and has more than 80 million registered users. Users can track their physical activities and share their results via various social media platforms. By doing so, users gain higher motivation to be physically active and reach their goals, feel less lonely and perceive companionship. Sharing their results on social media, especially Facebook, gains them support from friends, who encourage their achievements and provide them with instant gratification (Klenk, Reifegerste, & Renatus, 2017).

Fourth, one of the recent conceptual changes is the ability to precisely measure customers' activities, which enables companies to analyse not only customers' behaviours but their overall processes (Van Belleghem, 2017). Understanding interactions with customers is not enough; companies should understand their customers' processes so they can thoroughly improve customer orientation (Trkman et al., 2015). Accordingly, this helps companies understand evolving customer behaviours and preferences, which has been recognized as the top driver for DT (Solis, Li, & Szymanski, 2017). Traditional customer segmentation is not enough. Instead, data and information from mobile users enable companies to hyper-personalize their products and services (Van Belleghem, 2017). For example, in the past, confectioners knew customers' birthdays and what cakes they preferred. Nowadays, with

digital engagement and analytics tools, companies know much more – they can know where and when a customer is going to have a birthday party, who will come, who is invited, how they will be dressed, what they will drink, and when they will leave.

Fifth, companies are focused on measuring employees' work, especially their task performance. Modern technology allows highly precise and instantaneous measurement of key performance indicators. However, tasks in predictable and measurable situations can be automated relatively easily, as opposed to unmeasurable performances that require a personal touch. More intimate, creative, and rare tasks and services are acquiring more value as passion and empathy become more important (Van Belleghem, 2017). This means that the most important employee activities are unmeasurable. Workers will thus have to acquire different skills to succeed in the workplace of the future (Manyika & Sneader, 2018) and companies will need a new way to measure employees' performance. Hence, digital and human transformation will take place in which machines will take on operational labour and humans will perform emotional tasks. The success of companies interacting with customers will rely on the digital perfection of the computers on the rational side and human touch on the emotional side (Van Belleghem, 2014). Several such cases can be found in practice; one example is hotel service automatization. Recently, hotels have begun to apply various technologies to improve their services and increase customer satisfaction (Budler et al., 2019). Thus, they offer mobile check-in and check-out, mobile interactions with guests (i.e., for ordering items and services), motion-detected and key card guest rooms, robotized housekeeping, personalization of accommodations based on recorded preferences, etc. This way, hotels save staff time, so personnel can work efficiently on more complicated guest requests. That holds especially true when guests are upset and want to share their concerns with a person, not an artificial intelligence. They want responses that are not just sympathetic and senseless but helpful and emotional (Benbria, 2016).

4 DISCUSSION

Any attempt to change a company should take the possibilities of zero marginal costs, limited attention spans, the need for instant gratification, and hard-to-measure performances into account. According to Heraclitus, a Greek philosopher, 'the only constant is change'; our environment is ever-evolving. Mobile devices, social media, business intelligence, big data analytics, cloud computing, and the Internet of Things are just some of the current technologies (also often rebranding of previously existing solutions) that affect the way companies do business. While technology can automate processes and change businesses on an operational level, organizations need to go beyond to change their mindsets and the way they deal with customers.

Many issues arise from changes and DT. Fitzgerald et al. (2014) highlight barriers arising from a lack of vision, ineffective leadership, and inadequate experience that represent challenges for companies embracing DT. Often, roles and responsibilities in the DT process are not clear. Considering institutional challenges, much effort is needed to

overcome the historical leverage of companies' technology, idea, and innovation fatigue and shift the whole culture of the company (Burack, 1991). Additionally, the pay-off for investments in DT should be clear. Any kind of transformation is a complicated process that can succeed if leadership provides a clear vision and all employees are motivated and engaged (Fitzgerald et al., 2014).

Along these lines, accruing any benefits from DT requires a combination of business and technology skills from different areas. For example, regarding supply chains, reinventing business operations on the wings of digital technology should be thoroughly considered (Trkman, Budler, & Groznik, 2015) to maximize value proposition. Also, much expertise is needed to master the emerging IT infrastructure (Bowersox, Closs, & Drayer, 2005). Organizational culture also needs to be addressed, as it defines what an organization does and does not do. Management beliefs, employees' commitment to a common goal, and their interactions play a crucial role in a major organizational shift (Lucas Jr & Goh, 2009). However, instead of hiding behind generic statements that 'top management support and organizational culture are crucial' the companies must open this black box and investigate what kind of top management support and which specific changes in organizational culture are needed (Trkman, Oliveira, & McCormack, 2016).

Operational excellence is essential to manage DT, which is often more about incremental bridging than a large overhaul (Furr & Shipilov, 2019). More precisely, companies need to digitize customer and delivery processes, such as shifting to online sales, and exploit the Internet as an opportunity to reach and engage with customers (Barua et al., 2001) to achieve the reduction in transaction costs (Mahadevan, 2000).

To successfully approach and implement DT, companies need proficient staff in project, strategic, and information systems management. A company needs to develop a digital strategy and effectively communicate it to the employees (Kane et al., 2015). Thus, strategic managers need to know how to recognize critical factors for long-term success (Trkman, 2010) and form a common vision. Project management needs to guide the project team through DT, avoiding traps and solving problems. Furthermore, information systems management skills are also vital, especially in terms of change management and redesigning business processes, organizational leadership to orchestrate the IT team, risk management to cope with daily technical innovations, and core knowledge of IT to support decision making from the technical perspective.

As a field, BPM can be of extreme importance. While BPM has been traditionally used to boost operational efficiency, it is now recognized as a key DT driver. Contrary to the traditional need for efficiency and optimization, BPM delivers automation-fuelled agility to organizations, which enables them to immediately adapt to changes (Araujo, 2017). Furthermore, through vigorous BPM capability, a company's processes become more agile and efficient, enabling higher values for their products and services; thus, the target market can be reached more quickly and with greater returns (Kirchmer, 2011). New technologies

(i.e., machine learning) affect organizations' processes, and the need for high performance triggers innovation-centred strategies. With effective management approaches supported by BPM, organizations improve their process innovations (Kirchmer, 2017). Also, BPM enables interactions among departments and drives relations with customers and partners by enabling effective communication, information sharing, and collaboration via digital technology (Garcia, 2018). However, according to Sandle (2018), BPM is involved with DT on various levels. First, BPM offers modelling tools that enable businesses to run smoothly; business analytics can then be applied, and there are content management and collaboration tools to foster communication. All of these tools form an agile organization, and BPM can help change businesses by improving operations, reducing the complexity of team collaboration, and improving the customer experience.

5 CONCLUSION

The presented overview of unjustified hype and conceptual changes can serve researchers and practitioners as a starting point to 'separate the wheat from the chaff'. While organizations build (dynamic) capabilities to transform continually, it is not essential to follow the most recent hype and adopt whatever is currently most praised in the professional press (Trkman et al., 2011). To take advantage of the opportunities offered by DT, organizations should carefully investigate changes in their industry, among their stakeholders, and in the environment and then see which new technologies are most suitable to experiment with.

Our paper suffers from several limitations that are also excellent pointers for further research. The listed changes thus should not be taken as a definitive list of trends in the last decade. The research could be upgraded by conducting a Delphi study and focus groups of practitioners and researchers to provide a consolidated agreement on the hype and changes brought by DT (see Mergel et al., 2019 for a similar study on defining DT in public administration). Another illustration of DT can be found in work by Cech and Tellioğlu (2019), who studied current and future trends with an online real-time Delphi study of international academic experts. Another good example from the BPM field is a Delphi study with academic and practical experts examining cultural values that matter in BPM (Schmiedel, Vom Brocke, & Recker, 2013). Such an approach would allow research questions similar to ours to be answered in a more rigorous manner. However, this study presents a foundation for further research. On one hand, companies will always have to innovate and adapt to new technologies, and on the other, they will need to thoroughly consider how to process constantly appearing fads such as DT, as well as conceptual changes, such as instant gratification, constant connectivity through smartphones, or increased measurability of customer processes.

Furthermore, detailed case studies could be used to investigate and compare the perceptions of employees, managers, consultants, and researchers about what DT is and

how to approach it. Also, a bibliometric study (Zupic & Čater, 2014) should be applied to identify the state of the art in the field of DT.

In summary, our central message is that companies need to build an ambidextrous approach. To avoid overhyping the changes that DT will bring, they should tackle DT more strategically by focusing on a common goal and vision with sufficient business, management, and technological knowledge (Business Informatics, 2019). However, they can also profit by using the DT hype as an opportunity to build consensus and give a clear purpose to employees and management; this can serve as a strategy to build and maintain enthusiasm for changes and obtain short-term wins. To say it simply – DT needs a heart (Westerman, 2018).

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Digital Transformation – A Hungarian Overview

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ABSTRACT: *Digital transformation is considered as an increasingly important process for organizations today, critical for the survival of companies. The spreading of digital technologies throughout our societies brings along various changes in organisational culture, people, business processes and business models. The perception of digital transformation's importance among the management of companies is lower in some European countries, among others in Hungary. Our research aims to provide an overview of digital transformation in Hungarian companies from the dimensions of strategy, technology and digital innovation capabilities. We discuss the objectives of digital transformation and the role of IT departments in digital transformation. The research is part of an ongoing research, in which IT-related practice of Hungarian organizations is explored on a yearly basis, starting in 2009. 167 organizations participated in our last study, in 2018. As our survey results revealed, there is a moderate-strong demand for digital transformation, but the consciousness and perception of how technology will change the nature of business varies among industries. Most of the questioned Hungarian companies deal with digitalization at the strategic level; however, there is still a large group of firms that manage digital transformation as an IT problem. Although the objectives of digital transformation are clear, organizations heavily lack preconditions for successful transformation.*

Key words: *digital transformation, digital innovation, digital strategy*

JEL classification: M15

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1 INTORDUCTION

Digital technologies disrupt practically every industry; the development of information and communication technology has changed the economy as a worldwide phenomenon. However, most European countries are falling behind in this respect (Indihar Štemberger, 2017; Erjavec et al., 2018; Fehér et al., 2017). Indihar Štemberger et al. (2017) conclude that the perception of digital transformation's importance among the management of companies is lower in some European countries, like in Hungary and Slovenia, than in other countries. Most business executives say digital technologies are primarily an

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opportunity and not a threat (Kane et al., 2016). Digital transformation is one of the main factors of competitive advantage, it provides new methods for process maintenance and optimization, and it improves customer experience and engagement (Schreckling, E. & Steiger, 2017). Technology is a key precondition for business innovation, but as it is generally accepted, strategy has a decisive role in digital transformation (Berghaus & Beck, 2016). Digital transformation results in significant changes in the value adding processes, but carries risks as well. According to our experiences collected from the companies, organizational preparedness is a crucial factor which can reduce the risks. Hungarian companies notice the importance of digital transformation, but they assess their preparedness to be at a low level.

Pressures for digital transformation are present also in Hungary. Our research aims to provide an overview of the digital transformation in Hungarian companies using the framework suggested by Evans (2017). We discuss the following research questions:

- RQ1: What are the position and objectives of digital transformation in Hungarian companies compared to the literature?
- RQ2: What is the state of digital transformation in Hungarian companies compared to the literature and previous studies from the dimensions of strategy and digital innovation capabilities?
- RQ3: What are the key technological enablers of digital transformation?
- RQ4: What is the role of IT departments in digital transformation in Hungarian companies?

We detail the findings of the research on digital transformation as a special part of our yearly IT management survey of Hungarian organizations. We collected data through anonymous questionnaires. As discovered, digital transformation is a key priority for Hungarian companies, but they are uncertain about how to reach it. Most of the questioned Hungarian companies deal with digitalization at the strategic level; however, there is still a large group of firms that manage digital transformation as an IT problem.

This paper is structured as follows. Section 2 gives an overview of the theoretical background of the study. The third section specifies the research methodology and data collection. Section 4 presents the results of data processing. Finally, the fifth section provides conclusions.

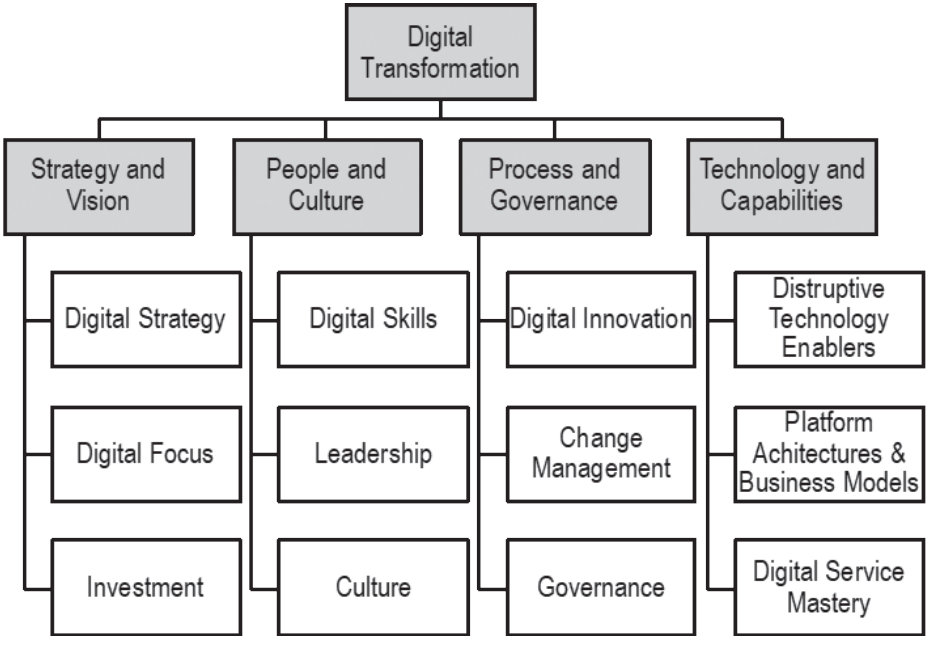
2 DIGITAL TRANSFORMATION – A LITERATURE REVIEW

Digital transformation is a hot research topic in the literature with several definitions. We discuss this concept on the level of organization. Westerman et al. (2014) emphasize the performance improvement as "the use of technology to radically improve performance or reach of enterprises". Bharadwaj et al. (2013) determine it as "an organizational strategy formulated and executed by leveraging digital resources to create differential value". Liu et al. (2011) underline the business process related aspect as "the integration of digital technologies into business processes".

Digital transformation as a concept has been investigated in the literature from several viewpoints. Morakanyane et al. (2017) present a concept centric matrix of digital transformation, which details its definition, characteristics, drivers, key impacts and transformed areas. Bohnsack et al. (2018) perform a systematic literature review regarding digital transformation of the past 20 years' articles. They incorporate various research perspectives into a comprehensive multi-dimensional framework of digital transformation, linking determinants, processes and outcomes. Determinants include enablers, firm capabilities and context. Processes cover agency, transformation processes, digital business strategy and digital innovation. Outcomes consist of change and economics. They apply the framework for research gap identification. According to Bohnsack et al. (2018), a limited understanding regarding digital transformation's theoretical constructs and underpinnings have been performed so far. They developed a multi-layered perspective of digital transformation, which supports a better theorization and explanation of "what" digital transformation is.

There are several researches targeting the overview, the maturity level and the decisive factors of digital transformation (Kane et al., 2016; Erjavec et al., 2018; Chanias et al., 2016). Evans (2017) identifies four key pillars of digital transformation: (1) strategy and vision; (2) people and culture; (3) process and governance; and (4) technology and capabilities (Figure 1). These key pillars have decisive components, as summarised in Figure 1.

Figure 1: *The key pillars of digital transformation*



Source: Evans, 2017.

The pillars and their components provide a framework for the digital transformation analysis and facilitate a bigger picture about it. Evans (2017) draws attention by claiming that digital transformation is not the "final destination" of the companies, as there is a need for an agile attitude, namely rapid response to change and continuous innovation. The strategy and vision pillar focuses on maintaining the customer-centric (outside-in) perspective and cover digital transformation strategy, digital transformation focus and investments. Digital transformation requires new capabilities and skills. These include capabilities related to disruptive technology enablers, platform architectures and business models, digital services mastery, and digital innovation. The people and culture pillar includes digital skills, leadership and culture. Change management has a key role in this rapidly changing environment; where companies must adopt business processes and new governance methods as well. The technology and capabilities pillar's components are disruptive technology enablers, platform architectures, business models and digital service mastery.

Our research targeted areas and questions belong to the strategy and vision (RQ1; RQ2); technology and capabilities (RQ3); and people and culture (RQ4) pillars from Evan's framework.

Manfreda (2018) investigates the potential barriers of digital transformation in organizations. As the main barrier, the companies expose the change management capability, followed by the lack of proper knowledge and skills, and the inability to experiment quickly. The companies also highlight isolated silos within the organization and too many competing priorities. The latter is also the main barrier in worldwide companies (Kane et al., 2016).

The barriers detailed are mostly of an organizational nature and are related to employees and their lack of knowledge and skills needed for successful digital transformation in companies. However, it is important to add that insufficient technical skills on the part of the technology staff within the analysed companies are perceived as the least important barrier (Kane et al., 2016). The latter indicates that the lack of proper knowledge and skills as one of the most important barriers for digital transformation does not refer to the lack of technical skills but rather some other knowledge and skills. Risk avoiding behaviour of the companies can be a possible answer for the above detailed barriers:

- Employees must be properly prepared for digital transformation; they need new digital skills, which must be improved by the companies.

- Companies must monitor and evaluate technological trends; they must apply new innovative solutions.

- New organizational roles and units/departments must be formulated with clear goals towards digital transformation.

3 RESEARCH METHODOLOGY AND BACKGROUND

This research aims to give an overview of the state of digital transformation in Hungary – according to the dimensions discussed in Section 2. The methodology is a combination of the quantitative and qualitative approaches, including literature review, questionnaires and processing of the collected data. Frameworks from the literature review supported structuring the research questions and areas. Digital transformation related surveys and questionnaires (HBR, 2015; Kane et al., 2016; IWI-HSG, 2015) were used as a reference.

The research of digital transformation in Hungary is part of an ongoing research in cooperation with Hungarian CIO Association (number of core members: 41 in 2018, direct reach to more than 1,000 Hungarian companies), in which we explore IT-related practice of Hungarian organizations on a yearly basis, since 2009. The expanded network of the Hungarian CIO Association consists of organizations that follow the recent IT research topics and innovation. We yearly invite small, medium and large companies from the network of the Hungarian CIO Association to participate in the study, sending them a questionnaire and asking them to forward it to a member of the administration

board responsible for digitalization or IT or to a person who is responsible for the field of digitalization in the company. In 2017, 150 organizations joined the research, and in our last study, in 2018, 167 organizations participated in it. It represents a 15 per cent response rate in 2017 and 16.7 per cent response rate in 2018 with all the data valid for the analysis. We completed the survey results with selected executive interviews, to understand the background and motivation or results. Considering the organizational side, the sample of the 167 companies consisted of 24% SMEs and 66% enterprises. 29% of the organizations were dominantly state-owned, 27% had domestic, and 44% had international private owners.

The survey consisted of the following blocks:

- Organizational demographic questions (size, industry, dominant owner)
- Role, position and reporting line of IT
- Applied technologies and planned new technology projects
- Digital transformation-related questions (objectives, strategic frames, organizational support, sources of innovation ideas, role of IT in digital transformation)
- IT strategy related questions
- IT service management issues

The survey was based on international standard surveys, adopting questions from IDG's "State of the CIO" survey, HBR (2015) and Kane et al. (2016) survey questions. In this paper, we concentrate on digital transformation related questions, but also involving technology development issues.

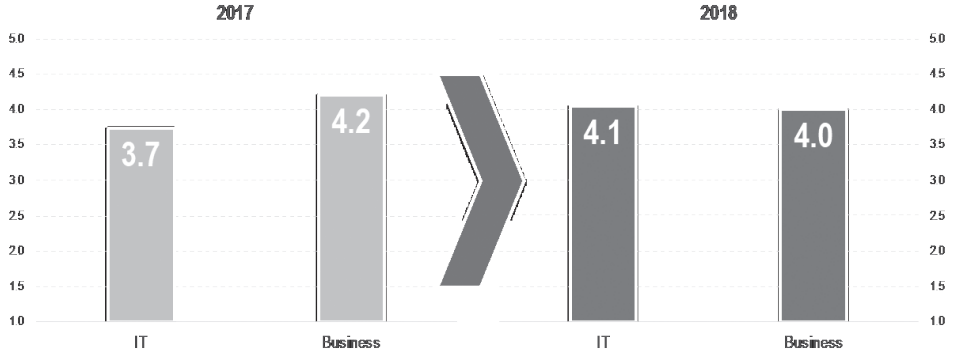
4 DIGITAL TRANSFORMATION – THE HUNGARIAN RESULTS

Digital transformation is a key priority for the Hungarian companies, but based on our results, they do not clearly see the way how to reach it. The key pillars of digital transformation defined by Evans (2017) provide the framework for the research questions' discussion. Section 4.1 deals with RQ1 (the position and objectives of digital transformation in Hungarian companies compared to the literature), focusing on vision, digital focus and directions (the strategy and vision pillar in Evans' model). Section 4.2 investigates the relationship between digital (business) and IT strategy, and classifies the approaches of digital innovation. This section gives an answer to RQ2 (the state of digital transformation in Hungarian companies compared to the literature and previous studies from the dimensions of strategy and digital innovation capabilities; it is the strategy and vision pillar in Evans' model). Technology and capability related issues (disruptive technology enablers, platforms) are reviewed in Section 4.3. This section resolves RQ3 (the key technological enablers of digital transformation). Finally, Section 4.4 analyses the topics of leadership, culture and governance, concentrating on the relationship and collaboration between management and the IT unit, answering RQ4 (the role of IT departments in digital transformation in Hungarian companies).

4.1 The state and objectives of digital transformation

The state and objectives of digital transformation belong to the strategy and vision pillar of Evans' (2017) framework. Similarly to IWI-HSG (2015) questionnaire and HBR (2015) study, we investigated the state and the importance of digital transformation in organizations from the IT and business departments' point of view (Figure 2).

Figure 2: *Experienced importance of digital transformation for organizations by organizational domain (IT and business) on 1-5 Likert scale*[4]



Although in 2017, business decisions makers were more ahead considering the importance of digital transformation, by 2018, IT departments showed more awareness in this question compared with business departments. Kane et al. (2016) suggest five categories of reasons to deal with digital transformation:

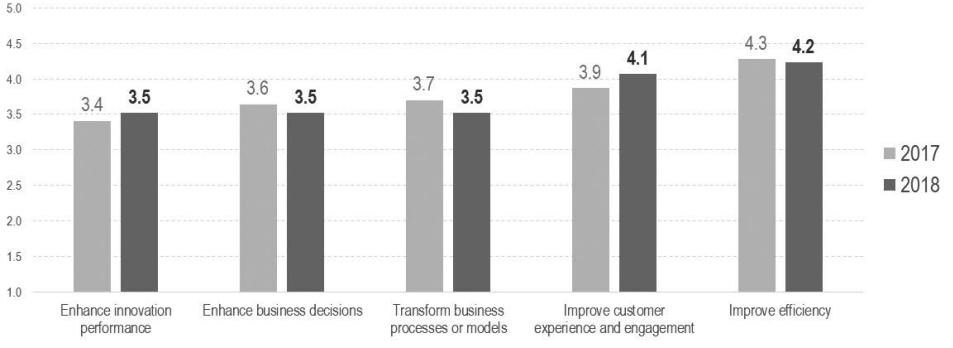
- Improve customer experience and engagement
- Increase efficiency
- Increase innovation
- Improve business decision making
- Fundamentally transform business processes and/or business models

We applied these categories in our questionnaire (Figures 3, 4 and 5) and analysed the IT and business side as well (Figure 6). The main reason to deal with digital transformation in our case was increasing efficiency, followed by improved customer experience and engagement from IT and business point of view too. The results in the first two categories are the same as in the cited Kane's et al. (2016) paper, but the order is different.

4 Abbrevations represent the background of the answering person: IT stands for the IT department, while business is used for various business departments.

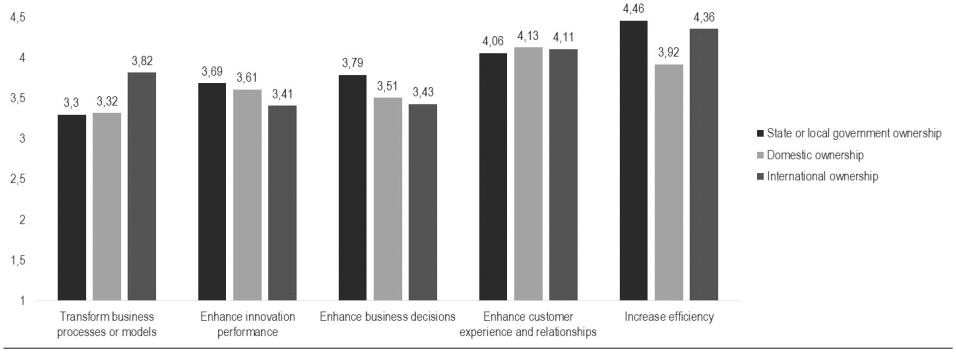
Comparing the objectives of digital transformation in 2017 and in 2018 (Figure 3), there are only slight differences. The first three options (enhance innovation performance, enhance business decisions and transform business processes or models) are equally important in 2018, most of the companies selected them. The most common objectives (strongly agree or agree) for digital transformation are increasing efficiency and improving customer experience and engagement, both in 2017 and 2018. Comparing to the research results by Kane et al. (2016), it is visible, that the expectations towards the objectives of digital transformation are stronger in their sample.

Figure 3: *The objectives of digital transformation by year (on 1-5 Likert scale)*[5]



The goal of enhancing customer experiences leads the list (4.52 in Kane's et al. sample vs 4.1 in our sample), followed by increasing efficiency (4.35 vs. 4.2). The remaining options (enhance innovation performance, enhance business decisions and transform business processes or models) are significantly lower in our sample (respectively, 3.5 4.1 and 4.06 vs 3.5). Although the leading goals are the same, the clarity of objects among Hungarian organizations is more uncertain.

Figure 4: *The objectives of digital transformation by ownership (on 1-5 Likert scale)*[6]

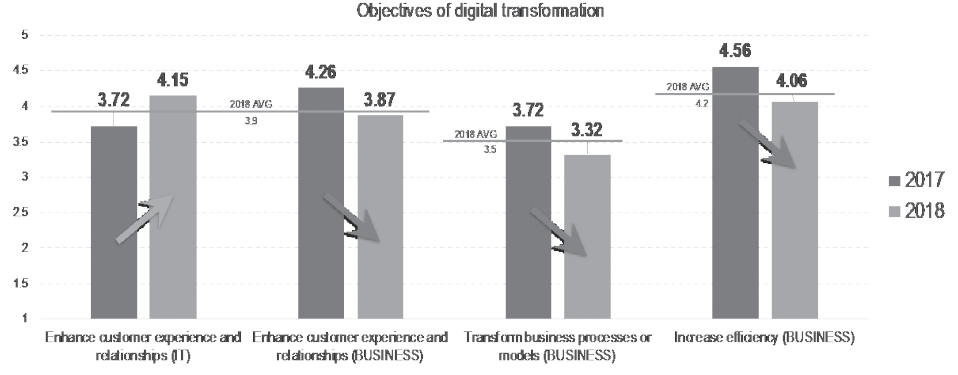


5 IT and Business together.

6 IT and Business together

Analysing the details of the objectives of digital transformation, by ownership of organizations, there are mixed patterns. For companies with international ownership, transforming their business models and/or processes is far more important than for Hungarian organizations, but they are less interested in achieving better decisions or enhancing innovation performance. For domestic companies, enhancing customer experience and relationships is the most important goal, and increasing efficiency comes only second. Surprisingly, considering the objectives, the public sector is on the same level as the private sector organizations or even more ambitious. The only exception is the objective of transforming business models (that is less addressed) or processes. We noticed some uncertainty from the business side, as shown in Figure 5. Comparing with the 2017 results, in 2018, business representatives show lower motivation for digital transformation goals, while IT departments pay more attention to these questions.

