Electronic Markets on digital transformation methodologies

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Published online: 16 September 2019
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Dear readers,

Digital business has spread. This has been reflected in a recent study among 702 executives, which stated that “89% of organizations have adopted or have plans to adopt a digital first strategy” (IDG 2018, p. 2). The notion of “digital first” implies that information technology (IT) is key in enabling worker productivity, in improving business performance as well as in meeting customer experience expectations. To make use of these potentials firms are constantly faced with building up expertise in upcoming technologies. Among the current top five emerging technologies are such diverse fields as artificial intelligence, machine learning, internet of things, software defined networking and software defined storage (IDG 2018, p. 6f). Besides gathering these technological skills, adopting a digital first strategy means that the new technologies need to be embedded in aligned business strategies and processes, an undertaking commonly described as digital transformation (Hess et al. 2015; Bharadwaj et al. 2013). With “digital first” technology is no longer only following the business, but has become the primary driver of change. This is reflected in new organizational structures where board members are responsible for digitization (or digitalization as in (Alt 2018); both terms are used synonymously in the following). For example, in February 2019 the car manufacturer Volkswagen appointed a dedicated board member for all software activities of the brand (Volkswagen 2019). In addition, the three goals worker productivity, business performance and customer experience, suggest that transformation projects need to include internal (workers, decision-makers) as well as external (customers, suppliers) stakeholders.

Evolution of transformation methodologies

Change is inherent in digital transformation projects. To successfully guide this change over time with many participants being involved, the information systems discipline has a long tradition in offering methodological support. Methods structure a transformation project in various activities and allow the coordinated collaboration of many participating actors. Following Brinkkemper (1996, p. 276) a method consists “of directions and rules, structured in a systematic way in development activities with corresponding development products”. The same source mentions techniques as “procedure[s], possibly with a prescribed notation, to perform a development activity”. Roughly speaking, methods determine the temporal relationships between activities occurring during a transformation project and techniques how the specifications of a transformation activity are documented. Such models are a major element in planning, communicating and documenting transformation activities.

In addition, the term “methodology” has been used to denote more precisely “the study of methods”. Being aware that this distinction has not received broad reception and that many sources see “methodology” as synonymous to the term “method” (Henderson-Sellers et al. 2014, p. 18), it still supports the separation of various methodological schools (Brinkkemper 1996, p. 276). These have emerged since the inception of (electronic) information systems in the mid twentieth century. More or less, their purpose followed the evolving role of information systems (e.g. Somogyi and Galliers 2003, Winter and Blaschke 2018), which may be summarized in three periods: while early mainframe computers in the 1960s and the 1970s mainly performed basic numeric calculations for specific business purposes (e.g. in accounting and transaction processing), the impact of IT on the competitiveness in the market became clear during the 1980s and the 1990s. Starting from the 2000s, an increasingly ubiquitously available digital infrastructure enabled numerous new business models and fueled the digital transformation of many

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Table 1 Methods and techniques for digital transformation on three levels

Design element	Technique	Method
Since 1960s: software (information system)	Entity relationship modeling (ERM) (e.g. Chen 2002) Unified modeling language (UML) (e.g. Rumbaugh et al. 2004)	Classical development methods (waterfall, iterative model) (e.g. Holt 1997) Agile development methods (Scrum, Kanban) (e.g. Al-Zewairi et al. 2017)
Since 1980s: processes (business processes, organizational structure)	Business process model and notation (BPMN) (e.g. Chinosi and Trombetta 2012) Event-driven process chain (EPC) (e.g. Scheer et al. 2005)	Business process management (BPM) (e.g. Elzinga et al. 1995) Business engineering (BE) (e.g. van Meel and Sol 1996) Business process improvement / Six sigma (e.g. Montgomery and Woodall 2008)
Since 2000s: values (firm strategy, external environment)	Business model canvas (BMC) (Osterwalder and Pigneur 2010) e3value (e.g. Weigand 2016)	Design thinking (e.g. Leifer and Steinert 2011) Business model innovation (BMI) (e.g. Moellers et al. 2019)

industries. Table 1 shows these three periods and the techniques as well as the methods that emerged for the varying purposes:

- *Software development.* Early transformation approaches were mainly concerned with building software. Among the prominent representatives are techniques to model data structures and methods for software development. The former include the entity relationship model (ERM), which was presented as standard notation for relational data structures in 1976 as well as the unified modeling language (UML) introduced in the mid-1990s. The latter comprise methods (e.g. waterfall model) that define various phases of a software development project. Based on the requirements that were received “from the business” software was designed, implemented, tested and maintained. Similar to UML, which is broader than ERM – it not only covers data structures (e.g. class diagrams), but also program structures (e.g. component diagrams) and behavior diagrams (e.g. activity, use case, sequence and interaction diagrams) – the classical methods were complemented by agile approaches that foresee a closer interaction between the stakeholders in a software development project. These agile approaches have spread since and conceiving transformation as an agile endeavor of many smaller steps and iterations has become an important principle.
- *Process development.* Another set of transformation methods and techniques evolved in the 1980s and was closely linked to the birth of integrated information systems. Also referred to as enterprise resource planning (ERP) systems, these applications combined functionalities from various business functions within a company (e.g. sales, procurement, accounting, human resources) in a coordinated manner and made data available to all business functions due to a single centralized database. Although data modeling and programming were still necessary, the emphasis now shifted to

customizing standard software and to (re)designing business aspects, in particular the flow of activities and the structural organization. Graphical notations such as the business process model and notation (BPMN) and event-driven process chains (EPC) made the logical flow of activities across a firm’s functional boundaries visible. The shapes of the diagrams included organizational units, conditions, events as well as the supporting information systems and their data. Process methods linked these various design aspects and distinguished various phases within a business process (re)design project. Many approaches include continuous improvement cycles that indicate their permanent use: while radical redesigns will only occur periodically, gradual improvements are an ongoing effort to make processes more reliable with less defects. Methods like Six Sigma emphasize these continuous improvement activities.

- *Value development.* Although the strategic potential of information systems as well as the need to radically challenge existing business solutions were recognized during the 1980s and 1990s (e.g. Wiseman 1988), methodologies that focus on strategic transformation aspects, are the youngest. Instead of designing processes they emphasize the modeling of (business) values (Winter and Blaschke 2018) and compared to the classical strategic methods (e.g. value chain and five forces analysis) their results (e.g. the business models) are more specific. Among the de facto standard techniques that loomed in the past years are the business model canvas (BMC) for structuring the (design) elements of a business model (see Alt and Zimmermann 2014) and the e3value notation that serves to graphically model the flows between the actors in a business model. The methods that have spread for developing (digital) business models are design thinking as well as business model innovation (BMI). Similar to the agile software development methods they distinguish multiple loops from the inception of a new solution to the testing of early prototypes or so-called mockups. However, the goal

is not to implement a productive software product, but to pursue a green-field approach that enables the creation of innovative solutions and to understand whether a business model might work.

Perspectives for digital transformation

The left column of Table 1 shows in brackets the design elements that are relevant for developing information systems in an organizational setting (Silver et al. 1995, p. 363f). Since each methodology addressed different elements, most aspects – i.e. organizational culture by its nature remains difficult – for developing information systems are covered with methods and techniques that may be seen as de facto standards. Remarkably, they have for a long time been accompanied by a division of labor: strategic consulting companies were mandated for the top-level business aspects (e.g. positioning in the market), process experts for making business solutions operational (e.g. process designs) and, finally, software companies for developing individual software or customizing commercial off-the-shelf software. There are two downsides to this setup: first, in times of digitalization, such sequential transformation has become obsolete. Technological and business aspects are closely intertwined and the ability to quickly unlock the business potentials of new emerging technologies has become a competitive advantage. Digital transformation is an ongoing effort and businesses need to shape a suitable environment for it. Second, information systems are no longer primarily developed for being used in a given organizational setting. With the rise of digital services and platforms they are becoming increasingly networked, virtualized and offered on demand. Users assume new roles as co-creators and as key actors in multi-sided platforms. The question is whether the existing methodologies sufficiently support these developments.

The large number of available methods and techniques may be seen as a well-filled transformation toolbox. In addition, many of them were enriched with new shapes and/or diagrams, which made them applicable for various purposes. For example, UML has been used to model processes and even business models. Many businesses also use multiple techniques and methods, e.g. design thinking in the early phases where creativity and innovation are important as well as BPMN or UML as notations for specifying aspects of a desired solution in the later stages. However, multiple methods may cause inefficiencies, such as lacking and/or incompatible artifacts or redundant development activities. In addition, directions might emerge where existing methods and techniques fall short in covering new transformation aspects. In this respect, Hevner and Malgonde (2019) state that “software development managers and teams face unique challenges in platform environments and require new development approaches”. Matt et al. (2019) assert that “the development of solutions in the context of the individual is different

than the classical development of corporate IT solutions.” Among the new directions towards more methodological support for platforms and services, are mobile platform development frameworks (e.g. Majchrzak et al. 2017) as well as approaches for developing (platform-based and/or smart) services. While the former are primarily technical in nature, the latter also feature a strong business orientation. Relevant methods for developing services have an origin in the engineering domain with service engineering being a discipline that “utilize[s] existing engineering know-how in the area of traditional product development to develop innovative services” (Bullinger et al. 2003, p. 276). Service engineering describes models of resources, processes and products as key artifacts when developing a service, which also combine the business and the technological perspective.