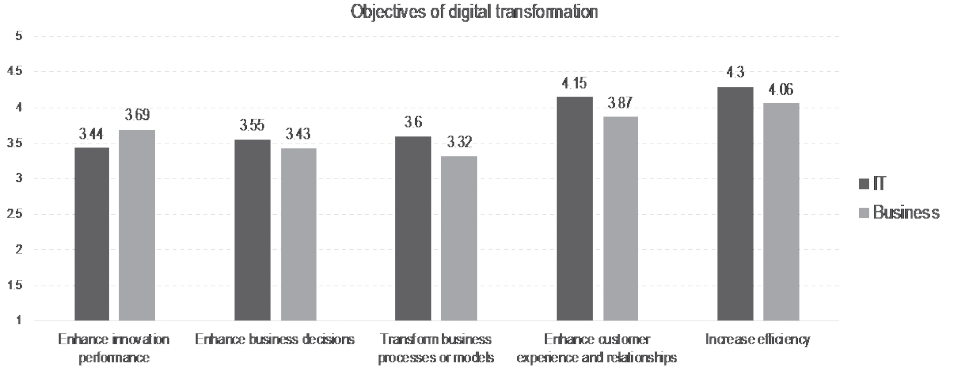
Figure 5: *Changes in the objectives for digital transformation by IT and Business (by year on 1-5 Likert scale)*



Digitalization is not a goal per se; it helps perform the business and strategic expectations. Only the customer relationship and customer experience improvement objectives are more important in 2018 than in 2017. Although the other three objectives are less important in 2018 than in 2017, all of them got high rates, so they are still in the focus of the digitalization.

Comparing the objectives reported by business and IT domains (Figure 6), we can observe the rising awareness of IT departments about the innovative utilization of digitization. IT representatives have a stronger priority considering the strongest objectives: increasing efficiency and customer experience questions.

Figure 6: *The objectives of digital transformation by IT and Business (on 1-5 Likert scale)*



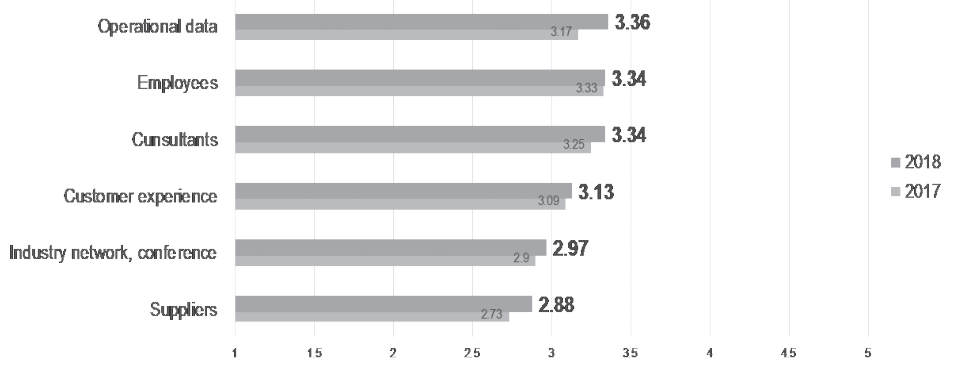
4.2 The relationship between business strategy and digital transformation

One of the key pillars of digital transformation emphasized be Evans (2017) is digital strategy. Digital strategy is different from the traditional IT strategy that focuses on business needs, and the IT organizational unit's responsibility is to fulfil these needs, discover unsupported areas, facilitate decision making and controlling. IT strategy is a technical answer to a business question, while digital strategy is about transforming business using emerging technologies. Digitalization needs a cross-functional strategy that has an impact on any function or processes. Digital strategy is the "new business strategy", the main input for IT strategy that will prepare and consolidate implementation. Our research shows a stable trend, more than 60% of the organizations deal with digitalization related issues as a part of business planning, while around 20% integrate digitalization into the traditional IT strategy. Only 9% of organizations have a dedicated digital transformation strategy, and almost 13% of the respondents reported that they have no strategy for digitalization at all. Most organizations manage digitalization at the strategic level, but there is still a large group of companies that considers digital transformation related issues as pure IT problems. Digitalization is less important for companies where IT plans are derived directly from the business plan (linked planning), some of them have digitalization strategy, but the influence of the IT unit on digitalization is less significant. Companies that implemented integrated planning process defining business and IT plans in a parallel way are more active in putting digital transformation and digitalization concepts into their planning initiatives. The results show that extensive experiences in strategic alignment are a powerful catalyst of digitalization strategies.

From the aspect of governance and processes, digital innovation is also a key pillar of digitalization (Evans, 2017). Improvement of digital innovation capabilities can be based on several strategies. Kane et al. (2016) finds that developing existing employees' digital capabilities is the most common way of strengthening digital innovation capabilities (in almost 30% of companies), while 20% of companies are strengthening it with

contractors and consultants. The most popular way of identifying new digital innovation opportunities is operational data (in 67.2% of the Hungarian surveyed companies), meaning that companies are collecting, processing and analysing operational data. This result is promising because data processing provides an objective and clear view of the operation, and the bottlenecks in business processes as well. Developing digital capacities of existing employees and consultants are also common ways (67%), so companies are aware of the need for more skilled personnel, but they rely on consultants too (Figure 7). Despite the fact that suppliers are the least used sources (57.6%) within industry network conferences (59.4%), they are used by more than 50% of the companies. Comparing the results in 2017 and 2018, all the sources were utilized more than in the previous years; companies are more committed toward improving their digital capabilities. To sum up, Hungarian companies apply all the methods we questioned, making them valuable sources of strengthening digital innovation capabilities.

Figure 7: *Sources of identifying new digital innovation opportunities (on 1-5 Likert scale)*



4.3 Technological enablers

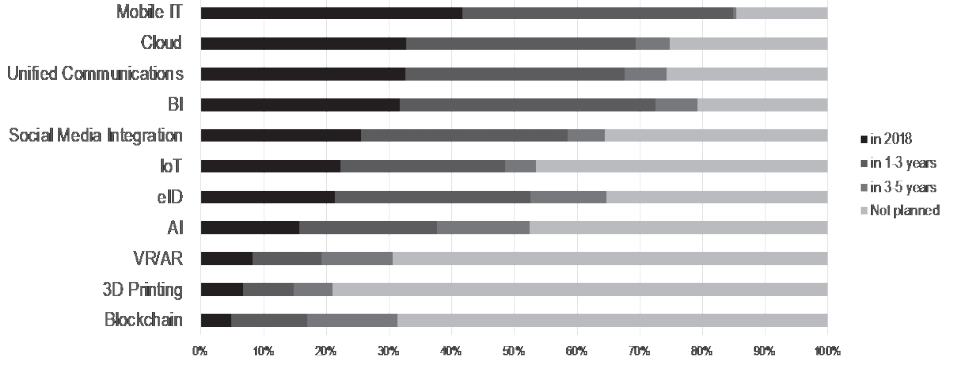
Digital technology is positioned as an opportunity or choice (Kane, 2016). This research analyses them with reference to literature and the previous years' research experiences. The main technological trends include cloud computing, mobile systems, big data analytics, and social listening (Morabito, 2014). According to the digital technology study from 2018, mobile, cloud and enterprise communication solutions are the top three ones (Figure 8), with mobile and cloud technologies changing their places on the list, compared with the 2017 results.

This results are similar to other surveys (e.g., BT, 2016), where the most widespread disruptive technologies are the cloud (58%), and mobile technology and collaboration (54%); while the popularity of data management related initiatives (business intelligence, big data management) are much less frequently mentioned in Hungary (19%) than on the

international level (52%). Mobile and cloud technologies are in the top three on Kane's et al. (2016) "most important technology" list as well. A growing interest in mobile technology is not a surprise, as they give support to easier access to services in several areas, e.g., customer relationship management.

Digital solutions enrich groupware, document management and communication. The need for BYOD (bring your own device) usage is growing, and relating to that usage of the cloud, the security of enterprise networks and mobile devices is a challenge from the operational aspects. There has been a noticeable interest towards enterprise communication solutions since 2014. At least 32% of the companies would like to start a project related to this technology every year from 2014 till 2018. Social media integration is not in the top three solutions anymore, based on our result. Companies find business intelligence (BI) more important than social media integration. Blockchain, 3D printing and VR/AR (virtual reality/augmented reality) are the least important technologies, similar to Kane's et al. (2016) results.

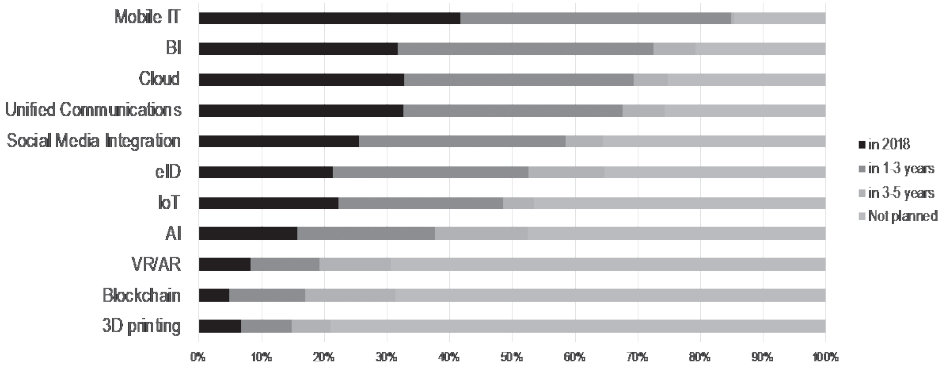
Figure 8: *The most important technologies (planned projects for the following years)*



Technologies in the next 1 to 3 years

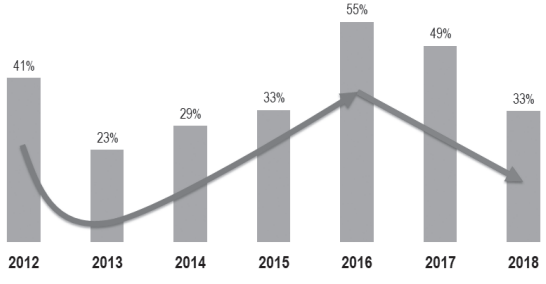
Regarding the planned projects in the next 1-3 years, the result is like the current technology landscape, except for business intelligence, which will become more important than it is now (Figure 9). Hungarian companies put mobile technology on the first, business intelligence on the second, and cloud technology on the third place. The least important technology group remains the same as at present; blockchain, 3D printing and VR/AR. There has been a continuous high interest in mobile technologies, with more than 40% of the companies planning to start a project related to them every year from 2012 to 2018.

Figure 9: *Technologies in the next 1-3 years*



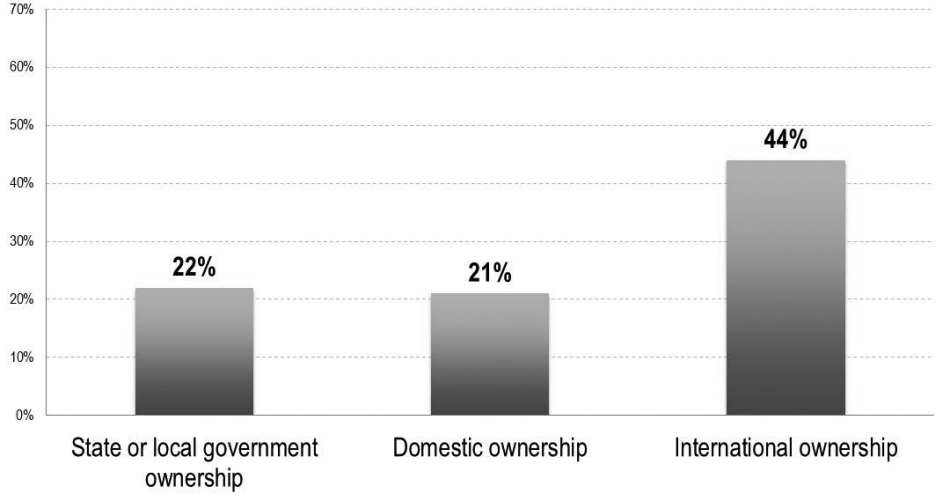
Compared with the results from the previous year, cloud solutions are still in the top. The application of cloud technology has moved forward in its maturity curve, it is in its matured phase now (Figure 10). After the decreased usage in 2013, companies started to use cloud solutions more, reaching a plateau in 2016. National companies preferred cloud solutions, and now foreign owned companies in the corporate sector use them too. There is a growing interest in the public sector as well.

Figure 10: *The usage of cloud technologies from 2012 to 2018*



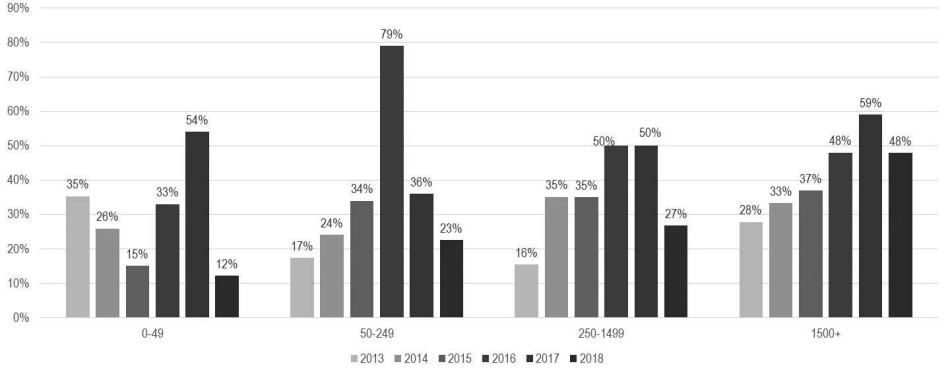
Cloud projects are clearly driven by internationally owned companies, as they are not only motivated but also required to do so by their parent companies (Figure 11). The roll-out of international projects and the support based on international experiences help local multinational companies to lower their risks in cloud technologies. Beside multinational organizations, cloud technology has gained advantage also in local organizations, and even organizations with state or local government ownership started cloud projects. Moreover, there has been an important change in the involvement of the Hungarian government in developing a central cloud solution and application services for the whole public administration sector. The roll-out of these services is developing continuously, especially for government agencies and local governments.

Figure 11: *Cloud solutions by ownership*



Through analyzing how organizations started their cloud-related projects, we can see a tendency that the popularity of using the cloud started in the SME sector, especially among small organizations (Figure 12). The reason is that for small organizations, the value offering was faster and cheaper than developing their own infrastructure, especially as companies in this size lack the required IT competencies. Popular solutions were the following: e-mail and calendar, collaboration tool, and basic business support applications. Small organizations were ready to take the technology risk in order to gain the cost advantage. Interestingly, this sector was able to renew. After the pioneers started their projects in 2013-2014, we identified a higher peak of cloud projects in 2016-2017, as technology also evolved. Medium companies also peaked in 2016.

Figure 12: *Ratio of cloud initiatives by the number of employees (on 1-5 Likert scale)*

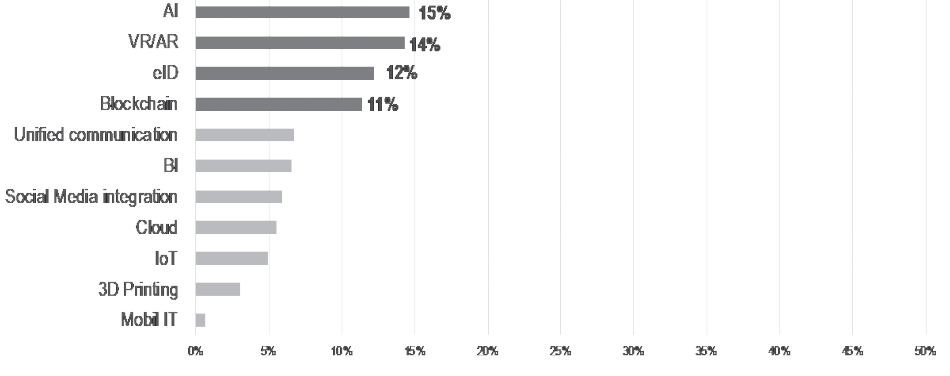


Large enterprises were more risk averse: the peak and popularity of applying cloud technologies were achieved parallel with the development of cloud technology. Larger companies often reported security and privacy concerns as a barrier. Another barrier was the complexity of the company's IT services: complex solutions (like ERP as a service) had to reach their maturity; additionally, the transition period was identified to be longer and riskier in larger companies than in small companies. Larger companies were expected to have clear business cases in order to be convinced to go on with cloud projects.

Technologies in the next 3 to 5 years

Technologies in the next 3 to 5 years show a different picture than the current one and the one depicting technologies in the next 1 to 3 years. Artificial intelligence leads the list, while VR/AR and blockchain shift their places from the last three to the top ones (Figure 13). Business intelligence is expected to be on the sixth place, it is an interesting mixture of "traditional" technologies and new trends. The matured BI technologies, such as dashboards and visual data discovery, are in a "slope of enlightenment" phase, according to Gartner's hype cycle terms (Willems, 2017), (Gartner, 2018). The business intelligence field has a key role in companies; they support data collection, processing and analytics. The BI domain has been continuously renewing, new interdisciplinary areas have appeared, e.g., security analytics. IoT provides new possibilities in data collection and BI trends include artificial intelligence and machine learning (Lebied, 2017) as well. Companies plan to have projects in the next 3-5 years related to artificial intelligence, which is considered as a megatrend now. Real-time and context-aware decision making appeared as a requirement and not only a possibility anymore. Social media integration to the enterprise solutions was a noticeable intention in 2017, with almost half of the companies planning a project in this field. This situation changed in 2018, as only 25% of the companies were interested in social media integration. We got the same result when we analysed the projects planned in the next 1-3 years. The reason of the low interest can be that social media solutions are matured, and companies have some solutions in this field.

Figure 13: *Technologies in the next 3 to 5 years*

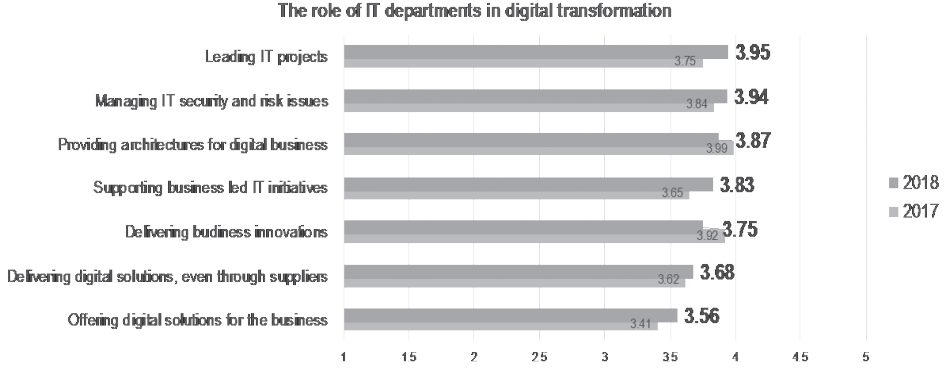


Identity management, which is a fundamental precondition of digitalization, is not in the current focus and will not be in the next 1 to 3 years. However, it is in the top three technologies in the next 3 to 5 years. Artificial intelligence solutions can enrich and extend the capabilities of identity management through the combination of machine learning and biometrics. It is interesting to see which technologies the companies avoid. 3D printing is a very interesting niche technology with a limited usage scenario in some industries; however, less than 5% of the companies showed interest in it in the next 3 to 5 years. Some studies forecast that mobile solutions will be decisive, but we got less than 2% of the companies plan to deal with them in the next 3-5 years. The megatrend in digital technologies, like the advent of artificial intelligence, influenced the companies to have projects in AI in the next 3-5 years. It looks surprising that IoT solutions are not in the focus in the long term; however, they could provide data for AI solutions. The Hungarian results are different from the international ones (Kane, 2016) where analytics, IoT, mobile solutions have the top priority. It is surprising; the highest priority (AI) is interesting only for the 15% of the companies.

4.4 The role of IT departments in digital transformation

The most frequent roles of IT departments in the analysed companies are related with the IT project management, information systems security, providing proper infrastructure and providing user support (including training, assistance and advice on the use of tools and IT solutions, troubleshooting).

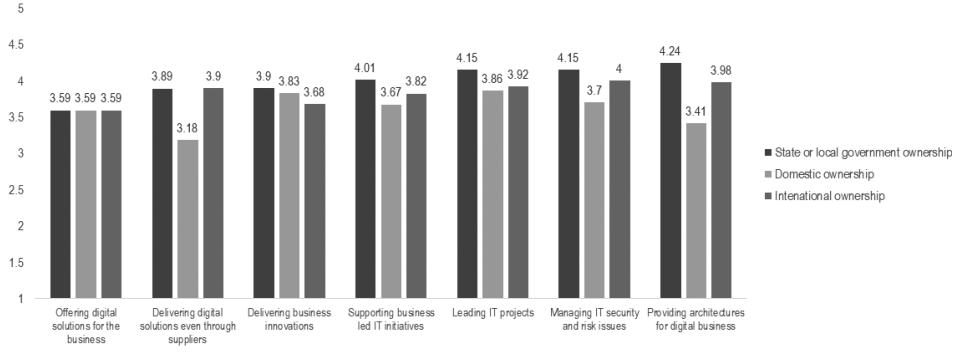
Figure 14: *The role of IT departments*



Analysing the role of IT departments by ownership (Figure 15), we can identify that the highest expectations towards internal IT departments can by identified in the case of public sector organizations. The dependency on IT departments in public organizations relies on the lack of digital capabilities in other departments. In business organizations, this dependency is weaker. In domestic companies, the expectation toward professionally

leading IT projects is the strongest, but the delivery expectation with suppliers is surprisingly weak. Domestic organizations tend to focus more on internal than external solutions.

Figure 15: *The role of IT departments in digital transformation by ownership (on 1-5 Likertscale)*

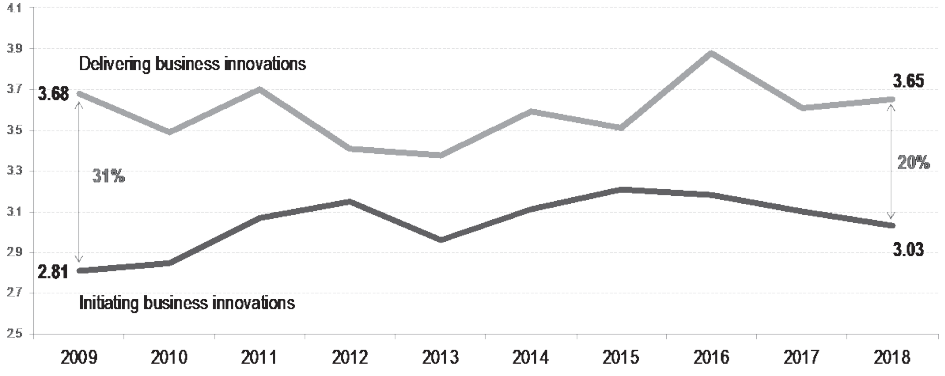


The position of the IT manager and the allocation of the IT function in the organization structure are of strategic importance. Most of the participating companies have an IT unit reporting to the CEO, which indicates a high-level integration of IT and acceptance of its strategic role. Close to 58% of the respondents reported this practice. In another typical arrangement, a functional unit supervises IT. According to the traditional approach, IT function is controlled by the operations manager, as reported by 20 percent of the organizations. In 14% of the organizations, the IT unit is reporting to the CFO, indicating the domination of cost-oriented approach – IT is costly and the financial unit can control it.

Large multinational companies, especially shared service centre structure, are defined by regional or global embeddedness, so the IT department is reporting to the manager of regional or central IT departments, rather than the representatives of the business units. Around 7% of the respondents reported this approach in 2017.

Based on the responses we observed, the strategic role of IT departments in competition is generally accepted. However, business functions still treat IT as a supportive background function.

Figure 16: *The role of IT in business innovation (on 1-5 Likert scale)*



Interestingly, an opinion on the innovative and implementing role of information technology is evolving. While domestic companies are seeing a gradually decreasing role of IT as an initiator for innovations, the perception of the implementation-oriented role has been steadily declining since 2013, with a few waves. In the case of digitization and digital transformation initiatives, the role of the IT function is implementation rather than innovation (Figure 16). Developing digital solutions for the company can be difficult if IT leaders are not involved in the management of ICT.

This problem is also reflected in the relationship between the organizational and IT strategy. Almost 77 per cent of companies reported that they are preparing an IT strategy, the duration of which is 3 years in two-thirds of the companies. In IT strategy-making organizations, 51% of corporations have the IT strategy as a part of the business strategy, and 26% make an independent strategy for IT. 13% of companies prepare only a corporate strategy, and 10% have neither business nor IT strategy. The results of the survey show a positive impact of maturity in IT planning and alignment on developing digitalization plans.

5 CONCLUSION

This paper discusses the digital transformation in Hungarian companies from various aspects. We investigated the position and objectives of digital transformation in Hungarian companies and analysed the role of IT departments in digital transformation. The state of digital transformation in Hungarian companies from the dimensions of strategy, technology and digital innovation capabilities was studied as well. The research belongs to an ongoing research, in which IT-related practice of Hungarian organizations has been analysed on a yearly basis, since 2009. This year, 167 organizations (small, medium and large companies) participated in our study. The most common objectives for digital transformation are increasing efficiency and improving customer experience and

engagement. Digital technology is considered as an opportunity or choice; we investigated it considering the literature and the previous years' research experiences. This year (in 2018), mobile, cloud and enterprise communication solutions are the top three ones, while blockchain, 3D printing and VR/AR (virtual reality/augmented reality) are the least important technologies, similarly to Kane's et al. (2016) results. Technologies in the next 3 to 5 years are different than the current ones and the ones in the next 1 to 3 years. Artificial intelligence, VR/AR and blockchain are the top ones.

Investigating the way of strengthening digital innovation capabilities, it was revealed that the main source is operational data (in 67.2 per cent of the Hungarian surveyed companies), meaning that companies are collecting, processing and analysing operational data. Developing digital capacities of existing employees and consultants are also common sources, but firms rely on consultants too. Most of the companies (60%) deal with digitalization related issues as a part of business planning, while around 20% integrate digitalization into the traditional IT strategy. Most companies manage digitalization at the strategic level, but there is still a large group of firms that consider digital transformation related issues as pure IT problems.

As our survey results revealed, there is a moderate-strong demand for digital transformation, but the consciousness and perception of how technology will change the nature of business varies among industries. Although the objectives of digital transformation are clear, companies heavily lack preconditions for successful transformation. They prefer matured technologies, such as cloud or mobile, and data management related technologies, while new risky or niche technologies are taken on cautiously.

To summarise, organizations in Hungary should focus on better preparation for digital transformation in the forthcoming years, including the identification of prerequisites and clarifying the role of IT departments in this process.

ACKNOWLEDGEMENT

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CONSTRUCTION 4.0 – DIGITAL TRANSFORMATION OF ONE OF THE OLDEST INDUSTRIES

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ŽIGA TURK[2]

ABSTRACT: *In the early 2010s, the German industry started their reform and revival under the keyword "Industrie Vier Punkt Null". The European Union's strategies adopted most of the ideas and member states followed. The European construction industry too stared to explore how to benefit from it. In this review paper, we explain the ideas behind Industry 4.0. We present aspects of Industry 4.0: what it means for the customer, business and industry as a whole. Based on that framework we analysed the potentials of Industry 4.0 in the construction industry and where – due to some specifics of the industry – construction is actually ahead in adopting the Industry 4.0 concepts.*

Key words: *industrial policy, Industry 4.0, Construction 4.0, Building Information Modelling (BIM), cyber-physical systems*

JEL classification: M15

DOI: 10.15458/ebr.92

1 INTRODUCTION

Construction was one of the first users of information and communication technologies (ICT), starting in the 1970s with structural analysis programs (Fenves, Logcher, & Mauch, 1965). In the 1980s, computer graphics began with the computerization of engineering drawing (Duhovnik, 1984). In Slovenia, the trends were followed in the 1980s, when first domestic programs for structural analysis (Marolt, 1981) were created at the IKPIR Institute. In the 1990s, construction informatics became an independent science-research discipline within the construction industry (Turk, 2006).

In the first years of this century, the first commercial solutions for one of the most pressing problems of construction informatics emerged – structured information exchange on construction products. The software for Building Information Modeling (BIM) started to replace Computer Aided Design (CAD) and Drafting (CADD). Because all ICT solutions in the field of construction in one way or another process data, BIM became a central concept and a topic of many research directions (Eastman, Teicholz, Sacks, & Liston, 2011).

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After centuries of a *drawn line* being the basic information unit for presenting information in engineering, it was replaced by a digital object which (in the construction context) can also be interpreted by a computer.

Today, structured information work is well supported by commercial software and is becoming a part of the usual practice in architecture and construction; countries are beginning to legally require the use of this increasingly mature technology (EU BIM Task Group, 2017).

This development followed a similar path to the one of all other industries and professions. It began with the introduction of generic software (e.g., word processing, spreadsheets, and in our case, CAD software) that can be used for a number of different purposes and is not limited to one particular application. Enterprise information systems backed by relational databases and higher-level frameworks emerged soon after in order to support well defined repetitive processes (Romero & Vernadat, 2016). However, a human has been an interface between information systems and events in the material world. It was mostly through human intervention that information was entered into information systems. And it was a human action – based on the analysis done digitally – that made a difference in the material world.

Nevertheless, a number of technologies, mostly those fitting under the keyword "Internet of Everything", started to change that. It meant that the "real" world was beginning to be equipped with sensors and controllers that would provide a human-free interface between the real and the digital. The stage was set for a change. The change came under the heading of Industry 4.0.

In this paper we ask and answer the following questions:

- What is Industry 4.0?
- How to interpret the principles of Industry 4.0 in construction?
- Where does the building industry already have the characteristics of Industry 4.0 and where are the biggest setbacks compared to other industries?

The paper starts with a background and discussion on the Industry 4.0 through the lens of historical development, technological building blocks and its characteristics. Next, we place those findings in the context of the construction industry. We will argue that the principles of Industry 4.0 can already be found in the construction industry with some of them (such as production of the one-of-a-kind products and processes) being the foundation of the industry from the start. The paper ends with a discussion and conclusions.

2 INDUSTRY 4.0

Industry 4.0 can be explained in terms of historical evolution from Industry 1.0 to Industry 3.0:

- Industry 1.0 - **mechanization**. It was initiated by the introduction of energy production from water sources and steam power as a source of (mechanical) energy production. This transition from agrarian and rural towards European industrial society took place in the late 18th century (Balasingham, 2016) and was based on three natural resources: coal, iron and waterways (Sharman, 2017). The development of steam engines had an affect not only on heavy industries, such as iron and textile industry, but also on transportation, communication and other economic activities (Rifkin, 2016). Nevertheless, the key resource remained the labour – a machine assisted labour (von Tunzelmann, 2003).

- Industry 2.0 - **electrification**. Rifkin (2016) argues that electricity (instead of oil and coal) as primary source of energy matured at the turn of the 20th century to create an infrastructure for the second industrial revolution. This enabled electrically powered mass production of goods (Industrie 4.0 Working Group, 2013) or, in other words, serial production. Production processes became relatively easy, resulting in mass productivity of labour-assisted machinery (von Tunzelmann, 2003) and consequently in an establishment of the social middle class with economic welfare (Balasingham, 2016).

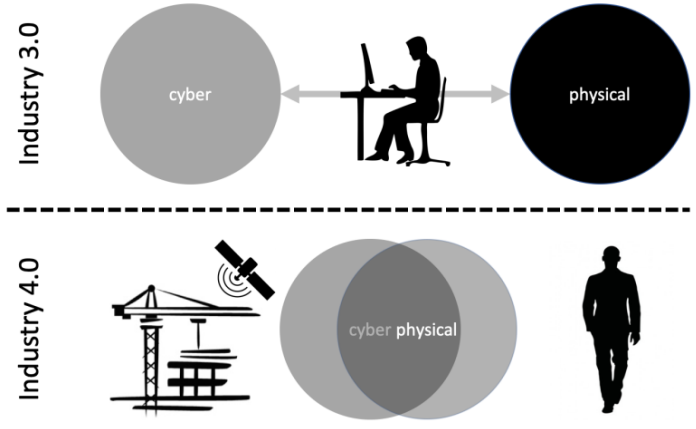
- Industry 3.0 - **automation**. Despite the first computers being built in 1930s, it took several decades (from transistors to programming languages and integrated circuits) before they became more powerful and more reliable but small and easy enough to be manageable (Sharman, 2018). The tipping point came during the 1970s with the introduction of computerization into existing serial production, digitally supported design and numerically controlled machines. Due to the fact that computers played a major role within the transition from an industrial nation towards an information society it was also named the digital revolution (Balasingham, 2016). It enabled an IT-based manufacturing automation (Preuveneers & Ilie-Zudor, 2017).

The idea of Industry 4.0 was introduced at the beginning of this decade in Germany as a strategic response to the competition brought to the German industry by the accelerated industrialization of Asia. It was later adopted by the European Union as an umbrella concept for activities leading to the modernization of European industry with the goal to maintain its global competitiveness in the 21st century:

- Industry 4.0 - **networking**. Industry 4.0 appeared at the beginning of the 21st century. Its essential building blocks are cyber-physical systems or, in other words, networking of the material world. It is a mashup of cyber and physical systems and describes the

"*organization of production processes based on technology and devices autonomously communicating with each other along the value chain*" (Smit, Kreutzer, Moeller, & Carlberg, 2016). Technologically, Industry 4.0 works with virtual digital copy of the real world. It is based on the building blocks of the modern digital world, such as the Internet of Things (IoT), Big Data, the Internet of Services, Smart Factories and Advanced Manufacturing. The essential difference with the automation of Industry 3.0 is that at first there used to be a human mediator between the real and the digital world (see Figure 1) who entered the information on the computer, read computer printouts and guided the events in the material world. (FIEC, 2015a) used simple terms and described Industry 4.0 as the digitalization of industry in general.

Figure 1: *The difference between the third and the fourth wave of the industrial revolution*



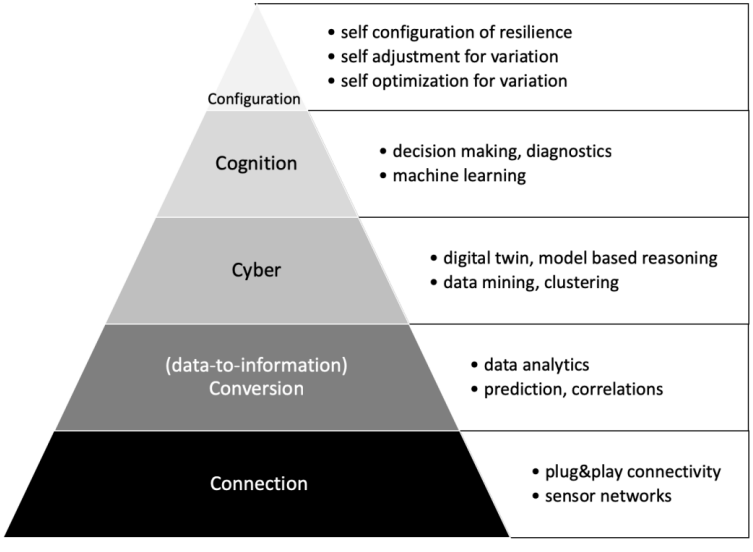
As observed by von Tunzelmann (2003), all industrial revolutions are associated with relatively slow productivity growth during their technological development stage. This is on one hand a signal of the saturation of the existing technology and, on the other, the immaturity of the new. The extent of application is very narrow and the cost of development very high. Among the expected consequences of Industry 4.0 are the usual increase in productivity, better use of resources, and higher quality of products. And there are some not so usual goals, such as significantly higher flexibility of products - serial production, where the size of the series is as low as one. Industry 4.0 is the subject of a number of national and European strategies (Santos, Mehrsai, Barros, Araújo, & Ares, 2017) and has its own chapter in the Horizon 2020 research program and the like.

2.1 Cyber-physical systems

The key technological concept of Industry 4.0 is cyber physical systems. A cyber-physical system is a system with a seamless automatic connection between the material world and smart digital components, capable of perceiving, directing and controlling the physical world. Jazdi (2014) noted that unlike the traditional embedded systems, designed as stand-alone devices, the focus of cyber-physical systems of Industry 4.0 is on networking several devices. Santos et al. (2017) describe cyber-physical systems as an extension of embedded systems bridging "*the physical and digital worlds by integrating complex information processing from multiple and networked physical elements*" (people, sensors, equipment, machinery, etc.).

Lee, Bagheri, and Kao (2015) observe that, in general, a cyber-physical system has two main functional components: (1) advanced connectivity, and (2) intelligent data management, analytics and computational capability. Based on this abstract guideline, a 5C (Connection, Conversion, Computation, Cognition, and Configuration, see Figure 2) architecture for implementation purposes was introduced (Muhuri, Shukla, & Abraham, 2019).

Figure 2: *Five levels of cyber-physical systems*



Source: Lee et al. (2015).

The proposed architecture defines a construction of cyber-physical system from the initial data acquisition through analytics to the final value creation on five different levels (Lee et al., 2015):

1. The level of **smart connections**. It includes "plug & play" devices, independent communications and sensor networks. Data acquisition and transfer within selected devices using standardized protocols has to be as straightforward as possible in order for this level to perform in accordance with expectations (Lee et al., 2015).

2. The level of **data-to-information** conversion. At this level, we find services based on data collected at Level 1 which are being processed and used for forecasts, correlations, statistics, and management to support decision-making.

3. The **cyber** level. It acts as a central information hub within this stack (Lee et al., 2015). The key concept for this level is the digital twin, digital representation of an object that exists or will exist in the physical world. When the data collected at the level of smart connections and analyzed at the data-to-information conversion level is placed in the context of the advanced data mining model, interconnections, simulations and analytics become real and useful.

4. The **cognition** level. Learning can take a step further and exploit artificial intelligence technologies to make advanced decisions, diagnostics and machine learning. It is assumed that a plurality of data that cannot be processed using traditional methods will need to be analyzed with machine learning, since the extent and diversity of data would be simply too great for the analysis to be handled manually by people writing algorithms.

5. The **configuration** level. This can lead to autonomous, smart, (self) learned and automatic configuration of cyber systems that can intelligently respond to environmental changes and user requirements. Lee et al. (2015) see it as the feedback from cyber space to physical space that acts as supervisory control to make machines self-configure and self-adaptive. To summarize, the material world shows the behavior of smart, adaptable, biological systems.

All levels combined will have a significant impact on the improvements to the industrial processes involved in manufacturing, engineering, life cycle management and wider (Industrie 4.0 Working Group, 2013).

Despite cyber-physical systems being on the very edge of the current technological development, the logical next phase is already being discussed – cyber-physical production systems. They will continue to blur boundaries between the real world and the virtual world in a way that smart products will be capable of planning, controlling and optimizing their

own production processes without or with minimal human intervention (Preuveneers & Ilie-Zudor, 2017). They are expected to be the key aspect in the growth of sustainable manufacturing systems (Muhuri et al., 2019).

2.2 Technological building blocks

There is no clear consensus on the key technologies for the Industry 4.0 among researchers (Vaidya, Ambad, & Bhosle, 2018; Erboz, 2017; Chiarello, Trivelli, Bonaccorsi, & Fantoni, 2018; Santos et al., 2017). The numbers vary based on the researchers' point of view and their understanding of Industry 4.0. From our (engineering) point of view, the technological base for Industry 4.0 includes six pillars:

1. **Internet of People (IoP)**. A radically new Internet paradigm where people are not seen only as end users but rather as active elements of the Internet (Conti, Passarella, & Das, 2017). This paradigm exploits legacy Internet services to achieve connectivity on a global-scale linking users, suppliers, designers, manufacturers, etc. into a homogeneous whole.

2. **Internet of Things (IoT)**. IoT technologies are enabling seamless interoperability and advanced connectivity between the physical and cyber world with potential benefits in various applications, including smart homes, smart buildings, smart cities and others (Faheem et al., 2018). The vision is to connect everything that is complicated enough to be connected via the switch to the Internet and can be routed from the Internet. To summarize: all that is important is going to be equipped with smart sensors that are detecting what is happening around them in real time.

3. **Robotization** and other forms of **computer-aided manufacturing (CAM)**. It can translate digital information into design (for example by mounting, adding – digital printing or removing) of the material world. The German Industrie 4.0 Working Group (2013) named this new concept a smart factory, as it facilitates fundamental improvements to the before-known industrial processes.

4. **Digital twin**. The cyber-physical system being a core component of the Industry 4.0 needs the digital twin as the representation of the physical object for the development, analysis and control of the production process (Uhlemann, Lehmann, & Steinhilper, 2017). Digital twin is a digital replica, a cyber model of its physical opponent.

5. **Cognitive computing**. This is an umbrella term for a stack of technologies including big data, machine learning, cognitive algorithms and artificial intelligence. It tries to simulate human thought processes in the computer model – using the digital twin described above. Conti et al. (2017) illustrated that cognitive computing is replicating

(in the cyber world) the way users are analyzing and managing data in the physical world.

6. **Computer cloud**. Information and communication technology (ICT) infrastructure provides warehousing, processing and communication services as a service, similarly as people are paying for running water, electricity, heating. Virtualization of hardware and networks makes it possible to effectively access the appropriate capabilities, to ensure privacy, security, resilience, etc. Cloud based systems act as platforms enabling Industry 4.0 partners better integration (Erboz, 2017), providing a range of services to the smart factories of the future to integrate better manufacturing and logistics processes (Marques, Agostinho, Zacharewicz, & Jardim-Gonçalves, 2017) and inevitably lead to cloud manufacturing (Smit et al., 2016).

2.3 Characteristics from the user's perspective

From the user's perspective, Industry 4.0 products have some special features that distinguish them from products made earlier. In the first place, these products are characterized by the fact that they are tailored to the individual. Consumers have already become accustomed to the services that came up with Web 2.0 (Klinc, Turk, & Dolenc, 2009) and are tailor-made for an individual (such as Facebook or Google services). Moreover, industrial products are still considered to be serial, that is, the same for all and everyone. Due to the automated transfer of information between the material and digital world, Industry 4.0 would considerably lower the price of the production of unique items and some early examples of the future are already hitting the market – body scans and custom tailoring, biological drugs based on the individual's DNA, custom shoes based on the digital replica of the foot, etc. Torn and Vaneker (2019) noted that "*this flexibility of production processes to fabricate products with a high level of customization is similar to the one from the era of crafts manufacturing*".

Industry 4.0 products are smart (Nunes, Pereira, & Alves, 2017). Products, such as mobile phones, cars, or home appliances, are already an indispensable part of the modern world, but now they will become "smart". This means that the car will, on the basis of data from different sensors and surroundings, adapt itself automatically to the conditions on the road and thus save energy, and the coffee machine will start the preparation process by its own when its owner usually starts and thus shortening the waiting time. Buildings will also be smart as they will "decide" when it is time to heat, open or close windows, or, depending on the current number of people in the building, how much elevators will be sent to the higher floors.

Industry 4.0 products are also (or mainly) connected. This means they communicate with each other: the car communicates with the road that communicates with the traffic lights which communicates with other cars and other smart products.

2.4 Characteristics from the economy's point of view

From the perspective of the company or industry, Industry 4.0 brings a shift from products to services and capital expenditure to operational expenditure. There is no more marketing, for example, for excavators, there are offers for digging services instead. Following the example of consumer platforms (such as Uber or AirBnB), there are industry platforms for mediation between providers and consumers. (Data) Business models where the company markets intellectual property, e.g., knowledge of how to manage a building, project design solutions, and the like, are emerging.

Santos et al. (2017) expect Industry 4.0 to "*influence paradigm shifts that are going to change the landscape of the European Manufacturing*" that is expected "*to achieve a growth from 15% to 20% by 2030 if it performs the digitization of their value chains*".

From the perspective of the AEC industry as a whole, digitalization is not limited to individual stages of design and construction, but digitizes the entire value chain from design through manufacturing to maintenance and the use of the product. Value chains (of data, processes and knowledge) can therefore be integrated.

3 CONSTRUCTION 4.0

When introducing highly innovative concepts embracing the state-of-the-art technologies into the traditional heavy industry, it is important to note that the construction industry is one of the lowest R&D intensity sectors despite being one of the most important industry sectors. Similarly, labour productivity in AEC has declined, while it almost doubled in other industries during the same period (Oesterreich & Teuteberg, 2016). Oesterreich and Teuteberg (2016) list and explain a number of structural problems within the industry that resulted in poor figures stated above: (1) the complexity of construction projects, (2) uncertainty over tangible and intangible constraints within the individual project, (3) highly fragmented supply chain, (4) short-term thinking as a result of the temporary nature of construction projects, and (5) rigid culture, resistant to changes.

Nevertheless, in the case of Construction 4.0 it is about exploiting the potentials caused by the massive digitization of information and material processes and large amounts of data in digital form that various sensors, cameras, builders and users give about building objects and the already built environment. Research agendas arise in the academic (Oesterreich & Teuteberg, 2016) as well as the industrial environment the AEC industry is co-shaping (FIEC, 2017).

3.1 Digitalisation of the construction industry

The European construction industry federation (FIEC, 2015a) wrote in its manifesto: "***Construction 4.0*** *is our branch of Industry 4.0. We use this term to refer to the digitalisation of the construction industry*."

Construction industry is known to be slow in implementing new technologies (Klinc et al., 2009; Klinc, Turk, & Dolenc, 2010), although there is an awareness that digital technologies are and will eventually transform the industry dealing with the built environment (Salamak & Januszka, 2018). The digitalisation of construction has many aspects of advanced processes and technologies, including (FIEC, 2015b):

- Industrial production (prefabrication, automation, 3D printing, etc.).
- Robotics (for performing repetitive and/or dangerous processes, use of drones for surveying, etc.).
- Digitally controlled building sites (equipment with sensors, inter-connected machines and processes leading to more fluid, faster construction with less errors, BIM, etc.).

It has to be noted though that the AEC industry is approaching Industry 4.0 from a different direction than others. Construction 4.0 is closing in the pattern for mass-production of the consumer-specific products (which is one of the goals of Industry 4.0) not from the state of mass and serial production but seeks opportunities for industrialization and repetition of manufacturing and maintaining ever-unique products. Construction has always been dealing with the production of unique, one-of-a-kind products and never had true examples of serial production within the sole scope of the construction processes. The AEC approach to producing goods could be seen as craft production on a massive scale, the product being either a sky-scraper, bridge or a family house traditionally. The main goal of the industry is therefore industrialization of production of unique products, which is quite different from other industries where the goal is customization of production of industrialized products. By digitizing value chains, dynamic and non-static value chains can become as effective as static value chains in classical industries.

Despite clear advantages of embracing digitalisation with a clear goal of bringing the construction industry up to date, Oesterreich and Teuteberg (2016) summarize a number of challenges that have to be taken into account when assessing the readiness for digital transformation (see Table 1).

Table 1: *Challenges of Industry 4.0 for the construction industry in the context of the PESTEL framework's perspective*

Challenge	perspective					
	P	**E**	**S**	**T**	**E**	**L**
Hesitation to adopt	*					
High implementation cost		*				
Organisational and process changes		*				
Need for enhanced skills			*			
Knowledge management			*			
Acceptance			*			
Lack of standards and reference architectures				*		
Higher requirements for computing equipment				*		
Data security and data protection				*		
Enhancements of existing communication networks				*		
Regulatory compliance						*
Legal and contractual uncertainty						*

P - Political, E - Economic, S - Social, T - Technological, E - Environmental, L - Legal

Source: Oesterreich & Teuteberg, 2016.

Most of the findings coincide with general recommendations for increasing the digital maturity of (Slovenian, but are also applicable widely) companies (Erjavec, Manfreda, Jaklič, & Štemberger, 2018):

- Digital competences of companies' employees need to be enhanced by developing skills on the cross-section of information technologies and business.
- Being a business initiative provided by the information technology, it is beneficial to assign accountable business roles to ICT personnel.
- It is important to develop and build an organizational culture, appropriate for successful digital transformation.
- It is necessary to strengthen and accelerate the development of the appropriate institutional environment.

3.2 Cyber-physical systems in construction

Following the research in the field of construction informatics in the last decade, it seems that most of the innovation in the construction industry is focused around BIM. That is why it is important to place stress on the statement of the European Construction Industry Federation (FIEC, 2015a) that wrote: "*BIM is central to Construction 4.0 but it*

is not the only element. Crucially, BIM can change the construction industry and facilitate Construction 4.0."

Being an important part and the core of the massive change construction industry is facing it is interesting to see that there is no uniform definition of what BIM is. Relying again on the expertise of the European Construction Industry Federation (FIEC, 2015a), one can read that "***BIM** means various things depending on the context: Building Information Modelling, Building Information Model or Building Information Management. Other terms are also sometimes used.*" Among the before mentioned other terms the one that perfectly captures the principle and the soul of the concept emerged recently: *Better Information Management*. From the context of Industry 4.0, BIM was perfectly described by Cerovšek (2011): "*A **BIM Model** is a digital representation of an actual building for project communication over the whole building-project life cycle*."

Examples from the AEC industry are found on all five levels of cyber-physical systems:

- At the level of **connectivity**, buildings, infrastructure objects, roads and other engineering facilities presenting the built environment have most probably been equipped with sensors for measuring, for example, temperatures, moisture, traffic volume, displacements, forces, voltages, and the like.

- At the level of data-to-information **conversion**, many of the collected data is already being analyzed resulting in computer made stochastic decisions based on raw sensor data, e.g., opening of traffic lanes based on the traffic volume, closing of the tunnel based on the speed of vehicles inside it, warnings based on displacement of the foundations, etc.

- The **cyber** level is the one that stands out the most from the AEC industry's point of view. The building information model provides a framework that is the basis for analysis, inference, design, planning and maintaining, and is the AEC industry's instance of the digital twin.

- The most work has to be done on the **cognition** level in the field of machine learning and deduction even though some applications are already present. Effective prediction of traffic density based on the data obtained from sensor networks is one of them.

- The **configuration** level. At the level of (auto)configuration and autonomous systems, autonomous solutions for automatic adaptation of systems to certain influences that neutralize adverse consequences have been known for some time. Examples may be smart buildings or self-configurable objects that actively learn how to respond to energy needs, wind or earthquakes, traffic, etc. Lourenco, Roffel, and Narasimhan (2009) presented one such example, an automatic adjustment of high buildings to the

wind load where self-adaptable system minimizes the oscillation frequency by using a movable ballast.

All described solutions are created at the level of the islands of cybernetization. Unified platforms for Construction 4.0 that provide technical infrastructure to services, together with a single market for applications and services, as well as an effective way to connect providers and consumers in the sense of enterprise-to-enterprise (B2B), are still in development.

3.3 Readiness of the construction industry for the principles of Industry 4.0

It can be argued that construction already is Industry 4.0, as they share many similarities:

- From the perspective of the consumer there are no significant differences since construction products (buildings, facilities, infrastructure) have always been adapted to the requirements of the investor, standards, conventions, location and similar, and were always unique. As a result, smart buildings and smart cities are being development.

- From the business perspective, project work in construction is an example of a dynamic, project-organized Hollywood economy. Construction factories and construction sites 4.0 have even more potential, with the greatest impact on construction costs and schedules as well as improved work processes and security.

- From the technological perspective, the construction industry had digital twins before the term was coined. BIM, Asset Information Models (AIM) and Geographic Information Systems (GIS) are all digital duplicates of their physical counterparts.

Nevertheless, Salamak, and Januszka (2018) argue that further digitalisation is the reason why the AEC industry is interesting, as there are many opportunities for profit by lowering the cost throughout the whole life cycle (from design to demolition). The most important opportunities were gathered by Oesterreich and Teuteberg (2016) and are presented in Table 2.

Table 2: *Benefits of Industry 4.0 for the construction industry in the context of the PESTEL framework's perspective*

Benefits	perspective					
	P	E	S	T	E	L
Cost savings		*				
Time savings		*				
On-time and on-budget delivery		*				
Improving quality		*				
Improving collaboration and communication		*				
Improving customer relationship		*				
Enhancing safety			*			
Improving the image of the industry			*			
Improving sustainability					*	

P - Political, E - Economic, S - Social, T - Technological, E - Environmental, L - Legal

Source: Oesterreich & Teuteberg, 2016.

4 DISCUSSION AND CONCLUSION

Having stated that cyber-physical systems are the key ingredient of Industry 4.0 and Construction 4.0, one first needs to acknowledge there is no other industry being more physical than construction and creating more volume of products or products that would pane larger areas. The entire built environment, all the infrastructure, is an area of interest for Construction 4.0. It is a big task for the construction industry with a huge impact on the life, work and leisure environment of humanity. Industry 4.0 is therefore a major challenge for the construction industry. The challenge is even bigger considering the low innovation culture in construction and the demographics of the business – few business leaders and a vast majority of small and medium enterprises with very different technological maturity.

The challenge is also to shift the industry from business models, where the product is of a material nature, to information and digital products, data and intellectual business models. The construction industry faces competition from other engineering professions for the primacy in integrating the digital and the material. Yet, the digital is just a layer of technology over what builders have been providing for centuries. The essential functions of places to live, places to work, or infrastructure to travel are not changing – just the technology to deliver the function is. Therefore, we are convinced that Construction 4.0 should be brought about by the construction industry and not by others that would develop a layer of digital over the "real".

The contribution of this paper to the corpus of knowledge is the harmonisation of the key principles of Industry 4.0 with the characteristics and specifics of the construction industry that were put into the context of Construction 4.0. In the end, we must also admit that Industry 4.0 is to some extent also a buzzword and a marketing gimmick – something that may not warrant a serious scientific analysis. Yet, sometimes it is important to give a name to a number of different but related developments. Names and concepts are an important motivator. With Construction 4.0 we are getting an umbrella concept for many of the technologies that interdisciplinary teams of researchers for construction, computer science, mechanical engineering, economics and social science – to name just the main ones – will be developing for years to come.

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INDEPENDENT CINEMA IN THE DIGITAL AGE: IS DIGITAL TRANSFORMATION THE ONLY WAY TO SURVIVAL?