Over the last years, a rich variety of methodological suggestions and artifacts may be observed in the literature on service engineering, which still await adoption and the recognition as “de facto” standards. For example, Arsanjani et al. (2008) propose an approach for service-oriented architectures that reaches from business modeling and transformation until deployment and employs a proprietary notation. Fruitful discussions also emerged in an area that Böhmann et al. (2014) refer to as smart systems engineering and Beverungen et al. (2019) as smart service engineering. Both aim at unlocking the potentials of service innovation and see methods as an important element in achieving this. For example, the model suggested by Hein et al. (2019) introduces new elements for specifying co-creation practices between customer, platform owners and other actors via boundary resources. Enhancing and combining existing techniques is another option shown by Suhardi et al. (2015), who suggest to combine the BMC in the early identification stage with BPMN and UML in the design phase. In a similar way, Grieger and Ludwig (2019) in this issue adapt BMC and UML for digital transformation in the automotive industry. Clearly, more research, in particular design- and practice-oriented research is required for a (smart) services and (digital) platform transformation methodology. Several existing developments seem promising and should be considered in this endeavor:

- *Integration.* In the first place, digital transformation projects are characterized by the combined change of business and technological change (e.g. Barthel and Hess 2019). While this integrated perspective has been recognized since process development, future developments call for an integration of methodological support from the early stages until operation and continuous improvement as well as for methodologies that cover an ecosystem-wide perspective (e.g. Bork et al. 2019).
- *Automation.* A digital transformation methodology for services and platforms should make most use of

digitalization itself. This could build on existing software engineering where cloud-based development kits and automated delivery pipelines have spread. Developments in the area of DevOps (e.g. Wiedemann et al. 2019) promise high efficiencies regarding the development of new solutions, the continuous improvement of existing solutions and the rapid deployment of updates. It may be expected that existing BPM and business model development tools will also become more powerful and that they will increasingly automatically generate executable code (e.g. Augenstein et al. 2018).

- *Creativity*. Digital transformation involves the combination of (periodical) radical innovation with (continuous) gradual innovation. In particular, achieving radical innovation appears more challenging and less amenable to automation. Although approaches towards automation based on artificial intelligence exist (e.g. Nguyen et al. 2015), the ability to create the suitable organizational setting that sustains creativity is key. It will involve many individuals with different skills from inside and outside the company. This will also include representatives from the customer (e.g. the company contracting a consulting company) and sometimes (e.g. in the case of open innovation) even the users, which often are end customers. In this regard, platform thinking has coined the notion of "reverting the firm" to include the need to manage value creation occurring outside the company (Parker et al. 2017, p. 256).
- *Usage*. Obtaining an early understanding about the needs of users is critical for many networked products and services. This applies to smart services (e.g. parking, transportation, payment) and digital platforms, whose value and sustainability is closely linked to network effects. Being able to quickly reach a large user base and a high transaction volume is often more important for creating value than a high return on investment. It is the basis for the platform's liquidity as well as for further data-driven business innovation (e.g. Basole et al. 2015). Among others, this means that service and/or platform providers should strike alliances with potential users like Facebook did with Visa, Uber, [Booking.com](#) and others when conceptualization their Libra currency project (Andriotis et al. 2019).

Articles of present issue

The special themes in the present issue may be seen as contribution to the body of digital transformation methodologies, which are needed for pursuing "digital first" strategies. On the one hand, a special issue section on the "digitization of the individual" shows how digital solutions differ at the individual (or user) level and what the implications for the development of these solutions are. The papers offer insights on the behavior of individuals, in

particular, the design implications of the digital traces left by individuals, the design criteria when selecting digital platforms and the role of the social environment. On the other hand, a special issue section on "design science research" presents research on methodological aspects that are critical in the future emergence of a digital transformation discipline. The research results address the understanding of dynamics in the firm's environment, the development of software on digital platforms, the design of hybrid intelligence decision support systems as well as design principles for digital value co-creation networks. Since most digital transformation projects involve innovation, the collaboration of many actors, the elaboration of numerous artifacts during development and operation as well as the close interaction with (end) users, the two special themes in this issue provide a congenial combination. We are indebted to the two teams of guest editors for organizing the special issues. These are:

- Christian Matt from the University of Bern, Switzerland, Manuel Trenz from the University of Augsburg, Germany, Christy M.K. Cheung from Hong Kong Baptist University and Ofir Turel from California State University in Fullerton, USA. They will introduce the topic of digitization of the individual as well as the three articles of their special issue in more detail in their preface "The digitization of the individual: conceptual foundations and opportunities for research" (Matt et al. 2019).
- Jan vom Brocke from the University of Liechtenstein and Alexander Maedche from the Karlsruhe Institute of Technology, Germany. In their preface, they present "The DSR grid", which represents a compelling framework for design science research (DSR). It comprises "six core dimensions for effectively planning and communicating design science research projects" (vom Brocke and Maedche 2019). This grid is also used to position the four papers of this special issue.