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ABSTRACT: *Development of digital technologies has resulted in the creative and cultural industries having to adapt business models in light of evolving consumer preferences. This paper aims to examine how independent cinemas can transform their delivery in light of the challenges posed by digital disruption, and more specifically, whether this has to focus entirely on digital transformation. This conceptual paper examines one independent cinema in Scotland, concluding that digitalisation should be used to complement existing activities, along with exploring other innovative business models. It is crucial to understand that the old-time patterns of running a business have irrevocably changed.*

Key words: *video on demand, film industry, digital disruption, digital innovation, business model, consumer preferences, independent cinema*

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1 INTRODUCTION

The rapid development of technology has had a massive impact on the creative and cultural industries. The Internet has altered the business landscape in all industries, and is unlikely to slow in progress, hence the so-called Fourth Industrial Revolution (Ismail, Khater & Zaki, 2017; Vey et al., 2017). The Internet has created both opportunities and challenges for the film industry (Re, 2018; Teece, 2010), moreover, new and increasingly more sophisticated technologies (such as home cinema systems) are putting pressure on independent cinemas (Dunn, 2018; Wroot & Willis, 2017a), which is the focus of this article.

The traditional model of film festivals and home theatres as the gate-keepers for the distribution of independent films is losing relevance in the age of digital disruption (Fisher, 2012). Disruption has been defined as "an event in which an agent must redesign its strategy

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to survive a change in the environment", affecting the ecosystem as a whole (Kilkki et al., 2018: 275). Hence, we consider digital disruption to mean the rapid and unpredictable development of technology (the event) which is pushing the whole film industry (the ecosystem, including the independent cinema as one agent) into the digital sphere. Media content used to be selectively circulated (Curtin et al., 2014), yet in recent years the rise of new film distribution business models has been based on the simple and accessible flow of video materials online; this has resulted in the emergence of numerous Video on Demand (VOD) giants. This change has stripped power from those institutions based on older models, deconstructing what is known about film distribution and exhibition. It is the continually-running artistic cinemas that have to reconsider their future as the number of people watching independent movies in the theatres connected to or run by festivals has been slowly falling, worsening the financial situation of independent cultural institutions (Peranson, 2008). In the modern digital era, many art-house institutions have noticed the extent of this shift and are slowly developing new ways to comply with the demands of emerging preferences to watch titles online. Indeed, digital transformation is seen as key to survival, with only those companies able to adapt to digital changes succeeding (Ismail et al., 2017).

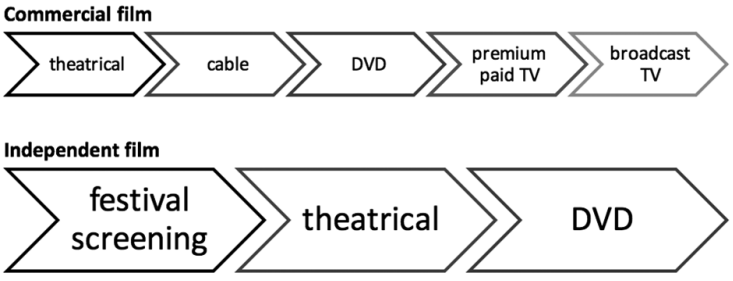
The aim of this conceptual paper is to examine how independent cinemas can transform their delivery in light of the challenges posed by digital disruption, and more specifically, whether this has to focus entirely on digitalisation. The paper builds on an unpublished dissertation study by Sadlowska (2017), identifying a sustainable business model for independent film cultural institutions. Sadlowska's proposed business model is further conceptualised with the use of one independent cinema in Scotland, the Glasgow Film Theatre (GFT).

2 LITERATURE REVIEW

Dynamic digital expansion is increasingly becoming one of the major themes in the academic and industry talks about the future of film distribution. The rapid rise of interest in film distribution has become more pronounced in recent years, typically focusing on exhibition, moviegoing, cultural geography, and audience studies (Adamczak & Klejsa, 2015; Aveyard & Moran, 2013; Smits, 2017).

The traditional business model of film distribution is based on the accumulation of power and controlling the scarcity of film availability (Elkington, 2017; Fisher, 2012). Known as the 'windowing' model (see Figure 1), it involves a step-by-step movement of a film through numerous release windows (Lobato, 2012; Smits, 2017; Wroot & Willis, 2017a). Karaganis (2011) explains that the windowing model traditionally insulated the theatrical release of films from the home video market by providing exclusive access to films for many months. However, once the DVD market became profitable, studios began experimenting with different ways of narrowing the theatrical window to maximise revenue (Re, 2018).

Figure 1: *The windowing model of distribution*



Source: Lobato, 2012.

Karaganis explains that film piracy has been the driver behind low-cost, on-demand models (2011). With the development of technology and emergence of VOD models, traditional frameworks are starting to lose their relevance at an alarmingly fast pace. Currently, digital distribution has already been marked as one of the main threats by the festival circles (De Valck, 2012), with release models increasingly tailored to online audiences (Smits, 2017). However, despite all of the extremely important changes, there has been relatively little literature on this particular aspect of the film business (Curtin et al., 2014), inviting further research.

2.1 Video on Demand models

VOD has impacted decisions concerning the timing of releases, given the capacity for VOD to satisfy consumer convenience (Ulin, 2009). VOD models are currently the most popular digital solution, constantly increasing the number of its users (Smits, 2017). In Poland, for instance, online viewers rose from 67.9% in 2009 to 78.2% in 2014 (Franek, 2015). Elsewhere in Europe, Re's (2018) case study of the Italian film market credits the introduction of Netflix to recent growth. In the UK, while revenues from VOD models are increasing, so too are revenues from film on television and from theatrical distribution. In 2016, theatrical revenues were still the most significant component of the film value chain in the UK (British Film Institute, 2017).

Although one can differentiate many different VOD models, the majority of the online distribution market seem to fall into three main categories described by Anderson (2007): *Streaming or Subscription Video on Demand* (SVOD); *Transactional Video on Demand* (TVOD); and *Ad-Based Video on Demand* (AVOD). What they all have in common is common to all subscription models – greater consumption associated with greater value for money.

The SVOD model has been named as the most successful one, with Netflix at the forefront – in March 2016, Netflix represented over 35% of Internet traffic in North America (Spangler, 2016). The transactional model (TVOD) is based on the premises of a user visiting a specific site, setting up an account, registering one's credit card, and then being able to either download or stream the requested movie after making a payment (Lobato, 2012). YouTube, the main representative of the ad-supported (AVOD) category, at its initial stages of existence was merely an up-root initiative not making any huge profits, allowing for the audio-visual materials posted there to be freely accessible by everyone; a video-content version of social media. This changed when Google bought the service in 2006 and introduced commercials. The SVOD giant, Netflix, entered the race for market control somewhat in the shadow of the great battle with YouTube (Jajko, 2015), which allowed it to quickly develop undisturbed. In the case of film piracy, hundreds of millions of dollars are generated in advertising revenue from illegal online sources to access films (see Digital Citizens Alliance, 2015; Incopro, 2015). Film piracy of course does not return profits to rightsholders, but can provide other useful outcomes for the industry including knowledge of how many people have viewed a title across different distribution channels (Lobato, 2010).

One of the biggest competitive advantages of VOD systems is their simplicity. Finding a desired film title and accessing it requires only a couple of clicks on consumers' TV or computer screens. It also gives them the ability to control the screening by being able to pause, rewind, and fast-forward at any given point in time (Rizzuto & Wirth, 2002). And, thanks to the recent technological advancements, VOD providers are able to continually widen the range of titles as they become available. The volume of web pages dedicated to facilitating circumvention of territorial barriers demonstrates how attractive it is for consumers to have access to a variety of titles.

2.2 The independent film market

Each year independent distributors release as many new films as the big Hollywood studios, but their cost is significantly lower. The advantages of choosing their services over big commercial distribution companies include: more time to spare for each of the titles; less bureaucracy; bigger willingness to cooperate with the producers; and a more open-minded approach towards the non-commercial values of the film (Goodell, 2003). Anderson (2007) names low prices, broad availability, easy and intuitive search strategies, and a great match between supply and demand as factors contributing to the success of independent film offering derived from harvesting new digital opportunities.

Another competitive advantage of independent cultural institutions has been observed – film festivals are able to offer the audience an *experience* that cannot be replicated online, and therefore, have the unique edge that can help them survive in the long-term. However, the question of whether film festivals can be included in the mainstream distribution model or at the core of an alternative one is being carefully considered (De Valck, 2007; Iordanova

& Rhyne, 2009; Smits, 2016). Problems are evident, especially when following the view that film distribution is a continuous, strictly-commercial process led with only one goal in mind – to deliver the film to as many people as possible. Film festivals are infrequent events, calendar-bound and limited by time. The implications of this predicament can be (and are being) reduced in two ways: taking the film to many festivals across the world to introduce it to numerous diverse audiences; and secondly, by seeking alternative methods of film exhibition (Adamczak & Klejsa, 2015).

Still, the notion of the authentic cinema experience is at the heart of the prominent anti-piracy advertisement 'The Last Cinema' (Myung, 2011), which suggests that film piracy will directly result in the closure of cinemas. Yet, while the consumption of digital films has increased, following on from the argument of the cinema *experience*, there has been a rise in the trend of 'experiential cinema' which refers to live and immersive film-based events, with interactive elements resulting in a change in the practice of film consumption (Nikdel, 2017).

Considering that the immense power of big global productions has been possible until now as a result of extensive distribution networks, it ought to be noted that online distribution is causing much havoc in the film industry. Using the Internet for film distribution is now the easiest task for producers of content that have no other links to physical distributors – the independent cinema segment (Cunningham & Silver, 2012). Therefore, it is vital for them not to underestimate the potential of this current situation and take advantage of it as long as the online distribution world is still less accessible to global distribution giants.

2.3 The emergence of new media audiences

Digital innovations, defined as "the concerted orchestration of new products, new processes, new services, new platforms, or even new business models in a given context" (Hinings, Gegenhuber & Greenwood, 2018: 52), such as technological changes, are leading the modern audience evolution and media consumption (Napoli, 2011). One can differentiate between two main phenomena produced by those changes: audience fragmentation and audience autonomy (Napoli, 2003). The fragmentation of the contemporary media environment is ever-growing, both in the portfolio of content options and in the increase in distribution platforms (Neuman, 1991; Turow, 1997, Smits, 2017; Wroot & Willis, 2017a). As a result of the Internet and spread of portable devices, the capacity to deliver content expands dramatically along with the ways to reach the continually increasing numbers of audiences. The key implication of the described situation is the extent to which the traditional approaches to conceptualising media audiences are being undermined (Napoli, 2011).

In the digital age, when people are faced with unrivalled choice, a shift in the types of consumers has occurred; going from 'push' to 'pull', people are now responsible for creating their own digital watching experience. This transition challenges the old-time model

of distribution, threatening the existence of non-profit cultural institutions (De Valck, 2012) by putting emphasis on quantity of distributed films. While theatrical distribution is still dominating the film industry, other forms of distribution release platforms are used in a complementary manner to maximise profits (Wroot & Willis, 2017a). The process of making cinema increasingly more portable has been developing almost since its emergence; first through television, then with VHS, DVD, Blu-Ray and now with the Internet (Smits, 2017). This expansion has been interchangeably linked with the increasing mobility and fluidity of audiences that are connected through virtual clusters, such as groups or communities online (Trowbridge, 2013). However, as Schwartz (2004) observes, consumers are increasingly less satisfied with their choice when the selection is greater, and this is supported by Hope (2012, cited in Elkington, 2017: 93), who noted that "we live in the time of grand abundance of content, total access to content and rampant distraction from content". This observation has far-reaching implications, suggesting that limiting the offering can in fact increase consumers' satisfaction levels, and hence independent film distributors with a limited number of new releases might have a big potential for retaining their audiences.

VOD platforms have started changing their content catalogues, though this is not specifically in response to audience dissatisfaction due to overwhelming choice. According to Napoli (2016), Netflix has reduced its digital content in the US, by going from 11,000 titles in 2012 to only about 5,300 titles in 2016, which represents more than a 50% decline in titles in a matter of years. Strategically, the company's focus switched to being less focused on quantity. The predictors of whether a film ends up on Netflix include its age and box office grosses, with newer and higher grossing films more likely to be available. In effect, Netflix, while initially being influential in eradicating the traditional video rental stores, has now moved in a similar direction in terms of strategy, except for being an online provider. While quantity over quality was perhaps characteristic of companies like Amazon and Netflix when they initially focused their efforts on making large libraries of books and videos available in digital form (Anderson, 2006, cited in Napoli, 2016), this is no longer the case, and a key reason cited for this is the cost of licencing which effectively works against providing large quantities of low-popularity content. Hence, even companies like Netflix are now far more selective in terms of the content they provide.

2.4 Implications of the audience evolution

Both content production and distribution have been undergoing the process of de-institutionalisation with audiences being in the centre of this change, playing a more prominent and active role in facilitating it (Napoli, 2011). As Uricchio (2004) observes, it is possible that in this rapidly changing environment even the very definition of the creative and cultural industries might require reconceptualisation. What might be just a natural process caused by the changes in the technological developments is summarised by Freidson (1953: 316), who suggests that "the audience changes as we change our perspective". Due to the ongoing process of audience autonomy and fragmentation, mere exposure has been enriched by other factors influencing the evolved institutionalised

consumers, including engagement, response, appreciation, and interest. The technological advancements that are the root cause of the emergence of user-generated content might also aid in developing alternative forms of traditional media content, as the degree to which they engage with the content is continually expanding (Napoli, 2011). It might be the case that online viewing platforms are actually facilitating not only promotion of the offering but also an increase in the quality of the narrative in terms of complexity and innovation (Ross, 2008).

2.5 The need for a new business model

As shown, the literature portrays digital distribution as a disruptive innovation in the world of media management (Kolb, 2005). It points out two ways in which it disturbs the established model of activities: (a) by introducing new product categories or market segments (Smith & Tushman, 2005); and (b) by completely changing the model of a company by forcing it to revise their markets, strategy, product portfolio, and business model (Küng, 2008). This is essentially what Hinings et al. (2018: 53) refer to as digital transformation: "The combined effects of several digital innovations bringing about novel actors (and actor constellations), structures, practices, values, and beliefs that change, threaten, replace or complement existing rules of the game within organizations, ecosystems, industries or fields".

According to Vey et al. (2017) we live in a 'platform economy' where digital disruptors create digital platforms in which they exploit already existing infrastructure, products, services and content, which allows faster growth than traditional business models based on physical goods. This leads to a situation where it is crucial for existing businesses to innovate. At the same time, customer behaviours have changed in that their expectations towards businesses has increased, e.g. wanting more individualised services and unique customer experiences. Therefore, businesses, in trying to achieve competitive advantage, must create operating models that meet the value expectations of modern customers, by taking advantage of technology. However, when considering going down the digital transformation path, businesses need to think about how far they should go down this path.

As noted by Christensen (2013), it is extremely challenging for companies to capitalise on a disruptive technology as its commercialisation requires a new tailored business model. The only way for existing cultural institutions to avoid market failure in this case is to create a new organisational space for managing this disruptive technology (Küng, 2008). The term first used by Burgelman (1983), 'internal corporate venturing', describes this process. To achieve innovation, and hence success in the long run, an organisation has to be *ambidextrous*, combining explorative and exploitative practices (O'Reilly & Tushman, 1997). The explorative tasks involve experimenting with new services, products, and technologies in a highly independent, entrepreneurial-like climate, whereas the exploitative

function is to "maximise the performance of existing products, driving out variations and maximising efficiency" (Küng, 2008: 142).

The concept of a business model has gradually evolved from a vague term to a key concept in management, although its definition is still widely debated (Massa, Tucci & Afuah, 2017; Massa, Viscusi & Tucci, 2018; McGrath, 2010). In basic terms, a business model is a "description of an organisation and how that organisation functions in achieving its goals" (Massa, Tucci & Afuah, 2017: 3). Importantly, it is a system level concept, focusing on the whole rather than isolated parts of the organisation (Massa, Viscusi & Tucci, 2018). All organisations have a business model, whether it is explicit or implicit. It is concerned with articulating all the core processes and functions of a company: essentially, how an organisation is creating and delivering value to its customers as well as outlining the architecture of revenues, costs, and profits involved in this process. A business model must be focused to meet particular customer needs and to some extent it must be non-imitable (Savič, Ograjenšek & Rejc Buhovac, 2016; Teece, 2010; Watson, 2005).

The dynamic aspects of business models have become important (Teece, 2010) as the only way of surviving is to continuously renew, amend, and redesign the operations of creating and capturing value (Achtenhagen et al., 2013). Cultural institutions have to change the way of managing their core processes and develop a set of new practices to find their relevance in the digital era, and some of this could involve undergoing changes leading to a digital transformation. However, many organisations fail to recognise the potential impact of far ranging digitisation, and many have failed to address this at a strategic level by failing to consider the real impact of the new digital landscape (Vey et al., 2017). According to Heaving and Power (2018), organisations need to include appropriate digital transformation as part of their core strategy in order to survive, and this involves having a deep understanding of customer needs and technology possibilities.

One of the possible directions the media business models can go in is the 'branded pre-selector' model described by Aris and Bughin (2005). Due to the constantly expanding amounts of content, the audience are becoming increasingly confused. Organisations that have a relationship with their consumers that is based on trust could become their trusted guides in this new world of overproduction, selecting only the best quality content, and therefore saving the audience's time. This would be possible through mass individually-tailored programmes, in which Aris and Bughin explain that situation revenues can be made via subscription, advertising, or transactional payments.

Sadlowska (2017) investigates contemporary film-watching behaviours, both in movie theatres and online (including via subscription services) and assesses the industry perspective on contemporary challenges facing independent film cultural institutions, with an emphasis on digital distribution practices. The ideas presented in Sadlowska's (2017) dissertation are considered of great importance and worthy of further investigation,

particularly given the relatively small sample utilised. Thus, the current work builds on prior research, developing the ideas further.

Sadlowska (2017) finds that on average, consumers tend to watch one to two films online per week and visit movie theatres the same amount across the span of a month. Independent film audiences tend to treat online platforms (followed by movie theatres) as their main point of contact with art-house cinema, as expected. The majority of respondents said that they would watch independent cinema more often if it was easily available online. Furthermore, the majority of respondents described themselves as watching independent cinema, with online viewing being the most popular platform. Nearly half of the sample indicated SVOD as the online watching model of their choice, as expected.

The principal challenge posed by the evolution of digital technologies found in Sadlowska's (2017) research is keeping audiences *engaged*. Their increasing fragmentation and rising levels of autonomy suggested by literature (Napoli, 2003) comply with Sadlowska's (2017) findings. Currently, the links of the industry to the younger audiences are not strong enough to retain them in the long term (Team Slated, 2016), and as such, Sadlowska (2017) argues that more effort should be put in appealing to younger audiences. As noted by Schwartz (2004), and confirmed by Sadlowska (2017), consumer satisfaction is diminishing when faced with an overwhelming choice offered by the digital world; this should be capitalised on, which SVOD platforms, such as MUBI (online art-house cinema), have already done. MUBI (2018) releases one film every day, but it is time-limited, so the viewer has exactly 30 days to watch it, and once it is gone, it is gone. Sadlowska's (2017) findings identify potential for growth of the independent cinema industry with the usage of VOD platforms. All consumer preferences, industry experts' opinions, and public data show a constantly increasing interest in this form of movie-watching (Netflix, 2016). As highlighted in the example of the European Parliament, public institutions also support this development (European Parliament, 2016). However, this opportunity cannot be harvested without an adequate digital equivalent of the independent distributors' technique of creating a locally-tailored demand for films. Additionally, there is a lack of trust in the digital platforms among the independent cultural institutions, which makes it more difficult to initiate the process of incorporating online aspects into their offering (Sadlowska, 2017).

Sadlowska's (2017) findings indicate that there is a need for further investment in the preservation of independent movie theatres due to their unique added value, confirming observations made by De Valck (2012). One of Sadlowska's (2017) participants (the CEO and founder of the biggest privately-owned chain of cinemas in Poland) noted that the movie theatre is "the most important element that makes people want to watch films in the first place". Moreover, her interviewees have no doubt that it is possible for traditional cinemas and digital platforms to co-exist in the future. This is similar to what happened in the music industry where artists have several business models at their disposal to create revenue, including live productions, movies, sale of physical CDs through stores and sale of digital content online (Teece, 2010). In order to survive this digital disruption, independent institutions have to evolve into local cultural hubs with a consequent

independent-focused repertoire, and concentrate on creating a welcoming, engaging, intellectually-stimulating platform (Gonzales, 2016; Salson & Arnal, 2016). Since the mere existence of VOD platforms is not able to create a local demand for films, it is vital for local cultural institutions to prevail. Cinemas and film festivals are vital for the promotion of independent film and the development of digital promotion of independent cinema should progress in a way that would incorporate a cooperation of those two outlets. As the representative of the biggest independent distribution company in Poland noted, the end goal is "to come up with a new formula that would make people less alienated in movie theatres. To think of a model that would transform cinemas and make them offer a promise of abandoning one's anonymity and meeting new people with similar tastes in return" (Sadlowska, 2017).

The most popular VOD model identified by Sadlowska's (2017) sample as a whole is a subscription-based one. The main disadvantage connected to this business model, identified by both literature (Neuman, 1991; Schwartz, 2004; Turow, 1997), and her interviewees, is the extremely extensive offering, making choosing a film more daunting. As Shirky explains, "surplus means that previously valuable things stop being valuable" (2011: 4). As a solution, decreasing the number of available titles in order to emphasise the important titles and encouraging people to watch them is suggested. This could involve a personalised 'taste-making' component, with information gathered from digital behaviour, as is the case with music subscription services such as Spotify, with personalised playlists created for individual subscribers (see Prey, 2016). Again, MUBI is an example of SVOD, where content is limited, but as the company boasts, "our curators scour film festivals for the most exciting and original new films…there are always 30 hand-picked films to watch or download. From forgotten gems to festival-fresh cinema. From cult classics to award-winning masterpieces" (MUBI, 2018).

When consumers are overwhelmed by choice, the so-called 'paradox of choice' occurs (see Dobelli, 2013), found to occur in the case of digital music subscription services; with consumers opting to stick with the familiar (Bylin, 2014; Luck, 2016; Nordgård, 2016). In the case of music, technology has freed up the opportunity to listen to a wide variety of music (Waldfogel, 2014). Yet, Ward et al. (2014) find that although consumers state a preference to listen to unfamiliar music, it is familiarity with that music that positively predicts preference for songs, playlists, and radio stations. Ward et al. (2014) argue that the need for familiarity is motivated by a desire for low levels of stimulation; this is certainly plausible, given music listening via mobile devices or on computers would be expected to be an accompaniment to other activities. This may also be the case with viewing films online, as the medium of delivery is not designed solely for watching films. Aiken, a cyberpsychologist, explains that "the Internet is like a catalog of desire begging people to flip through it" (2016: 39). The Internet is designed to interrupt (Carr, 2010). This poses obvious problems for the film industry as it has been established that the only way for cultural institution to survive and retain their audiences in the digital age is to harvest the opportunities of new technologies (Kolb, 2005; Küng, 2008), by engaging in internal corporate venturing (Burgelman, 1983), and combining both explorative and exploitative

practices (O'Reilly & Tushman, 1997). It has been clearly stated that capitalising on digital developments is extremely difficult and requires a flexible tailored business model (Christensen, 2013).

3 CONCEPTUALISING A BUSINESS MODEL FOR INDEPENDENT FILM INSTITUTIONS

The most suitable direction which would address market needs seems to be the 'brand pre-selector' option, as described by Aris and Burghin (2005). It is based on a mutual trust between the institution and its consumers, which allows the firm to act as a selector of a limited number of high quality titles for their audiences (instead of giving them access to thousands of films). Two main objectives to be met by the new generation of independent institutions are identified by Sadlowska (2017) as focusing on engaging young audiences and discovering a solution to overcome the lack of locally-tailored marketing programmes on online platforms.

Sadlowska (2017) proposes that independent movie theatres are transformed into local cultural hubs. This should be done by promoting the institution in relation to its specific location and incorporating it to the picture of a local community. The independent cultural institution of the digital era should incorporate more than just movie screenings; it ought to offer different types of socially-based activities, such as a café, a bookstore, a gallery for local artists, etc. In this way, it is possible for the institution to become an inseparable part of the community and a place linked with social activities and an alternative to the mainstream culture. Through building such a relationship, the lack of extensive and costly local promotion can be avoided and achieving the status of a 'brand pre-selector' is feasible. Bearing in mind all of the complexities of distribution agreements, the digital offering of such institutions should be based around the social aspect as well. This could centre around 'taste-makers', and it has been shown that tweets from individuals on Twitter expressing a desire to watch a certain movie can influence sales; this is pronounced amongst those with more followers (Rui et al., 2013).

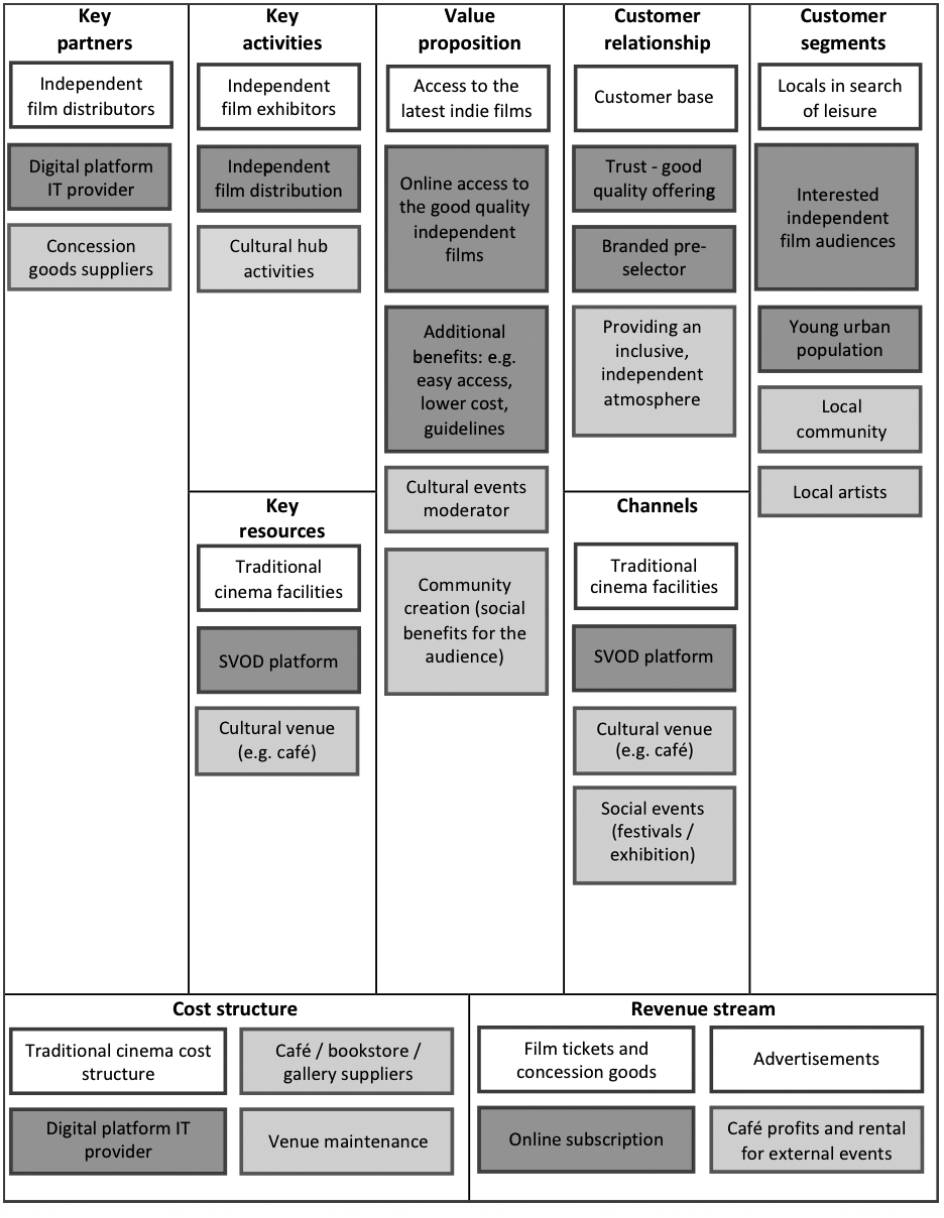
In order to be able to compete with digital distribution giants (e.g., Netflix or Amazon Prime), the competitive advantage should be based on a more interactive model. One of the possible suggestions is to create some sort of a discussion platform for the audiences that would offer only a couple of titles a month (for example all connected by a common theme), along with some engaging added value, such as discussions or panels on the movies shown online, based in cultural institutions and venues. In this way the business model of those institutions would be self-complementary, based on both traditional and digital screenings with the same audience base, and complying with the assumptions made by O'Reilly and Tushman (1997). Moreover, as Sadlowska's (2017) study shows, the digital practice should be modelled on SVOD. This solution has numerous advantages (including retaining a customer base, allowing for a different number of movies online across time without changing the price, becoming an extra source of a constant revenue for the

institution) and seems to be the most sustainable option in the long term for independent cultural centres.

Sadlowska's (2017) study defines an urgent demand for engaging with audiences more, concentrating on younger viewers, and building a community around them. Her research has confirmed both the growing importance of digital platforms and the need for preserving independent cultural institutions, suggesting that the co-existence of both (though seemingly contradictory) is indeed possible. Moreover, the SVOD model is identified as the most sustainable solution for online platforms in the long term. Reflecting on services such as Findanyfilm.com, Parkes (2013) highlights the ongoing efforts of the film industry to satisfy the demand for online access to films – this must continue.

Figure 2 below shows the business model proposed by Sadlowska (2017) for the new generation of independent film cultural institutions. It is based on the Business Model Canvas (Osterwalder, 2004; Osterwalder & Pigneur, 2009), which synthesises the already existing scientific approaches and puts forward a new approach to business model creation. It is based on nine building blocks belonging to four core pillars that respond to key areas of all businesses: product, customer interface, infrastructure management, and financial aspects. Those elements act as an overview and synthesis of the literature on the topic, incorporating a company's approach to distribution, value proposition, partnerships, cost structure, revenue, and target customer. At the heart of this proposition is the notion to divide all its business activities into three main divisions: movie theatre; VOD platform; and retail/community building activities. Elements placed on the model have been colour-coded to emphasise the possible three-dimensional design of an independent film institution of a new generation: movie theatre (white); VOD/digital (dark grey); and retail/community (light grey).

Figure 2: *The independent film institutions' business model*



Source: Sadlowska, 2017.

This business model figure acts as a graphical representation of different aspects and building blocks for an independent film institution. By incorporating the three components, an institution has a chance to transform into an independent culture hub fitting the needs of the new audience. It is important to accept however that a business model is nearly always provisional, as learning and adjustments will need to take place and eventually the model will be replaced by something new or improved, taking account of further technological innovations (Savič et al., 2016; Teece, 2010). The findings by Sadlowska (2017) are supported by the market need emphasised in the literature (Aris & Burghin, 2005; Burgelman, 1983; O'Reilly & Tushman, 1997; Perren, 2013) for independent cultural institutions to engage in a form of flexible internal corporate venturing necessary to survive in the world dominated by such a disruptive technology that is VOD.

3.1 The business model of the Glasgow Film Theatre

Next, the proposed business model is discussed in the context of the GFT, as a way of further developing the conceptualisation of a business model for independent film institutions. As the paper is of a conceptual nature, it does not rely on empirical data. Instead, it makes use of observations and secondary data available in the public domain, including annual reports and newspaper articles, as a way of developing a picture of one independent cinema and the business model it has implemented during the digital age.

According to Dunn (2018), "Scotland's independent art houses continue to provide some of the most illuminating and vibrant film programming in the UK in the face of competition from home viewing and other commercial forces". However, keeping the attention of audiences in this digital age is far from easy. In Glasgow, the independent cinema called the Glasgow Film Theatre (GFT) opened in 1939 as the second purpose-built art house in the UK. It is perhaps significant that the word 'Glasgow' is in the title of the cinema, with recent efforts to restore the building to its original presentation capturing the affections of locals who donated money to the cause. The GFT is notably situated in an area of the city known for its architectural history, with surrounding buildings designed by celebrated Glasgow-born architect and designer Charles Rennie Mackintosh. The GFT routinely emphasises that it is a charity. Independent cinemas operating as non-profit organisations gives rise to additional challenges, for example, what funding sources to pursue. The GFT currently gets the majority of its income from donations and legacies, followed by charitable activities (OSCR, 2017). The GFT thrives with a prominent film festival in the first quarter of the calendar year, along with many smaller events throughout the calendar year. Its film festival is now in the top 3 in the UK, having grown from 6,000 attendances in 2005, when it started, to over 42,000 attendances in 2017 (GFT, 2016; 2017; 2018). According to the GFT's Programme Director, summer is the time for blockbusters but these are not the type of independent and foreign language films that audiences in the GFT like, so in the summer of 2018 they presented old blockbusters (the Indiana Jones trilogy), which proved very popular. The GFT also tries to be timely, e.g., it presented films set in Berlin, which cleverly coincided with Glasgow and Berlin co-hosting the first European Sports Championships in August 2018 (Capaldi, 2018).

The GFT is a good example of all three components of Sadlowska's (2017) business model (movie theatre, VOD platform, and retail/community building activities) proposition in practice. As a movie theatre, the GFT boasts three screens – all of which can be hired for events. As well as screening new releases, the GFT curates themed festivals throughout the calendar year, in addition to the flagship Glasgow Film Festival, where many films are premiered. The Glasgow Film Festival is famed for its 'Fright Fest' series, screening the latest in horror, as well as special events often hosted outside of the confines of the cinema itself – in 2017, for instance, 'The Thing' (Foster & Turman, 1982) was screened in an indoor snow sport resort. The setting of the screening matched the setting of the film, and the partnership with the resort encompassed other optional activities such as skiing. A quiz dedicated to the film was also hosted. In 2018, 'Die Hard' (Gordon & Silver, 1988) was screened in an abandoned high-rise building in Glasgow city centre, mocked up to look like the setting of the film. This exemplifies what Nikdel (2017) discusses in the context of cult fandom and experiential cinema which seems to be a growing trend. "From abandoned warehouses to disused urban spaces, experiential cinema escapes the boundaries of traditional film exhibition by transforming the somewhat banal into a temporary space for creative expression and social cohesion" (Nikdel, 2017: 112), the suggestion being that community, public performance and social cohesion are important aspects in fighting against a claimed decline in cinema attendance (Wroot & Willis, 2017b). Linked to this is the annual showing of the classic 'It's a Wonderful Life' (Capra, 1946), which can be viewed at the GFT throughout December. This is a film that can easily be viewed from one's home, for free (it is likely to show around Christmas time on different TV channels). Still, hordes of people descend upon the GFT to take in this viewing experience, often in groups of friends or families, all gathered together demonstrating the need for social cohesion in taking in this experience. Therefore, the GFT appears to be doing well in regard to the cinema aspect, with its many differentiated activities as part of the 'movie theatre'.

The GFT also has its own VOD platform called the GFT Player (an example of SVOD). Launched in 2013, the project was a result of the partnership between Glasgow-based VOD platform Distrify and both the GFT and the Filmhouse in Edinburgh. The GFT Player received a £90,000 grant from Nesta, the sponsor. The GFT Player allows anyone to embed it on social media, which supports the idea of 'taste-makers' on social media (Rui et al., 2013). Moreover, since 2017 the GFT has partnered with curated online cinema MUBI (SVOD). Customers who purchase GFT's CineCard get a free (time-limited) subscription to the streaming service offered by MUBI. Interestingly, MUBI allows access to any film for only 30 days after being released on the platform, which models the pattern of traditional cinema of a time-limited viewing experience. As found by Albanese (2016, cited in Napoli, 2016), offering limited amounts of contents on a rotating basis has been a recipe for success in the case of e-books, suggesting this can result in success also in the film world. This membership perk provides an additional incentive to take out the CineCard membership, therefore supporting both the digital and the movie theatre revenue streams. Yet again, the GFT has differentiated its activities within one stream, the 'VOD/digital' element, meaning that it is not solely reliant on the success of a single digital platform.

In terms of retail, the theatre includes a licensed café, with events throughout the year, including regular movie-themed quizzes. Plans to expand the café to make it more accessible are in motion, ultimately providing pedestrians with more reasons to step into the premises than to watch a film.

In terms of community building activities, the GFT includes learning programmes to enable the GFT to investigate and develop cultural engagement with individuals and communities in a range of contexts. For instance, local scholars deliver courses on film studies, discussing new releases weekly, after screenings. A dedicated project room is used for such activities. Themed festivals such as the 'Scottish Queer International Film Festival' invite cinemagoers from the LGBTQIA community. Furthermore, the growing international community of students spread across the five Higher Education institutions in Glasgow is well catered for (as are those simply interested in world cinema). Of the 676 titles screened between 2015 and 2016, 55 countries were represented (Glasgow Film Theatre, 2016) and in the 2016-2017 period, the top releases across a four-month period were non-English speaking titles (Glasgow Film Theatre, 2017).

Another way of grabbing audiences' attention and luring them out of their 'home cinema setup' is the inclusion of expert introductions, post film discussions and Q&A in the GFT programme. Q&As are seemingly becoming more popular in independent cinemas, and this does not need to be in a face-to-face setting as successfully tested via satellite in the GFT during a sold-out screening of the 'BlacKkKlansman' (Blum et al., 2018; Dunn, 2018).

Perhaps the most significant investment in community building is also the one most closely matching the findings of Sadlowska's (2017) study – an emphasis on young people: a dedicated Glasgow Youth Film Festival, award-winning autism-friendly screenings, low ticket prices for anyone aged 15-25 (rather than 'student tickets'), family-friendly movies, and dedicated Schools programme, including not only films but also talks and events throughout the year, mean that young people are regular visitors to the GFT. This is highlighted by Dunn (2018) as a way of ensuring the sustainability of independent cinemas, and for example, the GFT's Programme Director stressed the importance of marketing to younger audiences who might not be aware of the type of titles shown at the GFT. This is the reason why the GFT promotes their membership card for 15 to 25-year-olds in conjunction with the titles that might appeal more to younger audiences. Consider this in relation to recent trends in youth behaviour, with young people less likely to be drinking alcohol in licensed premises such as pubs. At the same time, young people are willing to pay for experiences, and this is where the 'experiential cinema' and other independent cinema experiences are well placed to be competitive. Undoubtedly then, the GFT's activities around the 'retail/community' element is increasingly diversified.

5 DISCUSSION

Scholars of film studies may be well-positioned to facilitate enhancing the profile of independent cinemas as cultural hubs, with film studies being largely the result of the advent of home video (Altman, 2014). Scholars from academic institutions in the city where the GFT is located have long been involved in designing and running a 'Contemporary Cinema Course', with discussions of new releases occurring weekly, between screenings of new titles. Similar outreach could help other independent cinemas thrive as cultural hubs, performing a valuable public service in the name of educational outreach. Experimental work finds that when the proceeds from the legal sales of films go to a good cause, willingness to obtain copies illegally drops (Ćwiakowski et al., 2016). Perhaps incorporating a fundraising component to themed events to raise money for particular groups in the local community, may inspire a different attitude towards watching films in independent cinemas. An emerging pressure on the modern day consumer is to be an ethical consumer. This will surely increase, as widespread inequality becomes the norm in the developed world. To go to the cinema at all is a reminder that you are, as a cinemagoer, in a privileged position.

Much has been said about the music industry as an effort to draw parallels between different industries affected by similar technological changes and the consequent digital transformation. Current digital trends appear to have successfully dissuaded digital music piracy. This is directly as a result of having adopted subscription models, with Wikström and DeFillip (2016) noting that subscription models have been popular with film and TV for quite some time. Now TV, operated by broadcasting corporation Sky, adopts the subscription approach, where it appears motivated to provide consumers with sought-after convenience and flexibility. Remarkably, Sky has recently adopted an approach clearly modelled on Netflix, wherein shows in a series queue up episodes to watch back-to-back, encouraging the so-called 'binge-watching'. Some series have even been released with all episodes available to download immediately. Much has been said about Netflix' success earlier, and of course successful models will lead to imitators. Netflix has reduced its content over the years, though its focus has been on the content with high popularity, as opposed to the type of content independent cinemas would target, although, if using a VOD platform or providing digital content in other ways, the learning of Netflix should be capitalised on by focusing on providing a narrower selection of content. Furthermore, as has been noted before, business models are successful only as long as they remain non-imitable (Teece, 2010). To this effect, independent cinemas, particularly if rooted in the local community, should have a competitive advantage over mainstream cinemas, as the local community programmes may be difficult to imitate, or other cinemas may be unwilling to imitate.

The research findings identified the needs and problems of independent film cultural institutions, and the paper further conceptualises a proposed business model for independent film cultural institutions. The discussion focused on how a cultural institution can manage its disruptive environment and future development. The main

recommendation of this research is introducing a new business model (or evolving the existing one) based on co-operation of three components: (a) a traditional movie theatre, which can incorporate non-traditional settings for screenings; (b) a digital SVOD platform as a solo venture and/or via partnerships; and (c) retail/community activities which should cater for local communities, fostering the notion of a cultural hub and focusing primarily on building deeper connections with younger people to introduce independent cinema to them as a target audience. The key to introducing this business model, based in part on digital transformation, is the strategic consideration of digitisation and its effects on the business.

By focusing on a single organisation, the GFT, the research offers up potential solutions for other independent cinemas to adopt in the face of changing consumer film consumption practices. Perhaps surprisingly, this includes embracing digital solutions. Less surprisingly, this also includes embracing varied sources of income, with the income of cinemas long being sustained from sales of popcorn and other snacks. Large chain cinemas, such as Odeon and Cineworld, now dabble in the VIP experience which is built around packages of food and drink.

6 FUTURE RESEARCH AND LIMITATIONS

A concrete suggestion for future research would be to utilise consensus methodology (Waggoner et al., 2016) with one specific target audience, indicated as important by this paper – young people – to better define what it is that appeals to them. By doing so, products and services can be designed with them in mind. From a theoretical perspective, uses and gratifications theory (Katz et al., 1973; Katz et al., 1974) may be a relevant theory to guide future research in this area. Uses and gratifications theory is a framework used to study how people select and use new media (Stafford et al., 2004), working from the assumption that people distinguish between different types based on the needs they satisfy as a result of media use (Katz et al., 1973). In the case of film, research utilising this framework would unpack what drives Netflix subscriptions, cinema visits, etc. Different ways of engaging with film would be expected to satisfy different needs, hence why people mix and match between them; Netflix has not substituted cinema attendance, as findings by the British Film Institute (2017) suggest. Research in this vein would shed light on what defines different types of consumers. Film critic Mark Kermode (2011) has long supported the simultaneous release of films in cinemas, on home video and in downloadable or streamable formats; filmmaker George Lucas has also lent support for this proposition, arguing that it would satisfy the needs of different types of consumers, which is now seemingly occurring much more frequently (Smits, 2017). More knowledge of this would aid marketing, and the theory noted above would help achieve this in a systematic way. There is much to be learned from adopting a broader perspective on the creative and cultural industries. For example, in the music world, music is now released globally on Fridays. Introduced in 2015 and championed by the International Federation of the Phonographic Industry, this decision was made in an effort to minimise piracy resulting from lags in releases. The same problems are evident – helping people find new content

and finding ways to make them pay for it. Lobato's (2010) case study on 'Nollywood' (Nigeria) explains that the primary location for consumption of film is in fact in the home, though this conflicts with findings in the UK (British Film Institute, 2017). However, it is worth considering how consumer behaviours differ in a variety of territories, as this will have an impact on the number of people going to independent cinemas. Therefore, any future research into the effects of the digital age on independent cinemas should include cinemas in different countries for a broader picture. Absent in this work is a consideration of the role independent filmmakers themselves now play. Meißner (2015) explains that the Internet enables independent filmmakers to develop personal audiences and to some extent replace conventional opinion leaders. Accordingly, learning more about what filmmakers are saying to their audiences (i.e., recommended movie theatres) would be worthy of further investigation.

The present conceptual study is not without limitations, including utilising a suggested business model that has been created with a small sample size. Specific suggestions for future research have been put forward, and it is expected that the business model (Sadlowska, 2017) further conceptualised in this study will help guide future works in this field. More specifically, the model should be applied more widely than to just one organisation, and importantly, it should be investigated empirically.

7 CONCLUSIONS

Returning to the aim of this conceptual paper, it is possible (and necessary) for independent cinemas to transform their delivery in light of the challenges posed by digital disruption. However, the transformation does not need to be entirely digital and in fact it would be advisable not to go down this route, as it would severely affect the characteristic nature of independent cinemas, instead, digital transformation should be used as a way to complement existing activities, along with utilising other business model innovations. Viewers still want the experience of cinema going. Nonetheless, it is vital for independent cultural institutions to realise that the old-time patterns of running a business have irrevocably changed. The digital era has brought, along with the more demanding customers, new challenges, realities and customer needs that have to be answered in order to survive in the world dominated by the Internet.

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In Search of a Framework for User-Oriented Data-Driven Development of Information Systems

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ABSTRACT: *Although iterative and continuous improvements are common in the design and development of contemporary information systems, some interesting research directions are arising from general trends towards user-oriented data-driven approaches. Since this is a relatively active research area, the paper aims to provide a brief overview of the main concepts and research directions and to define the setup and the context for the proposed user-oriented data-driven information systems development framework. Experts from the field of information systems are interviewed and their feedback is used to evaluate different aspects of the proposed framework.*

Key words: *user-oriented development, data-driven development, framework, user experience*

JEL classification: M15

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1 INTRODUCTION

End-user requirements are a starting point for any information systems (IS) development, and as such, they are regarded as a critical success factor (Maguire, 2013; Medeiros et al., 2015). The need for the end-user involvement in the IS development process has been reported since 1982, although this involvement was far more elementary at the time (Robey & Farrow, 1982). The studies often confirm that the main challenges in the IS development are insufficient user involvement and the constant change in user requirements (Medeiros et al., 2015). One recent study indicated that changing user demands can cause 70% of the problems in the process (Geogy & Dharani, 2016). Some of the main causes for failures of software development projects are incorrect identification of the requirements, changes in user requirements, as well as their uncontrolled evolution during the project development lifecycle. Changes in the requirements impact the development process negatively, potentially causing budget breaks and, in the end, the result does not meet all customer

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needs (Garcia & Paiva, 2016). For example, the studies have shown that 60% to 80% of IT projects in the public sector fail in that regard (Brown, Fishenden, and Thompson, 2014).

For this reason, many researchers point out that Requirement Engineering (RE) is the earliest and most crucial phase of IS development (Amokrane et al., 2015). The purpose of RE is to understand the problem that arises from the transformation of different needs of all the stakeholders into the structured requirements that form the ultimate solution, taking into account all the requirements that could change over the entire life cycle (Wiesner, Nilsson, and Thoben, 2017). The main challenge is to "translate" users' requests into what the system ultimately provides (Geogy & Dharani, 2016). Managing requirements is very important because it is necessary to keep track of any changes that occur in user requirements and to ensure that the adequate changes are made to meet the needs of all stakeholders (Inayat et al., 2015; Geogy & Dharani, 2016).

Due to the extremely important role that user requirements have in the process of development or information system re(design), there is a large number of research studies regarding the different degrees of formalities for these requirements (Bjarnason et al., 2016). User requirements can refer to almost all major features, usability, accessibility, navigation, electronic resource formats, and more, and can be divided into functional and non-functional requirements (Medeiros et al., 2015).

In focusing on the user and his/her needs, it is necessary to set up a development process that incorporates the feedback loop, so that the result could be a product that provides the usability and other success factors for end-users for a longer time (Richre & Fluckiger, 2014). User-oriented development as a paradigm is applicable in all areas where users interact, "communicate" with the software and intensively use it. The main advantage of user-oriented development is the idea that the testing and optimization of the end-product is done in co-operation with end-users in all phases. This approach enables some of the "hidden" demands to be brought to light. What is more, the information on users' perspectives as well as weak points must be one of the basic inputs for the improvement of business processes within organizations (Vanwersch et al., 2015). Availability of user data has led to the evolution from the user-oriented development towards data-driven development. Authors anticipate a shift to a data-oriented and user-oriented paradigm, especially when it comes to identifying, collecting, and managing user requirements for development (Maalej et al., 2015). Business analysts at times do not have enough information about end-users, so a lot of aspects of the requirements remain incomplete (Maguire & Redman, 2006). New technologies make it easier to understand user needs, as well as to provide a much better quality of interaction – this leading to a more successful collection and analysis of user needs as a basis for (re)designing and developing user-oriented IS. Data-driven development assumes that the data collected informs some future decisions, i.e., influences the decision-making process (King, Churchill, and Tan, 2017). The development team must take into account all the available data when deciding about the development of the (next) version of the IS (Maalej et al., 2015). The data-driven approach contributes to an easier understanding of user needs, while agile approaches

to development enable rapid response to changed requirements (Brown, Fishenden, and Thompson, 2014).

In general, data-driven decision making is related to higher productivity, higher return on assets, equity, and market value (Brynjolfsson, Hitt, and Kim, 2011). In that sense, data can help in measuring the effect of design on users, and business results (King, Churchill, and Tan, 2017). Software developing companies thus need to focus on exploiting data to gain a competitive advantage as there is unfulfilled potential for data-driven approach in agile software development context (Svensson, Feldt, and Torkar, 2019).

Motivated by the presented argumentation, this paper provides an overview of the most important studies and fundamental concepts underlying contemporary user-oriented data-driven IS development in Section 2. In an attempt to structure and map out the potential research direction in this specific area, a framework is sketched and described in Section 3. It provides a basis and a good starting point for interviews with experts. The following research questions have been derived: How do experts understand and acknowledge the importance of data-driven approaches in IS development?; What is their personal experience in using related approaches?; What are the potential advantages and obstacles to following the proposed user-oriented data-driven IS development approach?; and What is their overall opinion about the proposed framework? Expert feedback is presented in Section 3, followed by conclusions in Section 4.

2 THEORETICAL BACKGROUND

2.1 The importance of User eXperience (UX) in information systems development

User eXperience (UX) is a multidimensional construct that includes different user reactions to the product throughout the entire user journey (Lemon & Verhoef, 2016). Each user has a unique set of preferences, knowledge, characteristics, as well as limitations that potentially affect UX and make them extremely subjective and depend on the context (Cormier & Lewis, 2015; Halvorsrud, Kvale, and Følstad, 2016). Although the phenomenon of UX is widely accepted in the industry, there is still no agreement in the scientific community about the comprehensive theoretical UX model (Zarour & Alharbi, 2017). The quality of UX is measured, for example, by usability observed when the user interacts with the system (Sohaib & Khan, 2010). Standard ISO 9241-11 defines usability as a "measure in which specific users can use a particular product to achieve certain goals, effectively, efficiently and with pleasure, depending on the context in which they are used." Studies have shown that end-users prefer a website with a higher usability rating, although one should bear in mind that the user requirements regarding usability and design depend on the type of digital service and users themselves (Ilbahar & Cebi, 2017). The results of the studies also confirm that user satisfaction has a positive impact on the user's intention to use the site but also on the use in general and that the perceived usefulness of the site has a positive impact on the customer's satisfaction (Cohen, 2006; Belanche, Casaló, and

Guinalíu, 2012). Usability is believed to be one of the main factors affecting the level of use of digital services in the public sector (Huang & Benyoucef, 2014) as well. Satisfaction with the use of digital public services is the ability of users to find the information they need and to experience a service that addresses their problems (Reddick & Roy, 2013).

Concepts of UX and an agile approach in development are compatible (Sohaib & Khan, 2010). The agile approach allows for easier adaptation when changes occur, either in the prioritization of the requests or changes in the content itself (Heikkila et al., 2015). It is an important advantage since the consensus is that most of the problems in the development are caused by overly frequent changes in user requirements and a low level of end-user involvement (Medeiros et al., 2015).

2.2 Data-driven approach in information systems development

In the context of IS development, it is important to emphasize the emergence of big data as one of the progressive technological areas, which enables the availability and analysis of extremely large amounts of data. Every day we witness the production of a growing number of digital artifacts (Tomitsch, 2018). The value of big data is not its size – it is that it can offer new kinds of information to study – information that has never previously been collected (Stephens-Davidowitz, 2017). The amount of data produced by users nowadays exponentially increases, and by reviewing the data, generated by users while interacting with IS, development teams could understand better what users are really doing and how they respond; and in addition, some defects are detected in real-time (Spiess et al., 2014; King, Churchill, and Tan, 2017). Development teams in the IT sector already collect huge amounts of implicit feedback in the form of usage data, error records, and sensor data (Maalej et al., 2015). Since the user habits and interests are changing rapidly, and new trends emerge daily, while having in mind that UX is ultimately subjectively, dynamically and contextually dependent (Halvorsrud, Kvale and Følstad, 2016), designers and developers have no choice but to take into consideration the data generated by different user actions and feedback collected from the overall user journey (Lemon & Verhoef, 2016).

Authors point out that tracking the objective user data is extremely important and that this data is a key component when evaluating the UX (Sengers et al., 2008). The problem is that user data has been so far often interpreted on intuition rather than actual data (Havice, 2017). Direct contact with users is the key to achieving user-oriented approaches and fulfilling their expectations (Kujala, Kauppinen, and Rekola, 2001). One can claim that there is nothing more direct than the data that users produce themselves. People produce data, so it is both important to enable its collection and to provide opportunities for end-user feedback (Tomitsch, 2018). Users should be allowed to provide the feedback while using the system, and whatever comes out of the exercise should be the best solution (King, Churchill, and Tan, 2017).

The more data is available, the greater the chances are of understanding the user and his behavior (Spiess et al., 2014; Anderson, 2015). When tracking objective user data, some authors distinguish between active and passive monitoring, i.e., there are two types of data: implicit and explicit (Maalej et al., 2015; Liikkanen, 2016). Passive tracking includes tools that capture users' actions and features, while active tracking consists of asking feedback about the service, directly (through polls) or indirectly (chat conversations). In other words, specific, explicit data can also come from the comments of the users themselves even if self-initiated (Maalej et al., 2015). The tools used for passive tracking usually address the challenges of automatic collection and analysis, and authors label that type of data as implicit data (Maalej et al., 2015; Liikkanen, 2016). An example of implicit feedback is a large concentration of clicks on one location that can point to a potential problem.

Authors define two categories of metrics used in the context of a data-driven approach to IS development (Rodden, Hutchinson, and Fu, 2010):

- PULSE metrics: number of page views, earnings, activities, and similar.
- HEART metrics: (1) Happiness – aesthetics, and perceived ease of use, (2) Engagement – frequency of use and / or intensity, (3) Adoption – number of unique users in a given period, (4) Retention – how many of the users from a given time period are still present in some later time (5) Task success – could be measured with effectiveness, efficiency and error rate.