Besides the seven special issue articles, the present issue of Electronic Markets includes four articles in the general research section. Together with three editorial pieces, this sums up to fourteen articles, which marks the largest number of articles in an issue of Electronic Markets. Two of the four general research articles also feature immediate links to the special issue. They focus on the interaction with customers and present examples of design science research. The first, written by Marcus Grieger and André Ludwig, is titled "On the move towards customer-centric business models in the automotive industry - a conceptual reference framework of shared automotive service systems". The authors present an in-depth analysis of customer-centric services for automotive manufacturers. They emphasize the digital transformation of the automotive industry where traditional manufacturers are increasingly becoming providers of product-service systems (or smart services). Based on a structured literature review, interviews and a workshop, they established a conceptual

reference framework for such automotive service systems (Grieger and Ludwig 2019). The framework relates to the business model canvas and uses UML to model relationships between framework elements. It convincingly illustrates the adaptation of existing techniques in digital transformation projects as mentioned above.

The second general research article presents “value co-creation practices in business-to-business platform ecosystems” and claims that although co-creation is “common practice on business-to-consumer platforms, research on their business-to-business counterparts is still sparse”. To fill this gap, the authors Andreas Hein, Jörg Weking, Maximilian Schreieck, Manuel Wiesche, Markus Böhm and Helmut Krcmar adopt the concepts of service-dominant logic and of boundary objects. They conduct a multiple case study in the context of internet of things platforms and identify three standardized value co-creation practices (Hein et al. 2019). The role of the boundary resources for the value co-creation in platforms is demonstrated using dedicated models that advance the knowledge on platform development.

The third general research article aims to determine the “online video impact of world class universities”. Angel Meseguer-Martinez, Alejandro Ros-Galvez, Alfonso Rosa-Garcia and Jose Antonio Catalan-Alarcon investigate how active universities are in distributing online video content via the social channel and how relevant the length of the video and the reputation of the institution are. They compile a listing of the top ten universities regarding online video impact and suggest that university rankings should also consider the online video impact as an additional dimension (Meseguer-Martinez et al. 2019).

Finally, Heng Tang and Xiaowan Lin investigate how the abandonment of shopping carts might be reduced. Using an approach, which distinguishes three types of uncertainty, they develop a structural model that investigates the impact on the intention to checkout. A survey among online shoppers yields interesting insights how measures, such as feedback mechanisms, are helpful in reducing uncertainty and thereby increasing the probability of finalizing the transaction (Tang and Lin 2019).

New editorial board members and impact factor

We hope you enjoy reading the present issue of Electronic Markets and we wish to thank all authors, editors as well as reviewers who were involved to make it happen! Academic journals like Electronic Markets rely on an active community of constructive and competent scholars. We are grateful that this community has grown with the agreement of the Electronic Markets board and that the following esteemed colleagues have accepted our invitation to assume new roles.

We are honored that four of our Associate Editors have followed the invitation to a position as Senior Editors. These are Maria Madlberger from Webster Vienna Private University, Austria, Mathias Klier from Ulm University, Germany, Mark de Reuver from Delft University of Technology, The Netherlands, and Martin Smits from Tilburg University, The Netherlands. The list for Associate Editors is even longer and comprises the following eight colleagues, who have contributed intensively to Electronic Markets as editorial board members in the past: Shengnan Han from Stockholm University, Sweden, Val Hooper from Victoria University of Wellington, New Zealand, Christian Matt from the University of Bern, Switzerland, James E. Richard from Victoria University of Wellington, New Zealand, Reima Suomi from the University of Turku, Finland, Adam Panagiotis Vrechopoulos from Athens University of Economics and Business, Greece, and Yun Wan from the University of Houston-Victoria, USA. Finally, seven colleagues have contributed convincing review work to Electronic Markets and have accepted our invitation to join Electronic Markets’ editorial board: Ricardo Büttner from Aalen University, Germany, Juho Hamari from Tampere University of Technology, Finland, Jianwei Hou from Minnesota State University, Mankato, USA, Cyrene Tangour from the Fraunhofer Center for International Management and Knowledge Economy IMW, Germany, Uwe Leimstoll from the University of Applied Sciences Northwestern Switzerland, Mazen Ali from the University of Bahrain, and Kim B. Serota from Oakland University, USA. We are deeply thankful to all of them and we highly value their effort. For sure, this has been a major cause for Electronic Markets’ rising and recently confirmed journal impact factor. Shortly after a board meeting in June 2019 the new metric was 3.553, which was almost the same as the exceptional score in 2018. Again, thanks to all and best regards,

Your EM-team.

Acknowledgements The author acknowledges the critical feedback and the suggestions to this editorial from Christian Hrach and Simon Kolb.

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