Diverse data is not only generated internally within software-intensive companies but also from different sources (Svensson, Feldt, and Torkar, 2019); for example, categories of data types are:

- Logs – can reflect relevant information about the past and current state of the system and could be of different types depending on predefined properties.
- Visitor metrics – referring to user data collected through external tools, such as Google Analytics, HotJar, and similar.
- Visual metrics – for example, heatmaps and clickmaps.

Table 1 itemizes the categories mentioned above and sources while providing references to authors that studied the availability and importance of specific data for various aspects of the IS success.

Table 1: *Common objective data sources and types used in data-driven IS development*

Categories of data types	Objective data types and sources	Authors
Logs	Logs in general	Rodriguez, 2002; Rodden, Hutchinson. and Fu, 2010; Andrica & Candea, 2011; Inversini, Cantoni, and Bolchini, 2011; Gordillo et al., 2014; Harrati et al., 2015; Maalej et al., 2015; Garrido et al., 2017; Grigera et al., 2017
	Keyboard	Saadawi et al., 2005; Andrica & Candea, 2011; Espada, Garcia-Diaz, and Crespo, 2012
	Usage patterns	Harrati et al., 2015
	Task duration	Oertel & Hein, 2003; Saadawi et al., 2005; Harrati et al., 2015
	Time metrics	Grigera et al., 2017
	Mouse clicks	Oertel & Hein, 2003; Andrica & Candea, 2011; Harrati et al., 2015; Garcia & Paiva, 2016; Frantz, 2018
	Task success	Saadawi et al., 2005; Rodden, Hutchinson, and Fu, 2010; Inversini, Cantoni, and Bolchini, 2011
	Scrolling	Au et al., 2008
	Error rate	Au et al., 2008; Rodden, Hutchinson, and Fu, 2010
Visitor metrics	Organic clicks	Rodden, Hutchinson, and Fu, 2010; Bakaev, Bakaev, and Mamysheva, 2016; Lee et al., 2016
	Bounce rate	Bakaev, Bakaev, and Mamysheva, 2016; Lee et al., 2016
	Traffic; the number of unique visits	Rodden, Hutchinson, and Fu, 2010; Bakaev, Bakaev, and Mamysheva, 2016; Lee et al., 2016
	User activity	Rodden, Hutchinson, and Fu, 2010; Bakaev, Bakaev, and Mamysheva, 2016; Lee et al., 2016
Visual metrics	Session recording, video recording	Oertel & Hein, 2003; Maalej et al., 2015
	Eye movement tracking	Oertel & Hein, 2003
	Heat maps	Gordillo et al., 2014; Courtemanche et al., 2017; Grigera et al., 2017

The importance of using objective data in the context of improving user experience and IS development has been acknowledged in the literature. However, studies on how practitioners and IS developers use objective data as a part of their data-driven strategies and IS-related decisions are scarce (Svensson, Feldt, and Torkar, 2019) and still focus on collecting objective data using Google Analytics almost exclusively. Examples include improving the user experience while anticipating potential customer complaints by telecom users (Bao, Wu, and Liu, 2017) or in online library users (Lee et al., 2016). The latter study also used A/B testing for collecting and using data during the design stage to get feedback in the early stages of development (Lee et al., 2016). It is essentially an experiment used when

changes are made to a product/service to measure the effect (Rodden, Hutchinson, and Fu, 2010; Lee et al., 2016; King, Churchill, and Tan, 2017). Controlled A/B tests are tests where two similar populations of users interact with different artifacts, and their responses can be rigorously measured and compared (Rodden, Hutchinson, and Fu, 2010). It is possible to automatically detect some issues without being a usability expert (Grigera et al., 2017), as exemplified by a recent study of differences between two different versions of a webshop to scope a few improvement actions (Mijač, Jadrić, and Ćukušić, 2018).

Authors agree that this type of experimentation is a well-established practice in online systems, yet it has not been applied extensively in large-scale development of embedded software systems (Olsson & Bosch, 2014). Olsson and Bosh (2014) proposed a model in which the final step is where the entire R&D organization acts based on customer data, and where the deployment of software functionality is seen as a way of evaluating what the customer needs. Their HYPEX model (Hypothesis Experiment Data-Driven Development) supports companies in running feature experiments to shorten customer feedback loops. They use strategic product goal to generate feature backlog and later analyze the gap between expected and actual behavior.

Software development companies are increasingly aiming to become data-driven by trying to experiment with the products used by their customers continuously. Controlled experimentation is becoming the norm in the software industry for reliably evaluating ideas with customers and correctly prioritizing product development activities (Fabijan et al., 2017).

A survey conducted in Sweden shows that there is a lot of potential for data-driven decision making in agile software development but currently unfulfilled (Svensson, Feldt, and Torkar, 2019). The development team should be able to incorporate the demands of all users when deciding what to develop and when to release the application (Spiess et al., 2014; Maalej et al., 2015). Collecting data, learning from it, and making iterations in the (re)design phase to find positive and negative elements leads to data-based approaches that provide systematic observation and a more ambitious approach for modeling and development (King, Churchill, and Tan, 2017). Organizations that are developing information systems are faced with the difficult choice of picking the right Software Development Life Cycle (SDLC) (Balaji & Sundararajan Murugaiyan, 2012). SDLC adheres to important phases that are essential for developers, such as planning, analysis, design, and implementation and evaluation. Traditional development is an approach characterized by slow cycles with ad-hoc customer feedback processes, and where the customer is not well integrated into the product development process (Olsson & Bosch, 2014), an issue solved by modern agile development approaches.

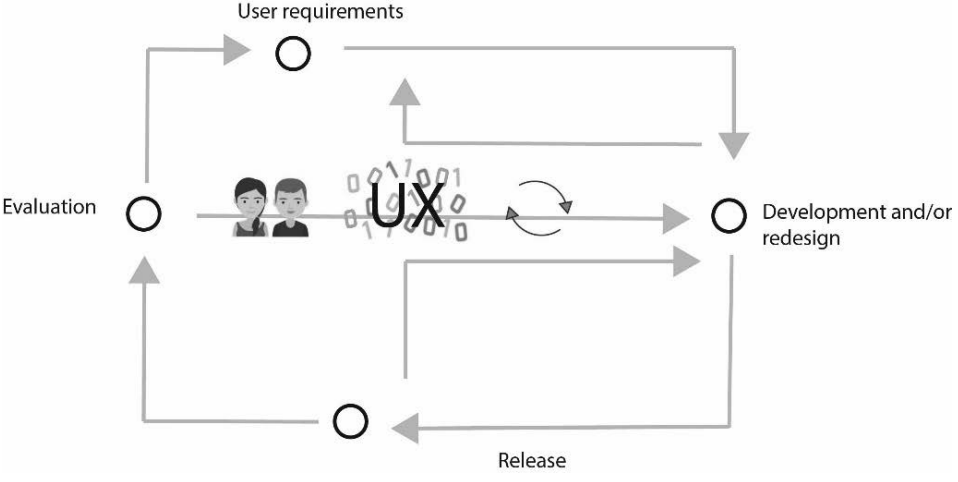
2.3 Formulating a user-oriented data-driven information systems development framework

Following the presentation of important aspects for the IS development and the potential of available objective (user-generated) data, the general concept of a framework for user-oriented data-driven IS development is proposed. It draws on an iterative approach to system design, similarly to Boehm's spiral model of IS development – a combination of iterative and linear software development approach (Boehm, 1988). The spiral model has two main features: (1) a cyclic/iterative approach that serves the gradual development of a system, and (2) reducing the degree of risk (Barry & Wilfred, 2000). As it is a layered development, developers go through all the stages of development several times. Agile methodologies already mentioned above are based on the principles of continuous improvement and testing based on feedback. The agile approach is user-oriented, unlike the process-oriented spiral model. In the spiral model, full specifications are known in advance, but the development is done in layers.

The first concept of the framework for user-oriented data-driven information systems development is sketched in Figure 1. It encapsulates the main phases already well known in the process of developing the information system. The first phase is named "User requirements" – which stands for the initial phase including planning, analyzing and collecting the user requirements. After collecting all the necessary input, the next phase begins – "Development and/or redesign". Here, term redesign has been added to put an additional highlight on the redesigning process as many systems running today need frequent rework and repositioning towards the user's changing preferences. It is also a typical phase in system development, and one can argue that it represents the core phase. The loop represents a repetitive action until all user requirements are collected. It is in line with the user-oriented paradigm argued in detail above. After the development of an information system, it is ready for its first "Release" (implementation). Only after releasing the initial version of the software, it is possible to continue with the "Evaluation" phase – which should represent the last phase of this process. Since the whole idea is based on the agile approach, delivering working software in short iterations has to be a condition, with teams that are frequently involved in short-term decisions and need to adapt to a fast decision-making process (Svensson, Feldt, and Torkar, 2019). For that reason, the loops between evaluation and development (redesign) have been added/envisaged, since the changes in user requirements need to be incorporated in subsequent versions. This relationship contains a dimension which, according to the theoretical background, stands as a crucial element for the user's intention to use the system and also has a positive impact on the user's satisfaction. Precisely this dimension represents an opportunity to incorporate data-driven approach, so apart from (or even instead of) asking the users whether they are satisfied with the proposed/existing solution, additional objective (passive) data can be used for enriching their feedback. As mentioned before, software development is a cyclic process, so after the "Evaluation" phase, the proposed process does not finish but goes back to the beginning. The sketched concept of the framework was explained and

discussed thoroughly with experts who helped to formulate the amended version of the framework that is presented and explained further in the paper.

Figure 1: *The first concept of the framework for user-oriented data-driven information systems development*



Source: Own elaboration.

3 EXPERT EVALUATION OF THE PROPOSED FRAMEWORK

3.1 Methodology and description of the procedure

The qualitative research method was used to explore our understanding of data-driven and user-oriented paradigm in IS development and to get feedback on the general idea of the presented framework. Also, the intent was to explore and discuss how software organizations may use this framework in the future in an agile software development environment. There are numerous advantages and recommendations for using the qualitative methodology in the field of IS (Marshall et al., 2013). It is especially relevant taking into account the purpose of this exploratory research study – to determine whether the proposed framework could be used in practice and, in general, to find out the pros and cons of using such data-driven approach in IS development. Consequently, an in-depth semi-structured interview was identified as a suitable data collection method for this specific purpose. Semi-structured interviews generally last for a considerable amount of time depending on the particular topic (Smith & Osborn, 2007) and there is no rule on how many participants should be included (Pietkiewicz & Smith, 2012). Sample sizes in qualitative research customary involve a range of 3 to 10 individuals (Creswell & Creswell, 2018).

Semi-structured interviews with four experts were conducted and recorded over six months (two in November 2018 and two in April 2019). In line with the qualitative approach methodology, the interviews lasted as long as the comments started to repeat – the duration of each interview was approximately one hour, in a total over four hours. All the interviews were conducted in the Croatian language and recorded with the permission of the participants. Basic sociodemographic information about the interviewees is presented in Table 2, while other job-related and topic-related characteristics are presented in the following section in relation to their feedback.

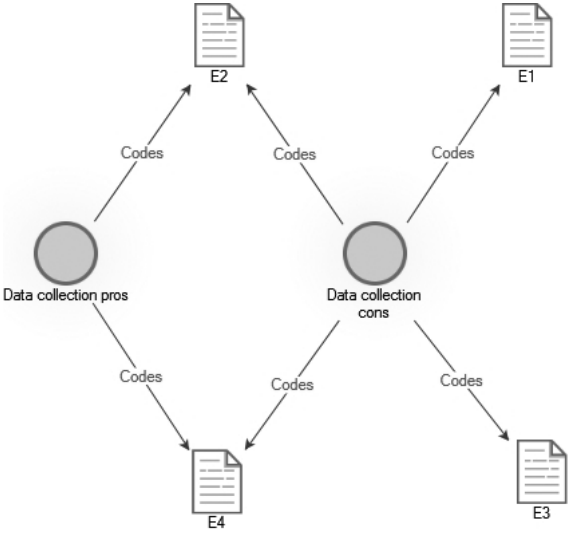
Table 2: *General characteristics of the four interviewed experts*

	Expert 1	**Expert 2**	**Expert 3**	**Expert 4**
Age	31	30	31	35
Gender	Male	Male	Female	Male
Education	Master's degree	Master's degree	Master's degree	Master's degree
Income (in HRK)	15,000 – 20,000	10,000 – 15,000	Less than 10,000	15,000 – 20,000

The interviews were based on open-ended questions to ensure that the same basic topics were covered with all the participants, but the format was kept flexible to allow the conversation to develop naturally and to elicit views and opinions. The rationale was that they would reveal a lot more about relevance and maxims connected with their positions and functions: they carry on talking about their activities, give examples, or use other forms of elaboration (Bogner, Littig, and Menz, 2009). After taping the interviews, a transcription of thematically relevant passages was created. The transcription was less detailed as important elements were notated only to a certain extent, since a transcription of the whole recording is not standard (Bogner, Littig, and Menz, 2009).

The data were then coded using the Nvivo software, an effective tool for qualitative data analysis (Creswell & Creswell, 2018). In NVivo, extracted themes are presented as b nodes, with parent and child nodes for the main themes and subthemes, respectively. To identify the themes commonly discussed in the field, starting nodes were not predetermined. Nodes are also used as a tool to organize qualitative data in particular ways (Bazeley & Jackson, 2013), in this case, a comparison diagram is generated for child nodes users' data collection pros and users' data collection cons (Figure 2), showing cases where the four experts talked about the same issues (E1 – Expert 1, E2 – Expert 2, E3 – Expert 3, and E4 – Expert 4).

Figure 2: *A comparison diagram for child nodes 'Data collection pros' and 'Data collection cons'*



Source: Own elaboration, export from the analysis in the Nvivo software.

All four experts had a different style, so while three experts were talkative, one had to be guided and answered with semi-official statements for the most part. Because of the data structure, the text was sometimes coded line by line, sometimes sentence by sentence and sometimes even paragraph by paragraph. The main goal was to break down and understand the text and to attach and develop categories and put them into an order (Flick, 2009).

After the coding was done, thematically comparable passages from different interviews were tied together, and some coding was revised. In total, five themes were recognized (as presented in Figure 3): Users' data collection, Deciding on the redesign, A/B testing, User requirements, and Value of user satisfaction. It is in line with general recommendations for using coding to generate five to seven themes per research study (Creswell & Creswell, 2018). A larger area indicates more references, and the number of direct and aggregated coding references is specified as well.

Overall, the procedure consisted of two phases. The first one involved interviewing, after which the first concept of the framework was prepared and sent to the experts for a review. After considering their feedback, the revised version of the framework was proposed (Section 3.3).

Figure 3: *Hierarchy of nodes compared by the number of coding references*

3.2 Summary results of the interviews

3.2.1 Interview with Expert 1

The first interview was conducted with an (experienced) professional who is currently working as a quality assurance (QA) analyst and business analyst in a new IT company. Since the company just started operating, all company's projects are in the initial phase. It implies that there is very little or almost no data on existing users. In their case, the phase of collecting user requirements is very intensive, and sometimes more than half of the allocated project time goes into briefings. User requirements are documented, and most of them are reduced to functional requirements, i.e., the focus is mostly on processes than on the specific need that is to be supported by an application. Although there are some non-functional requirements, it usually gets down to a client's personal opinion, such as:

"This is ugly, it looks too complicated, the font is ugly, this image is too big, and the colors are ugly."

When asked about the automated collection of certain data and the prospects of its usage, the company plans to keep track of the technical logs and business metrics – but these are not yet defined. Also, the interviewee mentioned using Google Analytics as a tool and is aware that it provides more business metrics than other available data that can indicate some defect, which can possibly be used to improve UX. One of the further steps for the company will be the redesign of the current versions they are developing for their clients, so they certainly accept the idea of systematically incorporating data-based improvements into the next versions. Now, in the initial (demo) phase, technical metrics have already

been set up, but there has not been an opportunity for using them yet. As an example of using such data, the expert mentioned:

"One minute for some action is maybe too much… well it does not have to mean that one minute is too much, but for an example, we will keep track of the average duration, so based on that we will make some improvements if necessary."

To improve user experience in the initial phase, they involved one expert for conversion who suggested some specific changes in the design. The proposal was to incorporate the padlock icons in the parts of the application where users make payments to emphasize the security of the web application. However, no one asked the end-users; they just assumed that this would help. Mentioning this specific example made the expert think about using the A/B testing method. The expert agreed on the importance of A/B testing, especially regarding some major features. However, they will not have two versions of the application running at the same time since it would be too expensive. The expert further got acquainted with the basic tools for passive monitoring, such as heat maps and session recording, and found them very useful, but still did not have the opportunity to incorporate these into their working process. At the end of the interview, the issue of GDPR was also discussed as one of the potential problems.

3.2.2 Interview with Expert 2

The second interview was conducted with another expert, who is currently working as the head of the programming department and has been working on that same position in the company for several years now.

When asked about collecting user requirements, the expert answered that concerning collecting information from the users, the company differs between functional and design requirements, but does not document them all – a similarity with the first expert's experience can be observed here. They rarely get non-functional requirements from their users, so they create a design conforming to the standard guidelines.

The expert stated that some data is automatically collected, but it mostly refers to server logs. They use those logs to check whether there has been some unexpected crash of the application. In case the crash is repeated, they reprogram and launch another version of the application. Even though without using any additional tools, the company could easily collect all usage data, such as the number of clicks, mouse tracks, time tracking, and more, but they still do not collect it. Another type of logs was mentioned, and those are the logs that show whether each user uses the application in general, but not the extent to which it is used.

They have never used A/B testing formally, even though they usually put an application to production, and they wait for the response from end-users. As an example, one of the versions was more complicated than the old one, which users reported themselves after they realized that it took them a lot more time to accomplish a certain task, as compared to previous versions. The company is aware that this may have a negative impact on users' satisfaction.

Although the expert agreed on the fact that data-oriented approach would have a better effect on UX, the interviewee focused rather on the disadvantages of this approach, such as the memory that this data would occupy. Additionally, related to this issue after connecting to a server, the expert added:

"Look at the amount of these logs and imagine how much data would be here if all click data were recorded? Do you know how many miles do you run with your mouse every day?"

However, as the interview continued, the importance of users' satisfaction was nevertheless to a certain extent acknowledged by the expert, as demonstrated in the following statement:

"It would be better if the data pointed out the problems that the user encountered without waiting for them to tell us."

By the end of the interview, the expert did agree that collecting this data for purposes of redesign would eventually shorten the time spent on conversations and interactions with end-users, especially after pointing out the fact that the main goal is still to keep users satisfied with the service and to improve their overall experience, particularly in this extremely competitive industry.

3.2.3 Interview with Expert 3

The third interview was conducted with a CEO and co-founder of a start-up, whose main activities are in digital marketing (a five-year experience) and in manufacturing natural cosmetics products. Due to her knowledge of digital technologies, together with a business partner they created a website with an integrated webshop. For developing their website, they did not collect any user requirements, since they decided to create it very spontaneously, and they wanted it done quickly. They followed their intuition combined with some standard guidelines, such as the ones related to the number of clicks, amount of text, picture resolution, and similar. They have put great emphasis on the visual appeal, since their primary goal is to establish a well-recognized brand. They believe that the visual part is crucial for attracting new customers and plays a huge part in their revenue, but the expert is also aware that without a functional website visitors would not buy their products.

As for external data collecting tools, they have been using Google Analytics from the beginning. They have recently participated in the research (which her former colleague was conducting), they have had Matomo tool installed (toll for recording users' sessions and creating Heatmaps). Even though the expert did not conduct A/B testing herself, their website was used for an experiment. For that purpose, an alternative website was created, and user data was collected and compared. The experiment results were unexpected.

"Research participants picked the alternative design as better (the results of objective data showed the same thing) …but it is because the participants were students who are not our target group …we target tourists, hipsters …the alternative website was based on a template, and I do not like it. It is very, very ugly."

Although objective data showed some potential for redesigning the current website, she did not take into consideration any changes in the visual aspect of the website. In that particular case, personal opinion and intuition prevailed over objective data. As for the functional changes, there are several things which they plan to change – they came as a result of A/B testing. Such as:

"The results of A/B testing were actually useful; it is just that we do not want to step away from our visual appeal. For example, testing showed that language plugin is better when positioned top right than on the bottom of the page."

In general, her attitudes towards collecting user data and data-driven (re)design were very positive, even though they plan to postpone this approach for a while:

"We plan to implement that approach, and I do believe it is the smartest thing to do, but the biggest problem for us currently is a lack of time. Besides, it is quite expensive. I hope that when we get to the stage where we can employ a person who will be in charge of that. We understand how important it is, but we currently have other priorities."

They do not formally manage user reviews, but since they still have a relatively small customer database, they have been contacting each customer to see how their shopping experiences were, and if they had any suggestions regarding improvements. They are not quite sure when they would take action, whether they would wait for some feedback to be reported repeatedly (such as their webshop being too complicated) or would they try to make improvments based on only one or two similar customer feedbacks.

As for the negative aspects of user data collection, besides time and cost (mentioned several times), the expert added the GDPR – or to be more precise, the unclear instructions for its implementation.

3.2.4 Interview with Expert 4

The last interview was conducted with another IT professional, who is currently working in a developer position with 10 years experience. Besides coding, he recently became a leader of a small team and also takes part in writing technical requirements. Collecting user specifications is very important, and they put a lot of effort into that phase, regardless of whether it is about upgrading the current system or developing a new one. Workshops are organized, where the most typical future users are gathered in the same place. During this phase, they use all data available, implicit and explicit:

"In the context of user feedback, the users' impression is always taken into consideration when developing a system… Also, we always do a detailed analysis of users' logs from our system – using tools customized for extracting key parts of the log, and moreover, we have a database where we can, with some classic queries, get usage data, for example, every month."

The company is very data-driven oriented; they have also developed a monitoring system:

"Monitoring observes live system data and enables real-time response to the needs of users."

The expert further explained the real example of how this monitoring system works. When observing the logs, they compare logs which are typical of normal usage, and if they notice any discrepancy, they do some modifications.

They have been applying data-driven approach from the beginning, but over the time, they have evolved since their systems became more robust. Now they put a lot more attention to user data. The expert confirms applying the data-driven approach in all kinds of situations (designing from the start, redesigning, and redesigning on request).

When asked about the methodology they follow, his answer was:

"It depends, everyone wants it to be a waterfall, but real-life situations require an agile approach."

When asked about the end-user satisfaction and experience, they do not have any form of tracking it, but they do get feedback from time to time. For example, they differ between two kinds of users, the ones that are agile and willing to spend their time to fix possible problems with the system, and the other ones that are inert.

They do not practice A/B testing due to the complexity of the systems they develop. Sometimes, while developing a new system or a feature, they provide end-users with several options – since they sometimes work with rapid development technologies. Also,

some features/functionalities can be tested alone, but a high level of the analytical approach is hardly possible due to the complexity of their systems.

As the main advantage of a data-driven approach the expert sees in shortening time for both developers and end-users:

"Based on data, we noticed that our client had a business problem, which could be solved with minimum effort – so we made some changes. That was an example where we helped our client (even before he asked) and as a result got a satisfied user at a small cost. Mutual benefit…"

As for the disadvantages of this approach, the expert stated hardware resources and initial time needed to set it up, but, compared to the benefits, they are negligible. Even though experts in previous interviews mentioned the GDPR as a possible obstacle, the GDPR in his company does not present a problem, since they do not work on information systems for wide range usage. Data issues are covered within contracts with each client.

3.3 Discussion of the collected feedback

Even though the interviews followed a rigid methodological procedure, a small number of experts consulted (4) should be pointed out as one of the key limitations of this research. The results showed some observed differences (Table 3) between the experts, which were expected since they work in different settings. Expert 1 suggested that the interview could be repeated after a period of time when their application goes into production, since then the discussion about the type of data collected and similar would be more useful.

The interviews showed that there are also significant similarities between the experts' opinions. The most important is their agreement on the importance of incorporating the data-oriented approach into the whole IS development procedure. Also, they agreed that this approach, in their view, could improve the overall experience, without waiting for users' complaints. It could be especially useful in the redesigning projects, since without prior service usage there is no data available. Also, they agreed that there are still some unsolved issues and undefined gaps that have to be worked out to fully embrace the data-driven development paradigm.

Table 3: *A comparison overview of the four conducted interviews*

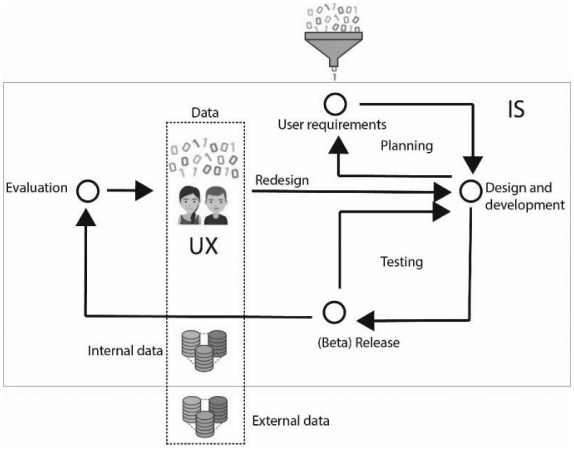
Characteristics	Expert 1	Expert 2	Expert 3	Expert 4
Position	Quality assurance (QA) analyst and business analyst	Head of the programming department	CEO & co-founder of a start-up	Senior developer
Type of IS	Web applications	Web applications	Web applications	Web applications, desktop
Type of requirements collected	Functional, less non-functional	Functional, less non-functional	Functional	Functional and non-functional
Automatically collecting data	Not yet	Yes	Yes	Yes
Using data for decision making	No	No	Medium	Strong
Perception and attitude towards a data-oriented approach	Positive	Positive	Positive	Positive
Negative aspects	GDPR and other related issues	A lot of memory and time for such amount of data	GDPR, time-consuming, cost	
Focus on the satisfaction of end-users	High	Low-medium	Medium	High
User-oriented	Strong	Medium	Low	Strong
A/B testing use	Yes in the future, even if it is too expensive	Not formally, too expensive	Pilot	

As mentioned already, the first concept of the framework for user-oriented data-driven IS development was sent to the experts, and their feedback was received in the form of sketches and comments. After their comments, the changes and specifications were introduced, and the first version of the framework for user-oriented data-driven IS development is presented in Figure 4. To be more precise, several changes have been made in comparison with the first concept (Figure 1). First, there were several "basic" changes, such as adding "Planning", "Testing" and "(Beta) Release" for the more detailed presentation of the development process in the proposed framework. One more functional change has been made in terms of adding a new phase "Redesign", which now stands as a separate phase different from the previous "Development and redesign" phase to reflect its importance, and based on the comments from the experts, to better clarify the required types of input resources. Those input resources can be differentiated as "Internal" and "External" data, as well as "UX data". Another additional element of this framework is system boundaries. It is well known that the system by itself communicates with the environment, but this framework uses these boundaries to differ between internal data

and external data. External data, as mentioned before, stands for objective passive data which is collected through some external web services, such as Google Analytics, HotJar, Matomo, and similar. Another change has been made – the relation between evaluation and user requirements has been removed, since after evaluation it is more fitting to define the next step as "Redesign" than start from the beginning.

The framework acknowledges the well-known phases of information systems development. The difference is that the proposed framework aims to emphasize UX and promotes using the data-driven approach systematically. Both in the theoretical and practical analysis with the experts, it became apparent that objective and passive data can be used effectively and frequently to improve UX by way of eliminating critical errors if these are detected or "just" in a way to improve the whole users' journey while interacting with the system.

Figure 4: *The first version of the framework for user-oriented data-driven information systems development*



Source: Own elaboration.

In brief, the initial phase consists of collecting users' specifications. After that, the information system is being developed, which is then followed up by a testing phase. The testing phase is especially important for developing the first version of the system and, if done correctly, it can be supported by the collected usage data. To be able to use the data, metrics have to be defined and incorporated and devised in the development phase. A very important phase before any redesigning is using the collected data, as emphasized in the illustration.

The data that should be used for redesign purposes can come from different sources, external (tools used for passive tracking) or internal (server logs produced by users and

by the system itself). Even though UX does not stand as some additional step in the proposed framework, by adopting the user-oriented and data-driven approach, UX should be improved as a result. The redesign process can also be repeated during the whole life cycle. As already mentioned, the agile approach aligns well together with these small and incremental changes and, as a result, a redesign can be done during several sprints. In general, the cycle of IS development never ends as long as the system is running.

4 CONCLUSION

A user-oriented data-driven information systems development process puts the needs of end-users in the center. To increase the use of digital services, users need to be satisfied. Two main issues were highlighted in the paper regarding users' needs – the inability to define who the end-user is and frequent changes in the requirements. The development and/or (re)design of an IS, regardless of the technology used, is never a simple process. In theory, the life-cycle should never end; whether it is about completely new versions or new updates of IS, a large number of applications are constantly updated even without the knowledge of end-users (Tomitsch, 2018).

Data collection through experimentation allows decision-making based solely on the needs of users, and such results provide the best possible experience for end-users (King, Churchill, and Tan, 2017). For this reason, the most commonly used method for mass experimentation and collection in the context above is A/B testing (Anderson, 2015; King, Churchill, and Tan, 2017) that was introduced in the first part of the paper and underlined during the interviews with the experts. It was presented to the experts based on relevant studies (Richre & Fluckiger, 2014; King, Churchill, and Tan, 2017; Tomitsch, 2018) primarily as a method that aims to compare two or more versions of an experience, a system, to detect differences, but at the same time enables the feedback loop and as such it is crucial for the user-oriented approach. Since it was well-received by the experts, further research on the proposed framework is planned to be more empirical in terms of developing several case studies to demonstrate the benefits of the data-driven development process and to devise and operationalize the specific elements of the framework, regardless of the data collection methods. Also, as many companies are using A/B tests routinely, more interviews with experts knowledgeable on the subject are planned, including the investigation on the pressing ethical issues (SciPol.org, 2019) regarding this specific method.

As of early 2019, serious efforts have been made towards passing the bill that would prohibit dividing individuals into groups for behavioral or psychological research without their consent, which could dramatically affect test practices. In that regard, the importance of collecting objective usage data would increase, and other methods would gain in popularity that would be analyzed in relation to the proposed framework. Apart from that, further research is planned to be done relating to the specific value of implicit data for the use as a part of the framework, as there is evidence that it can provide new insights

beyond the usage patterns and user satisfaction (Stephens-Davidowitz, 2017). For that purpose, preparation of an experiment with one of the experts is ongoing and planned on top of the systems they are (re)designing. The aim is to compare the original version and the version extended with experimental functionalities while following the future detailed specifications of the framework to examine the effects and the feasibility of the approach in practice.

In the paper, a general notion of the importance of the objective, observable and available (big) data for the development of a user-oriented service or a system was presented followed by valuable inputs from the professionals in the field, all this to structure the first version of the future framework. Authors are fully aware of many issues in this area (some of which are published in Mijač, Jadrić, and Ćukušić, 2018) and would take these into account when developing and describing the specific elements of the framework in the following phases of the research.

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PATTERNS OF APPROACHES TO DIGITAL TRANSFORMATION: AN INSTITUTIONAL ARRANGEMENTS PERSPECTIVE*

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ABSTRACT: *Companies face huge challenges in managing their digital transformation in terms of key actors, their roles and the way they interplay. Based on a survey of 181 large and medium-sized Slovenian companies, we discover six differently successful organizational patterns. The most successful identified pattern is the business–IT partnership approach, where top management and the IT department are responsible for the digital transformation, and the CIO is an orchestrator and a member of top management. However, this is not the only possible successful approach for digital transformation. Recommendations and possible evolutionary paths for companies in each pattern are also outlined in the paper, including the importance of orchestrating the activities and actors of digital transformation and its strategic role.*

Key words: *digital transformation; organizational patterns; CIO; CDO; IT department; digital strategy; digital maturity*

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1 INTRODUCTION

Although digital transformation is often seen as just another buzzword, it has certainly increased top executives' interest in IT-related matters. Companies around the world have started to digitally transform or are at least interested in considering it. Some research revealing the positive influence of digital transformation on organizational performance

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has already been done, e.g., Chen et al. (2016). Digital transformation is not only about new technology (Hinings et al., 2018) but demands major changes in strategy, business models, processes, and organizational structures (Westerman et al., 2011), as well as a reassessment of a company's norms and values (Liu et al., 2011). Companies therefore encounter huge challenges in managing their digital transformation.

Digital transformation elevates IT-related matters to a more strategic level (Peppard, 2018). It is no longer customary for only the Chief Information Officer (CIO) and the IT department to be in charge of such matters, lately the CEO and other members of top management (Whitler et al., 2017) and other departments (Sousa & Rocha, 2019) also wish to actively partake (Dumeresque, 2014). Therefore, companies need to establish strategies, organizational structures, and management practices to govern these complex transformations (Matt et al., 2015). Since most complex organizational changes require collaboration (Seijts & Gandz, 2018), new institutional arrangements are emerging (Hinings et al., 2018), although it is difficult for practitioners to know which approach is best for their companies.

Little is known about the actors in digital transformation, their roles and connections (Kohli & Melville, 2019). Recommendations vary and sometimes contradict each other, therefore further research is needed to clarify how companies should transform (Ismail et al., 2017). Although some call for new positions to be established, for example, a Chief Digital Officer (CDO) and bimodal IT (Horlach et al., 2016), others suggest the existing structures should assume responsibility for the digital transformation (Tumbas et al., 2017). Further, Matt et al. (2015) state that the actors and organizational patterns of digital transformation and their success should be further investigated.

Therefore, our research aimed to investigate how companies institutionalize digital transformation through dimensions identified in previous research: top management involvement, CIO involvement, establishment of the CDO position, role of the IT department, and the presence of a digital strategy. Thus, we wanted to explore typical combinations of key actors in digital transformation, their roles and interplay and to examine which combinations are connected with higher digital maturity.

Based on a survey of large and medium-sized companies conducted in 2017, we examined who the key actors of digital transformation within companies are, as well as their roles and interplay. Besides actors of digital transformation and digital maturity, the questionnaire covered also the understanding of the digital transformation, current state, approaches, plans and key barriers. For this paper only parts of the questionnaire were used. They are presented in the appendix. The analysis, which included some steps of multi-value Qualitative Comparative Analysis (mvQCA) (Rihoux & Ragin, 2009) and different statistical methods, revealed there is not simply one approach to digital transformation; rather, six organizational patterns with different levels of success were discovered.

Besides that, additional characteristics were revealed for each pattern that are also described in the paper. We also discuss how several of the organizational patterns so identified lead to successful transformation; yet, they require different sets of approaches and coordinating activities. Finally, we discuss possible evolutionary paths for companies to consider when seeking to achieve higher levels of digital maturity either through their existing pattern or by evolving to a different pattern with a greater digital maturity potential.

The remainder of the paper is structured as follows. In the next section, we discuss the theoretical foundations of the institutional arrangements of digital transformation, highlight previous findings from the literature and conclude with research questions. The subsequent section describes the research design and methodology. Then, we present the results and discuss the findings and implications. The paper concludes with suggestions for future research.

2 LITERATURE BACKGROUND AND RESEARCH QUESTIONS

2.1 ACTORS AND INSTITUTIONAL ARRANGEMENTS IN THE CONTEXT OF DIGITAL TRANSFORMATION

In essence, digital transformation is an approach to organizational change with an information-centric focus (Glazer, 1991) where IT plays a pivotal role. Digital transformation can be defined as the process through which companies converge multiple new digital technologies, enhanced with ubiquitous connectivity, with the intention of reaching superior performance and sustained competitive advantage, by transforming multiple business dimensions, including the business model, the customer experience and business processes (Ismail et al., 2017). While digital transformation finds its roots in the 1990s (Muzyka et al., 1995), the degree of complexity of current initiatives in this area exceeds that of previous IT-enabled transformations (Ismail et al., 2017). They are even more complex than the radical changes brought by the widespread business process reengineering (BPR) movement (Ismail et al., 2017) during the 1990s, following the work of Hammer (1990), Davenport (1993) and others, but which ended in many unsuccessful projects (Al-Mashari & Zairi, 1999). Similarly, as with previous IT-enabled transformations, the success of digital transformation depends largely on the particular approaches companies take (Ismail et al., 2017).

Lusch and Nambisan (2015) emphasize that the focus of such transformation has shifted to the value (or the experience) several actors create together in a collaborative process. From the service-dominant logic (Vargo & Lusch, 2004, 2008) perspective, digital transformation is about applying the capabilities and skills of the actors to the needs and desires of others within the company (Lusch & Nambisan, 2015). Thus, service-dominant logic (Vargo & Lusch, 2004, 2008) offers an appropriate framework for analyzing various aspects of how companies tackle digital transformation internally.

Structures that actors create through their activities are considered to be one of the building blocks of the framework of service innovation (Lusch & Nambisan, 2015). Vargo and Lusch (2016) further argue that institutions, coordinating mechanisms of various types, and institutional agreements, interdependent assemblages of institutions, represent the most important features of these structures and the foundational enablers of value co-creation. Value-creating actors are coordinated through institutions and institutional arrangements. Furthermore, Storbacka et al. (2016) point out that the need exists for the evaluation of resource integration patterns in the context of digital transformation because it drives novel forms of engagement, which is in line with transdisciplinary vectors of service-dominant logic diffusion identified by Vargo and Lusch (2017).

Research reveals several important actors and institutional roles that are studied individually, along with their roles and responsibilities in a digital transformation context. Some suggestions can be found in the scarce literature (Kohli & Melville, 2019; Matt et al., 2015) in this field. However, to the best of our knowledge, none of these studies examines the interplay or coordination of these various actors and their roles in co-creating value by way of digital transformation. We briefly summarize prior research on the roles of CEOs and other top management members, the CIO, CDO and similar new positions, and the digital transformation strategy.

Gerth and Peppard (2016) and Matt et al. (2015) claim that CEOs and other top management members should be actively involved and possess knowledge of different technology types (Sousa & Rocha, 2019). Recently, members of top management have become more involved in IT-related matters (Turel & Bart, 2014) as seen in an increasing digital focus and a more strategic direction for IT among the CEOs of many companies (Gerth & Peppard, 2016), which results in increased organizational performance (Turel & Bart, 2014). However, the idea that the CEO and other top management members should be involved in IT-related matters to increase organizational performance is not new. A research by Byrd (2003) confirms that top management's support for IT-related initiatives positively impacts organizational performance. Furthermore, Weill and Ross (2004) developed the concept of IT governance which strongly encourages top management's involvement in certain IT-related decisions. Their research also shows that the level of top management involvement in IT-related matters is higher in companies with superior performances (Weill & Ross, 2005).

Becker (2018) suggests companies need a member of top management who provides specific expertise and encourages digital transformation. In some companies, the CIO takes on this role (Tumbas et al., 2017); however, a gap often exists between the CEO's expectations of IT and its current performance (Gerth & Peppard, 2016; Krotov, 2015) and, therefore, CIOs are thought to be unsuitable for leading a digital transformation (Singh & Hess, 2017). This is probably true for some of them because the traditional responsibilities of a CIO include managing the operation of the IT infrastructure (Peppard et al., 2011), yet digital transformation goes above and beyond this and calls for different mindsets and skills (Singh & Hess, 2017). Gerth and Peppard (2016) discovered three

distinct roles based on the level of the CIO's strategic influence; namely, service provider, solution provider, and strategic contributor. To be the spearhead of digital transformation, CIOs must be strategic contributors and thus need more business knowledge and skills (Dumeresque, 2014; Indihar Štemberger et al., 2011; Krotov, 2015).

To deal with the challenges of digital transformation, some organizations appoint new positions, typically a CDO with the role of driving the organization's digital agenda and being the orchestrator of both the IT department and all other departments (Dumeresque, 2014). Some CDOs work alongside CIOs (Hess et al., 2016), whereas others upgrade or even replace the CIO role (Gerth & Peppard, 2016). Tumbas et al. (2017) find that the typical reason for appointing a CDO is the IT departments' preoccupation with large-scale infrastructural projects or the organization has many localized digital initiatives but lacks an overall strategic direction.

Gerth and Peppard (2016) analyzed the possible reasons of shrinking the CIO's business and strategic roles or even replacing the CIO with a CDO and report five particular causes: misunderstanding the transition, ambiguity in defining IT success, ambiguity in role expectations, poor relationship management with peers, and pushing change at the wrong pace. On the other hand, Tumbas (2017) reports there is no need for CDOs in organizations where CIOs have found a way to both drive the digital transformation and take care of the IT infrastructure. In any case, the role of one of the key digital transformation actors must be more business oriented, representing both the business and IT sides (Horlach et al., 2016) irrespective of whether they are called the CDO or the CIO (Gerth & Peppard, 2016).

The analysis in Peppard (2018) reveals that IT organized as a separate organizational unit responsible for keeping IT infrastructure functioning (a technologically-oriented IT department) no longer meets the requirements for generating business value from IT. In the era of digital transformation, IT departments and their heads must become more business-oriented and seek to manage around their boundaries by establishing a partnership between business and IT (Manfreda & Indihar Štemberger, 2019). Moreover, Peppard (2018) suggests that companies adopt pervasive ways of organizing IT, which spread through the entire company, and that CIOs should take on the role of an orchestrator. In addition, Horlach et al. (2016) reveal the necessity of having a bimodal IT operation where digital IT and traditional IT, sometimes referred to as "two-speed IT," coexist. However, contrary to what one might expect, Gerth and Peppard (2016) observe that IT departments are losing their business role and adopting a more technological one.

An important way of coping with the complexity of digital transformation is to formulate a digital transformation strategy that provides a central concept for integrating the entire coordination, prioritization, and implementation of digital transformations within a firm (Matt et al., 2015). It is a company-spanning strategy formulated to enable a company to incorporate the opportunities of the digital technology by leveraging digital resources and

capabilities. Although many companies have developed a separate digital transformation strategy and many consultants have been involved in these initiatives, digital transformation strategy should be aligned to both business strategy and a firm's resources (Yeow et al., 2018). Several researchers (e.g., Bharadwaj et al., 2013; Ismail et al., 2017; Kane et al., 2016) suggest the digital transformation strategy should be closely integrated, or even become part of the corporate strategy.

2.2 Digital maturity

Maturity assessment is used to measure the existing maturity level of a particular aspect in an organization in order to identify strengths and improvement options to reach even higher maturity levels (Proença & Borbinha, 2016). Therefore, maturity models were developed to measure the progress that an organization achieves in its continuous improvement endeavors (Kosieradzka, 2017). The level of digital transformation development can be measured as digital maturity (Mettler & Pinto, 2018), which is similar to other maturity models connected with IT (J. Becker et al., 2009), for example BPM maturity or BI maturity.

Several maturity models are emerging in the area of digital transformation, for example, IDC's five dimensional digital maturity model focusing on planning and governance, customer experience, managing talent, connectivity between internal and external systems, and information architecture (Magee et al., 2015), Forrester's Digital Maturity Model 4.0 focusing on culture, technology adoption, organizational alignment and insights (Gill & VanBoskirk, 2016), the Digital Asset Management (DAM) maturity model emphasizing human roles, information, systems and processes (Proença & Borbinha, 2016), a digital maturity model for telecommunications service providers focusing on strategy, organization, customer, ecosystem, operations, technology and innovation (Valdez-de-Leon, 2016), and others. Despite the fact that there is no commonly agreed-upon definition for the digital maturity concept (Mettler & Pinto, 2018), the models are converging on emphasizing the process of adapting to the changing digital environment. Kane et al. (2015) use the characterization of "an ideal organization transformed by digital technologies and capabilities that improve processes, engage talent across the organization, and drive new and value-generating business models." Therefore, digital maturity is not merely implementing new technology, but rather aligning organizational strategy, culture and technology to meet the digital expectations of different stakeholders (Kane et al., 2017). Nevertheless, Kane et al. (2015) claim that the distinction between companies with high and low digital maturity is based more on strategy, culture and talent development than the use of technology. Moreover, digital maturity presents an asset for engaging with different actors and discussing improvement initiatives beyond focusing on technologies only (Mettler & Pinto, 2018).

Given the importance of various aspects when considering digital maturity, we used the IDC's five level digital maturity model (Magee et al., 2015), which measures the

aforementioned five dimensions. According to this model, digital transformation thus requires companies to maintain a comprehensive view of all five dimensions and ensures cooperation between them. The five dimensions of the chosen model are also in line with the characterization of digital maturity by Kane et al. (2017).

2.3 Research questions

Findings about institutional arrangements of digital transformation can have an important theoretical and practical contribution. As we can see from the above literature review, suggestions about possible successful institutional arrangement are quite diverse. Therefore, we argue that not only one arrangement is best for all companies, but several successful approaches to organizing digital transformation and institutional arrangement patterns are possible. This is in line with the framework proposed by Sinha and Van de Ven (2005), who argue that sets of equally effective work designs for different combinations of inputs should be studied, thus giving managers different work design options. We wanted to discover the patterns that lead to equal effectiveness (higher digital maturity) while using different work design approaches. More precisely, we wanted to explore the following topics:

Q1. What are typical combinations of key actors in digital transformation, their roles and interplay?

Q2. Which patterns are connected with higher digital maturity?

Q3. How are organizational patterns related to digital transformation strategy, and what other characteristics do they have?

This research can contribute to the body of knowledge about actors and institutional arrangement of digital transformation in the framework of service-dominant logic (Vargo & Lusch, 2004, 2008). Furthermore, it can offer practitioners more information about suitable approaches to digital transformation for their companies.

3 RESEARCH METHODOLOGY

In order to investigate how companies seek to digitally transform themselves, we conducted a survey among large and medium-sized Slovenian companies during the summer of 2017. The questionnaire was based on previously developed questionnaires (Indihar Štemberger et al., 2011; Kane et al., 2016; Magee et al., 2015). We sent the questionnaire to the whole population of 1,389 such companies and asked the recipients to forward it to the highest-ranking employee in their organization responsible for digital transformation. We received a total of 196 responses from companies which had already started their

digital transformation. Most responses came from CIOs, business executives or business managers.

The questionnaire was based on previously developed questionnaires and consisted of the following parts: digital transformation (Kane et al., 2016), digital maturity (Magee et al., 2015), and the role and state of IT (Indihar Štemberger et al., 2011). Since we wanted to investigate the patterns of digital transformation, we excluded the responses in which nobody was responsible for digital transformation, as these companies were obviously not involved in digital transformation. Besides that, we also excluded the responses in which the respondents did not know who was responsible for digital transformation, as we found them unreliable due to the respondents' potential lack of knowledge about the subject. Based on these criteria, we eliminated 15 responses and continued the analysis with 181 units. Table 1 shows the general characteristics of the companies included in the final sample.

Table 1: *Characteristics of the sample*

		Size	**Share in %**
Size (number of employees)	Less than 250 (Mid-sized)	129	71 %
	250 or more (Large)	52	29 %
Position of the respondent	Business executive	27	15 %
	CIO	56	31 %
	Business manager	47	26 %
	IT employee	15	8 %
	Non-IT employee	36	20 %
Industry sector	Primary	7	4 %
	Secondary	70	39 %
	Tertiary	104	57 %

The successfulness of digital transformation was measured with the digital maturity model developed by Magee et al. (2015), which is based on self-assessment. In order to select the right methods for further analysis, we tested the variable digital maturity for normality by Kolmogorov-Smirnov and Shapiro-Wilk tests. The results showed that the data was probably not normally distributed (see Table 2). Therefore, non-parametric tests were used for further analysis.

Table 2: *Tests of normality for the dependent variable*

Variable	Test	Statistics	df	Sig.
Digital maturity	Kolmogorov-Smirnov	0.086	181	0.002
	Shapiro-Wilk	0.988	181	0.123

For further analysis, we applied different statistical methods to analyze survey data by using IBM SPSS Statistics 24. In order to discover typical combinations of key actors in digital transformation – typologies or patterns, we also applied some steps of multi-value Qualitative Comparative Analysis (mvQCA) (Rihoux & Ragin, 2009; Fiss, 2011) and the Tosmana software. For testing the statistical significance of differences in digital maturity among various groups, we used the Mann-Whitney U test in the case of two groups, and the Kruskal-Wallis test in the case of three or more groups. The Mann-Whitney U test is a non-parametric test that compares differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed (Hair et al., 2010). Similarly, the Kruskal-Wallis test is also a non-parametric test for the one-way analysis of variance used to determine if three or more samples originate from the same distribution (Hair et al., 2010).

4 DATA ANALYSIS

4.1 Exploring the data

To explore which approaches to digital transformation are more successful, we first checked the differences in digital maturity according to different actors' responsibilities for such a transformation. Respondents could select up to three answers from the list in the survey: the CEO or other member of top management, the CDO, the IT department, the Marketing department, the R&D department, other, nobody, or do not know. The latter two were excluded from further analysis, because these companies were obviously not involved in a digital transformation. The results of digital maturity according to the different actors' responsibilities for digital transformation together with the number of companies in each group are presented in Table 3. We also examined whether these differences are statistically significant and found they are not. Even the minority of the 15 companies with an established CDO position does not stand out as being higher in digital maturity.

Table 3: *Digital maturity according to different actors' responsibilities for digital transformation*

	Yes		No		Mann-Whitney U test	
Responsible	**N**	**Digital Maturity**	**N**	**Digital Maturity**	**U**	**Sig.**
CEO	99	2.80	82	2.92	3674.500	0.272
Other member of top management	58	2.98	123	2.80	3037.000	0.106
CDO	15	2.77	166	2.86	1154.000	0.639
IT department	110	2.93	71	2.75	3382.000	0.128
Marketing department	21	2.87	160	2.85	1630.000	0.824
R&D department	20	2.91	161	2.85	1540.000	0.751

While at first glance it looks as if the responsibility of different actors for digital transformation is not connected with digital maturity, we decided to further analyze the data to detect any patterns in the frequent combinations of these actors and other elements in which digital maturity is higher. We decided to include top management as a possible key actor because the literature gives considerable support for the notion that top management should be responsible for digital transformation. For similar reasons, we decided to include the IT department as a possible crucial actor. We also found, surprisingly, that IT departments are frequently not responsible for digital transformation and wanted to further investigate this.

Therefore, we split the sample into two groups according to whether anyone in top management was responsible for digital transformation. Digital maturity for each group is presented in Table 4. As we can see, digital maturity is higher if top management is responsible for digital transformation; however, the difference is not statistically significant.

Table 4: *Digital maturity according to the responsibility of top management for digital transformation*

Top management responsible		**Top management not responsible**		**Mann-Whitney U test**	
N	**Digital Maturity**	**N**	**Digital Maturity**	**U**	**Sig.**
137	2.88	44	2.78	2701.000	0.300

In the next step, we further investigated the responsibility of IT departments. Some companies had completely outsourced their IT and therefore did not have an IT department. Therefore, we divided the sample into three groups: (1) IT department responsible for digital transformation, (2) IT department not responsible for digital transformation, and (3) no IT department. The results about digital maturity in these groups are presented in

Table 5. Since there were three groups, we used the Kruskal-Wallis test. As we can see from Table 5, digital maturity is much lower in companies which are without an IT department ($p<0.001$). Moreover, we were surprised to find that in one third of the cases where companies do have IT departments, they are not responsible for digital transformation.

Table 5: *Digital maturity according to the responsibility of the IT department for digital transformation*

IT department responsible		IT department not responsible		No IT department		Kruskal-Wallis test	
N	Digital Maturity	N	Digital Maturity	N	Digital Maturity	H(2)	Sig.
110	2.93	53	2.94	18	2.20	17.876	0.000

We further investigated the differences in digital maturity among companies. We wanted to see whether the position of the highest-ranking employee responsible for IT (CIO) was connected with digital maturity; therefore, we investigated digital maturity according to the CIO's position in the hierarchy. As we can see from the results presented in Table 6, digital maturity is higher ($p<0.05$) in companies wherein the CIO is a member of top management.

Table 6: *Digital maturity according to the position of the highest-ranking employee responsible for IT (CIO)*

In top management		Lower in hierarchy		Mann-Whitney U test	
N	Digital Maturity	N	Digital Maturity	U	Sig.
36	3.10	145	2.80	1933.500	0.016

4.2 Detecting patterns

While at first glance it looks as if the responsibility of different actors for digital transformation is not directly related to digital maturity, we decided to further analyze the data to detect any patterns in the frequent combinations of these actors and other elements in which digital maturity is higher. To determine what typical combinations of key actors in digital transformation are, we applied the mvQCA method (Rihoux & Ragin, 2009). Since we were interested in typical combinations of key actors in digital transformation (RQ1) and not only which patterns are connected to higher digital maturity (RQ2), we applied only the first two steps of the method (Fiss, 2011): constructing a truth table, and reducing the number of truth table rows based on the minimum number of cases required for a solution to be considered. We formed the truth table based on three dimensions: (1) responsibility of top management for digital transformation, (2) responsibility of the IT department for digital transformation, and (3) the position of the CIO in the hierarchy.

Some rows in the truth table contained no cases — take, for example, a group in which the IT department is responsible for digital transformation, but top management is not, while the CIO is also a member of top management. We got a truth table with ten groups. As we were not interested in single cases or in very small groups, but in organizational patterns, by which we mean that they are large enough to be considered frequent, we combined groups from the truth table into larger ones if they were smaller than ten cases. As the result, we got six groups with distinct patterns about organizing digital transformation, which are presented in Table 7. We based the groups' names on the archetypes of the IT governance concept (Weill & Ross, 2004) because they are self-explanatory and well established.

Table 7: *Organizational patterns of digital transformation*

	Name	Key actors and their roles	N	Others responsible	Digital Maturity	Digital transformation strategy	Size of companies
1	**Business-IT partnership**	Top management and IT department responsible, CIO in top management	31	In 19%, mostly marketing and R&D, also 1 CDO	3.20	Most companies (65%) include digital transformation in their business strategy. Digital maturity is higher (3.43) for this group. Only 16% do not have a digital transformation strategy.	Similar to the overall sample
2	**Business-IT duopoly**	Top management and IT department responsible, CIO not in top management	52	In 27%, mostly marketing and R&D, also 3 CDOs	2.77	The share of companies in each group is similar to that for the overall sample. Digital maturity is higher for groups that include digital transformation in their business strategies (3.02).	Similar to the overall sample
3	**Business monarchy**	Top management responsible, IT department not responsible	41	In 27%, mostly marketing and R&D, also 2 CDOs	3.00	The share of companies in each group is similar to that for the whole sample. Digital maturity is higher for groups that include digital transformation in their business strategies (3.37).	Similar to the overall sample
4	**Business monarchy with outsourced IT**	Top management responsible, IT outsourced	13	In 38%, mostly marketing and finance	2.20	The majority of companies (77%) do not have a digital transformation strategy.	Mostly mid-sized companies

	Name	Key actors and their roles	N	Others responsible	Digital Maturity	Digital transformation strategy	Size of companies
5	**IT monarchy**	IT department responsible, top management not responsible	27	In 26% (7 cases), mostly R&D, also 4 CDOs	2.91	Only 11% of companies do not have a digital transformation strategy. The share of companies with a special digital strategy is higher (37%). Digital maturity is highest for the group that includes digital transformation in its business strategies (3.07).	More large companies
6	**Feudalism**	Neither top management nor IT department responsible	17	In all cases, mostly marketing and R&D, also 5 CDOs	2.57	A higher share of companies with a special digital strategy (35%) and a lower share of companies with digital transformation included in their business strategies (35%). Digital maturity is higher for companies with any kind of digital transformation strategy (2.81).	Mostly mid-sized companies

Statistically significant differences in digital maturity exist among the patterns. The greatest digital maturity (3.2) is found for the *Business-IT partnership* pattern, in which top management and the IT department are responsible for digital transformation and the CIO is a member of top management. In contrast, companies in the *Business monarchy with outsourced IT* pattern, in which top management is responsible for digital transformation and which do not have an IT department, have the lowest digital maturity (2.2). The *Feudalism* pattern, whereby digital transformation occurs without top management and also without an IT department, also displays very low digital maturity (2.57).

We further investigated the actors involved in digital transformation by examining who else is responsible for digital transformation in order to determine where a pervasive IT organization (Peppard, 2018) is emerging. One third of the sample contains other actors responsible for digital transformation, mostly marketing and R&D departments. However, the share of companies in which others were responsible for digital transformation (see Table 7, "Others responsible") varies among the patterns. Since none of the key actors identified in other groups are responsible for digital transformation in the *Feudalism* pattern, others expectantly take on this role; however, their share is also high in the *Business monarchy with outsourced IT* pattern. On the other hand, their share is the lowest in the *Business-IT partnership* group. We can also see that CDOs are found in almost all patterns, but most of them are in the *IT monarchy* and *Feudalism* group, where top management does not take part in the team.

Further analyses revealed other characteristics of the patterns. Previous findings suggest the way the digital transformation strategy is devised and applied, also plays an important role in successful digital transformation initiatives. We divided the responses into three groups: (1) companies that include a digital transformation strategy in their business strategy (48% of companies); (2) companies that have a special digital transformation strategy (24%); and (3) companies without a digital transformation strategy (28%). Again, we calculated the mean values of digital maturity for each group and tested whether the differences were statistically significant. Digital maturity is highest for companies that include a digital transformation strategy in their business strategy (3.17), lower for companies with a special digital transformation strategy (2.76), and lowest for companies without any digital transformation strategy (2.39); the differences are statistically significant. One might expect that all organizations in patterns entailing top management involvement (*Business-IT partnership*, *Business-IT duopoly*, *Business monarchy* and *Business monarchy with outsourced IT*) included digital transformation in their business strategy, yet the analysis did not confirm this assumption. Nevertheless, some important differences were detected (see Table 7, "Digital transformation strategy").

The final step was to inspect whether any characteristics of the patterns were connected with a company's size. Only a few differences in individual patterns from the whole sample were discovered. These are also presented in Table 7.

5 DISCUSSION AND IMPLICATIONS

The results of this study reveal the existence of several organizational patterns of digital transformations in terms of key actors, their roles, and their interplay in co-creating the business value of digital transformation. While several of these patterns can lead to success, clearly not all patterns are equally suitable and some will typically not provide a good basis for achieving a high level of digital maturity. However, on their way to successful digital transformation, companies may consider different approaches to organize and coordinate activities depending on their current resources, knowledge, skills, technical and change management capabilities, organizational culture, etc. Moreover, different evolutionary paths for further development are possible.

5.1 Understanding the patterns

The **Business-IT partnership** pattern has the highest average value for digital maturity. These companies rely on the partnership type of IT department (Peppard, 2018) and the strategic role of the CIO (Gerth & Peppard, 2016), which seems to be the right approach to digital transformation. Their CIOs and IT departments have not only played an active role in implementing and managing new innovative IT and in developing IS, but also contribute to changing the business processes and business models. They apparently understand how IT contributes to the company's success. Presumably, in these cases, the CIO has appropriate skills and has managed to take on the role of a digital transformation

orchestrator in addition to handling frequently required bimodal IT operations. This may also be the reason for the small number of CDOs in this group. At the same time, top management is actively involved in the digital transformation and thus in certain IT-related decisions. In these companies, the digital transformation has obviously become part of everyday business and the CIO–CEO gap (Krotov, 2015) has been bridged. The success of this group supports earlier findings (Dumeresque, 2014; Gerth & Peppard, 2016) about the importance of the CIO and the IT department's strategic and orchestration roles.

However, it appears that this is not the only organizational pattern that can lead to high levels of digital maturity. Also successful is the **Business monarchy** pattern, whereby the IT department is not responsible for digital transformation, but top management is. Here digital transformation is presumably understood as a business initiative. Not only is the IT department not a service provider (Gerth & Peppard, 2016), but it is also unable to cope with the business requirements for innovative and quick solutions (Tumbas et al., 2017). Instead, its role remains within the traditional IT world (Horlach et al., 2016). The business side apparently takes care of providing new innovative IT solutions either through external resources or internal emergent, technology-enabled, end-user computing (Peppard, 2018).

The importance of a strategic direction transformation has evidently become apparent in this group, particularly when included in the business strategy and not as a separate digital transformation strategy. When the strategic importance of digital transformation is recognized and digital transformation becomes an integral part of everyday business, top management apparently adopts the orchestration role and becomes actively involved in some IT-related matters and decisions. This also prevents uncoordinated localized digital initiatives that may not result in the strategic digital goals being achieved. Still, it looks that a pervasive IT organization is evolving in these companies, since in many of them other departments are also responsible for digital transformation.

In the **Business-IT duopoly** group, digital transformation relies more on the IT department, which shares responsibility for this with the top management. Nevertheless, this approach appears to be less successful than *Business-IT partnership*. In this case, the IT department frequently only plays the role of a service or solution provider. This is seen in the fact that the most senior person responsible for IT is not in top management and consistent with the findings of Gerth and Peppard (2016) that some IT departments are nowadays becoming even more focused on taking care of the IT infrastructure exclusively. It appears that a technologically-oriented IT department could be a barrier to digital transformation. The biggest challenge in this group seems to be the inadequate orchestration and interplay of different roles that do not support success in digital transformation.

Companies in the **Business monarchy with outsourced IT** group seem to be at the start of their digital transformation paths. Their IT has been outsourced; accordingly, IT was not strategically important in the past. As these are mostly mid-sized companies with limited resources and fewer opportunities to implement IT with the aim of gaining a competitive

advantage, their lagging is understandable. This is all reflected in their digital maturity levels being the lowest. However, these companies have recognized the possibilities of new digital technologies changing their business processes and models. Most have not yet defined any strategic directions for digital transformation, although it is important that top management is involved and responsible for these initiatives.

Based on the discussion of the previous groups, it may seem as though top management's direct responsibility for digital transformation is irreplaceable; however, the IT monarchy pattern proves the contrary. In this group, top management is not directly responsible for digital transformation. Yet, it seems that digital transformation is a strategic initiative in these companies because most companies in this group include it in their strategies. Top management recognizes the strategic importance of digital transformation, but probably does not accept it as a part of its daily activities. Instead, it appears that this responsibility has been transferred to other positions, mostly to the IT department and its head, that have to be strategic contributors or close to this level and be able to take on the role of an orchestrator. It is also not surprising that in these cases we quite frequently see CDOs or R&D alongside those responsible for digital transformation. They might also take on the roles of orchestrators (Singh & Hess, 2017) and try to bridge the gap between the business and IT sides. One reason for this situation may be that the size of the company and related complexity of management do not allow them to cope with these activities. The responsibility for digital transformation at lower hierarchical levels is also reflected in the more frequent standalone digital transformation strategy, wherein digital strategic directions are not an integral part of the overall business strategy.

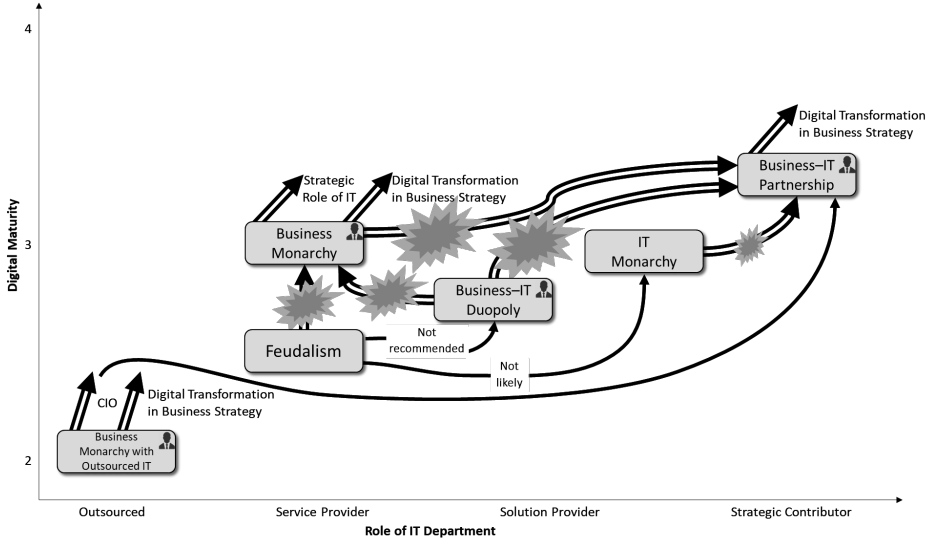
Finally, the **Feudalism** pattern of typically mid-sized companies with localized initiatives and a low digital maturity score was identified. Neither top management nor the IT department is responsible for the digital transformation of these companies. It seems that these initiatives are not strategic and also not orchestrated. Top management obviously has not recognized the strategic importance of digital transformation and IT departments are probably incapable of even being a part of it. Therefore, other actors apparently assume responsibility for digital transformation. However, like with IT governance archetypes (Weill & Ross, 2004), when each business unit makes independent decisions, the results cannot be good in the long run. But some of these companies appoint CDOs who can take on the role of an orchestrator.

5.2 Evolutionary paths

Organizations from all groups have the opportunity to further develop and improve their approach to digital transformation. Therefore, in the following we discuss possible paths of development or transitions between groups based on the characteristics of individual groups and the differences between them. The possible paths, their likelihood, and the barriers to transitions, as shown in Figure 1, are also derived on the basis of linking the findings of this research with previous insights from the literature on individual actors

and institutional roles of digital transformation. In some cases, improvements are possible within their group, whereas transitions between groups are often difficult and require radical changes, and are sometimes not possible without bringing in new employees.

Figure 1: *(R)evolutionary paths of digital transformation patterns*



Legend:

- Top management is (co-)responsible for digital transformation
- Recommended paths
- Possible paths
- Difficulty level of (r)evolution

Organizations in the **Business-IT partnership** group presumably have the best opportunity for progress towards a pervasive IT organization in which the CIO operates as an orchestrator (Peppard, 2018) since these organizations treat IT as highly important, and also understand the business–IT relationship. Currently, other departments are still relatively less involved (only 19% of companies in this group). Furthermore, the key step for these organizations is to embrace digital transformation as a normal business development and therefore include it in the business strategy.

Obstacles found on the path to successful digital transformation, created by the inadequate interplay of different roles in the case of **Business-IT duopoly**, can be significantly reduced with a strategic approach. For instance, suggestions about CMO–CIO alignment and the importance of the CEO's role in improving this relationship are discussed in Whitler et al. (2017). This may result in a higher level of digital maturity. Transition to the *Business-IT partnership* group, which is more digitally mature, is difficult since it is necessary to bridge the gap between business and IT, which calls for different knowledge and skills,

and often also a different mentality and understanding of the role of IT (Krotov, 2015; Manfreda & Indihar Štemberger, 2019). As a rule, it requires personnel changes since the IT department, especially the CIO, must be able to switch over to bimodal "two-speed" IT operations (Horlach et al., 2016).

On the other hand, transition to the *Business monarchy* group is somewhat easier as management may have already recognized the importance and taken part of the responsibility for digital transformation, which can be improved by involving other non-IT departments and establishing appropriate orchestration. Transition to the *Business-IT partnership* group, in fact, brings a revolutionary change in the role of the CIO and the IT department, which as regards the existing situation can hardly expect to go without changing its employees; that is also quite hard to absorb by the remaining parts of the organization. It is also unlikely to move in the direction of a pervasive IT organization as that would require a strong coordinator, namely a CIO orchestrator.

Although high levels of digital maturity may be achieved by an arrangement where IT is the main department responsible for digital transformation and not, top management (**IT monarchy**), these companies will need to change their approach to digital transformation from being IT project focused to constant transformation focused. It is crucial for top management to understand how digital technologies will impact their business and to recognize the nature of digital transformation for which major changes in strategy, business models, processes, and organizational structures are required. Consequently, they need to take their part and responsibility along this path and take advantage of the push from the IT side. By spotting this opportunity and the IT department's current position, they can establish a healthy relationship which can in turn result in moving towards the *Business-IT partnership* group with its higher digital maturity potential. Orchestrators, like CDOs, may help in this process.

Business monarchy can also provide a good environment for digital transformation mainly due to digital transformation being understood as strategic. However, in the long run, this pattern can lead to inadequate IT governance or inconsistency and a lower level of integration of new processes and models with existing ones because the IT department is excluded. This may also lead to problems in implementing business processes. In this case, IT can have a constraining role (Eardley et al., 2008). Yet, organizations in this group hold the greatest potential for developing in the direction of a pervasive IT organization by including other non-IT departments, although this might also pose a risk of developing towards *Feudalism*. In such a situation, it is vital that top management coordinates activities and orchestrates the roles played by different actors during the digital transformation. The latter can be easier where proper basis is detailed in the strategic guidelines for the digital transformation. Thus, including the strategic goals of digital transformation in the business strategy is the most important step in this group for raising the level of digital maturity. In order to ensure the long-term coordination of IT development, it is advisable to move towards increasing the IT department's strategic role which, in the presence of

proper leadership, can result in a transition to the *Business-IT partnership* group; still, this transition is even more difficult than for the *Business-IT duopoly* group.

Feudalism is quite an undesirable situation in terms of further development since top management has not actually recognized the nature of digital transformation and the IT department is unable to take up the leading role in progress or as a strategic contributor. In these cases, when there is no technological push nor any real strategic business pull, it is quite likely the organization will remain in this position. In such companies, the coordinator role of CDOs is less plausible; instead, they probably act as digital evangelists or digital entrepreneurs (Singh & Hess, 2017). Given that this is obviously more of a business pull, the prospects for further development in the direction of *Business monarchy* are greater than in the direction of *IT monarchy*. A prerequisite for transitioning to *Business monarchy* is for top management to recognize the importance of digital transformation, where successful local projects can provide important stimuli. In any case, it is necessary to avoid developing in the direction of the *Business-IT duopoly*, which may represent a dead spot. *Feudalism* should not be confused with a pervasive IT organization in which, despite the involvement of different departments and more distributed roles, the strong coordination of IT's development across the organization is needed.

While the **Business monarchy with IT outsourced** group is making its very first digital transformation steps, the most promising movement was that top management has taken on the responsibility. Nevertheless, they will have to establish strategic directions for digital transformation and involve people with IT knowledge and skills who are capable of understanding digital IT opportunities and limitations. It appears that having the CIO or CDO onboard would be a major step towards achieving significant results of digital transformation efforts. Certainly, not all companies in this group will be able to move to another group, and this would not always be justified. However, when they appoint an appropriately skilled CIO with a balanced business and IT role, this could be the first move towards a successful *business-IT partnership* situation.

5.3 Implications

By identifying patterns of digital transformation, we have answered the first research question (Q1) about the typical combinations of key actors in digital transformation, their roles and interplay. We have analyzed their main characteristics (Q3) and their importance for successful digital transformation. Furthermore, when looking for the answer to the second research question (Q2) about the patterns that are connected with higher digital maturity, we have found that earlier partial recommendations concerning the key actors in digital transformation (Horlach et al., 2016; Matt et al., 2015; Peppard, 2018; Tumbas et al., 2017) are simultaneously both correct and incorrect. It is namely possible to achieve high levels of digital maturity with either CDOs, bimodal IT operations or existing structures, but none of these ensures success in itself. Thus, the main theoretical contribution of this study is therefore the key finding that successful digital transformation is more about the

roles and their interplay; that is, how different (key) actors collaborate to co-create value. It is crucial that organizations properly define the responsibilities for digital transformation, give attention to orchestrating the activities, create a balance between stability and flexibility, attribute strategic importance to the digital transformation, and understand the latter as a business change. This is of value also from the practical point of view, as further elaborated below where also some practical guidelines for organizations are given.

One of the most important issues seems to be the orchestration of different aspects, such as new digital IT, legacy systems, business processes and business model changes, customer experience improvements, understanding the business value, etc. It appears optimal if the role of the orchestrator is played by a business-oriented CIO (the *Business-IT partnership* group). Otherwise, someone else must take on this role, for example, top management itself, CDO, or other structures outside of the IT department. The finding that there is also a relatively high share of companies where other key actors are involved, especially R&D and marketing, shows that pervasive IT organizations are evolving (Peppard, 2018). However, a pervasive IT organization is impossible without proper orchestration. Furthermore, a strategic focus on digital transformation seems to be a crucial factor. For almost all of the groups, the digital maturity score becomes considerably higher when the digital transformation strategy is included as an integral part of the business strategy.

There are significant differences in maturity scores depending on the position of the CIO and the existence of IT departments. In other words, the strategic role of IT is important. Accordingly, organizational patterns are placed according to the role of the IT department and the level of digital maturity in Figure 1. As discussed above, an IT department which is exclusively a service or solution provider can impede digital transformation (the *Business-IT duopoly* group) if a gap exists between business and IT and the digital transformation is not properly orchestrated.

Companies can also organize digital transformation without the IT department being on board (the *Business monarchy* and *Feudalism* groups). However, there is a big difference if top management assumes the orchestration is (in the *Business monarchy* group) or is not (in the *Feudalism* group) evident in the level of digital maturity. In companies without an orchestrator role in the existing structures, parallel structures (e.g., CDOs or whole departments established due to the digital transformation) evolve and adopt that role. Moreover, IT departments in these companies have to do something to avoid becoming secondary players in digital transformation by having related activities outsourced.

Undoubtedly, an optimal case is when IT takes on the role of a strategic contributor and orchestrator, when mutual trust and respect between management and IT is established, and the importance of digital transformation is recognized. Yet, for various reasons, such as the historical development of IT, personality traits, management or IT capabilities, in many organizations these circumstances are impossible or unreasonable (Krotov, 2015).

5.4 Limitations and avenues for future research

The results of this study should be considered in light of some important limitations. Foremost, because this is the first attempt to analyze the interplay of actors based on service-dominant logic, the methodological approach used only allows for a broad view of the patterns. The findings of this study have several important implications for research and practice as discussed above. In order to better understand these patterns and reasons for them, identify other possible key actors and the details of interrelationships between the actors and their roles, norms and beliefs, we propose the next step in the research to be exploratory with the intent to provide grounds for hypotheses development and testing.

There are several questions that arise from the results and that require further research. One of the most important ones is the changing role of IT departments. While past studies suggested that the business role of IT departments should have increased, the results of this research show a reverse trend of increased technological roles. Nevertheless, some IT departments have managed to take an important part in the digital transformation efforts of their companies, but many of them mostly take care of traditional IT infrastructure. Further studies could reveal the root reasons for this situation, whether this is related to the increasingly pervasive nature of IT, the position of CIO, or whether this occurs for some other reasons. Another important question for further research is identifying different dimensions of digital transformation and its actors, considering contingency factors and how to efficiently orchestrate them. Nevertheless, despite these open questions that remain for further research, we hope that this study may serve as guidance for practitioners seeking to increase returns on their digital transformation efforts.

6 CONCLUSION

Organizations should be aware that several different approaches can bring a successful digital transformation. They need to consider contingency factors such as industry competitiveness level, opportunities, historical development, skill sets and mindsets that their current key actors possess, and similar when defining roles to be held in the digital transformation. In particular, it is important to ensure orchestration of the activities and roles. The identified patterns can inform companies about their existing positions and they can then decide which of the evolutionary paths to follow based on their current situation.

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POVZETKI V SLOVENSKEM JEZIKU

DIGITAL TRANSFORMATION – THE HYPE AND CONCEPTUAL CHANGES

DIGITALNA PREOBRAZBA - EVFORIJA IN KONCEPTUALNE SPREMEMBE

Luka Tomat, Peter Trkman

Različni vidiki digitalne preobrazbe (DP) privabljajo vse večjo pozornost. Pogosto pa se DP uporablja za 'prodajanje' obstoječih idej. V članku trdiva, da je izraz DP pretirano uporabljen in se izkorišča za preimenovanje konceptov na različnih področjih za ponovno pritegnitev pozornosti vrhnjega managementa. Vendar samo to ne more pojasniti razlogov za tako veliko priljubljenost koncepta DP. Najin članek analizira konceptualne spremembe, ki so se zgodile v zadnjem desetletju in so vodile k povečanju pomena DP. Te spremembe morajo podjetja upoštevati, če želijo strateško pristopiti k DP in uporabiti trenutno evforijo za DP, da bi pridobila »organizacijski zanos«, ki je potreben za izvajanje sprememb.

Ključne besede: *digitalna preobrazba, zavzetost zaposlenih, management procesov strank, takojšnja zadovoljitev, pozornost, mejni stroški*

DIGITAL TRANSFORMATION – A HUNGARIAN OVERVIEW

PREGLED STANJA DIGITALNE PREOBRAZBE NA MADŽARSKEM

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Digitalna preobrazba danes velja za vse pomembnejši proces, ki je ključen za preživetje podjetij. Širjenje digitalnih tehnologij po naših družbah prinaša različne spremembe organizacijske kulture, ljudi, poslovnih procesov in poslovnih modelov. Zaznavanje pomembnosti digitalne preobrazbe med vodstvi podjetij je v nekaterih evropskih državah nižje, med drugim na Madžarskem. Namen naše raziskave je podati pregled stanja digitalne preobrazbe v madžarskih podjetjih z vidika strategije, tehnologije in digitalnih inovacijskih zmogljivosti. Razpravljamo o ciljih digitalne transformacije in vlogi oddelkov za informatiko pri digitalni preobrazbi. Raziskava je del tekoče raziskave, v kateri vsako leto od leta 2009 raziskujemo prakse madžarskih organizacij, povezane z informacijskimi tehnologijami. V zadnji raziskavi leta 2018 je sodelovalo 167 organizacij. Kot so pokazali rezultati raziskave, obstaja zmeren do močen interes za digitalno preobrazbo, vendar se zavest in dojemanje, kako bo tehnologija spremenila naravo poslovanja, razlikujeta med panogami. Večina anketiranih madžarskih podjetij se ukvarja z digitalizacijo na strateški ravni, vendar še vedno obstaja velika skupina podjetij, ki digitalno preobrazbo obravnavajo zgolj kot tehnološki izziv. Čeprav so cilji digitalne preobrazbe jasni, v mnogih organizacijah ni predpogojev za uspešno preobrazbo.

Ključne besede: *digitalna preobrazbe, digitalne inovacije, strategija digitalizacije*

Construction 4.0 – Digital Transformation of One of the Oldest Industries

Gradbeništvo 4.0 - Digitalizacija Ene Najstarejših Dejavnosti

Robert Klinc, Žiga Turk

V začetku desetletja je nemška industrija opisala svoje pristope k reformam s krovnim pojmom "Industrie Vier Punkt Null". Tako Evropska unija kot tudi posamezne države članice so predlaganim idejam sledile, pozitivne učinke pa je pričela iskati tudi evropska gradbena industrija. V tem članku pojasnjujemo ključne ideje Industrije 4.0 in predstavljamo, kaj Industrija 4.0 pomeni za potrošnika, podjetja in industrijo kot celoto. Znotraj teh okvirjev smo analizirali potenciale Industrije 4.0 v gradbeništvu ter ugotavljali, kje gradbeništvo predlagane koncepte Industrije 4.0, predvsem zaradi svojih posebnosti, že tradicionalno uveljavlja in celo presega.

Ključne besede: *industrijska politika, Industrija 4.0, Gradbeništvo 4.0, informacijsko modeliranje gradenj (BIM), kibernetsko-fizični sistemi*

Independent Cinema in the Digital Age: Is Digital Transformation the Only Way to Survival?

Neodvisni Kinematografi v Digitalni Dobi: Ali je Digitalna Preobrazba samo Način Preživetja?

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Zaradi razvoja digitalnih tehnologij je bilo treba v ustvarjalni in kulturni dejavnosti prilagoditi poslovne modele glede na spreminjajoče se želje potrošnikov. Namen tega prispevka je preučiti, kako lahko neodvisni kinematografi pretvorijo svojo ponudbo glede na izzive, ki jih prinaša digitalizacija, oziroma ugotoviti, ali se morajo v celoti osredotočiti na digitalno preobrazbo. V konceptualnem prispevku obravnavamo neodvisni kino na Škotskem in ugotavljamo, da bi bilo treba digitalizacijo uporabiti za dopolnitev obstoječih dejavnosti, skupaj z raziskovanjem drugih inovativnih poslovnih modelov. Ključno je razumeti, da so se stari časi poslovanja podjetja nepreklicno spremenili.

Ključne besede: *video na zahtevo, filmska industrija, prebojne inovacije, digitalne inovacije, poslovni model, preference potrošnikov, neodvisna kinematografija*

In Search of a Framework for User-Oriented Data-Driven Development of Information Systems

Iskanje Okvira za Podatkovno Usmerjen razvoj Informacijskih Sistemov

Tea Mijač, Mario Jadrić, Maja Ćukušić

Čeprav je pri oblikovanju in razvoju sodobnih informacijskih sistemov običajen iterativen pristop z nenehnimi izboljšavami, iz splošnih trendov k uporabniško usmerjenim pristopom izhaja nekaj zanimivih raziskovalnih smeri. Ker gre za razmeroma aktivno raziskovalno področje, je namen prispevka predstaviti kratek pregled glavnih konceptov in raziskovalnih smeri ter opredeliti nastavitev in kontekst predlaganega uporabniško usmerjenega okvira za razvoj informacijskih sistemov. Različne vidike predlaganega okvira smo ovrednotili na podlagi intervjujev strokovnjakov s področja informacijskih sistemov.

Ključne besede: *uporabniško usmerjen razvoj, podatkovno usmerjen razvoj, okvir, uporabniška izkušnja*

Patterns of Approaches to Digital Transformation: An Institutional Arrangements Perspective

Vzorci Pristopov k Digitalni Preobrazbi: Vidik Instucionalne Ureditve

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Podjetja se soočajo z velikimi izzivi pri upravljanju svoje digitalne transformacije v smislu ključnih akterjev, njihovih vlog in načina prepletanja. Na podlagi raziskave v 181 velikih in srednje velikih slovenskih podjetjih smo odkrili šest različno uspešnih organizacijskih vzorcev. Najuspešnejši identificirani vzorec je pristop partnerstva med managementom in informatiko, kjer sta za digitalno preobrazbo odgovorna najvišje vodstvo in oddelek za informatiko, pri čemer je direktor informatike član najvišjega vodstva in usklajuje izvajanje digitalne preobrazbe podjetja. Vendar to ni edini možni uspešen pristop k digitalni preobrazbi. V prispevku so opisana tudi priporočila in možne evolucijske poti za podjetja v vsakem vzorcu, vključno s pomembnostjo usklajevanja dejavnosti in akterjev digitalne preobrazbe ter njene strateške vloge.

Ključne besede: *Digitalna preobrazba; organizacijski vzorci; direktor informatike; direktor digitalizacije; oddelek za informatiko; strategija digitalizacije; zrelost digitalizacije*