

The Impact of Digitization on Contemporary Innovation Management

Completed Research

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Abstract

Innovation management is challenged by the new circumstances created through the pervasive digitization of entire industries and society at large. Since digital technology is an important part of most novel services and products, innovation management is searching for ways to align traditional innovation processes and routines with the new requirements. To better understand how digitization challenges the established assumptions of traditional innovation management, we conducted a total of 27 interviews with senior managers from 11 companies in various industries. Our results empirically confirm and underscore conceptual insights from extant research. We find that the pervasive digitization leads to (1) blurring external boundaries, (2) fusion of process and outcome, and (3) shortened innovation cycles. Most importantly, we uncover first insights into how senior managers react to the ubiquitous challenges of digitization.

Keywords

Digitization; innovation management; digital innovation management; case study research.

Introduction

The digital transformation of entire industries and society at large sparks profound changes and revolutionizes the way organizations work and develop (Nambisan et al. 2017). With digital technology becoming an integral part of most services and products, organizations are increasingly looking for ways to align their structures and processes with those new circumstances (Yoo et al. 2012). Since innovation is at the very heart of every organization (Drucker 1955), the impact of digitization on contemporary innovation management is particularly noticeable (Nambisan et al. 2017). We define innovation management as the “practices, processes, and principles that underlie the effective orchestration of [...] innovation” (Nambisan et al. 2017 p. 224).

For instance, with the advent of pervasive digitization, the costs for communication and coordination are literally vanishing (Altman et al. 2015) enabling organizations to create new forms of innovation networks by including various actors (Lyytinen et al. 2016) and experiment with new ways to transition between different innovation network types (Hund and Wagner 2019). Furthermore, the lowered costs facilitate routine experimentation and alter how innovation processes are designed (Fichman et al. 2014). For

example, due to digitization, organizations can keep their product design phases open for much longer, thereby, enabling changes even after releasing a product (Svahn et al. 2017). Hence, organizations can incorporate the feedback of their customers much better (Svahn et al. 2017) and can quickly implement changes to update their offering consistently (Huang et al. 2017). Even the architecture of products changed since the convergence of the modular structure of physical components and the layered structure of digital technology (Yoo et al. 2010). This layered modular architecture allows to interconnect physical devices with networks, services, and digital content, thereby, changing how organizations think about innovative product creation (Yoo et al. 2010).

However, even though extant research provides great insight into the ramifications of digitization (e.g., Lyytinen et al. 2016; Yoo et al. 2010) and we do know that there are significant changes (Nambisan et al. 2017), we still do not fully understand how pervasive digitization influences organization's innovation management. Currently, there is the notion amongst scholars that "[...] because of the shift in the locus of innovation and because some of our core organizing axioms [...] may be challenged or fundamentally changed by the digital revolution, the nature of innovation and organizational scholarship may be at a transition point" (Benner and Tushman 2015 p. 498). Thus, extant innovation theories might not be able to fully explain current developments (Nambisan et al. 2017). While novel theorizing is taking place in extant literature (e.g., Henfridsson et al. 2018; Nambisan et al. 2017; Yoo et al. 2012), it is predominantly conceptual and not empirically tested yet (Hund et al. forthcoming). To gain further insights into how the underlying developments caused by digitization influence contemporary innovation management we put forward the following research question:

How does digitization affect innovation management in contemporary organizations?

In the following, we explore the extant literature to examine essential factors of change in a digitized environment. Subsequently, we conduct and analyze 27 interviews with senior managers from 11 companies in various industries. For the interviews, we chose companies that are amid transformations due to digitally induced change. Finally, we present and discuss our findings, explicate the limitations of our study and provide thoughts for further research.

Development of Research Propositions

In recent years, digitization made significant progress, and digitized processes are now part of nearly every organization. We define digitization along the lines of Tilson et al. (2010 p. 749): "[...] *digitizing—the process of converting analog signals into a digital form, and ultimately into binary digits (bits). Because all digital information assumes the same form, it can, at least in principle, be processed by the same technologies. Consequently, digitizing has the potential to remove the tight couplings between information types and their storage, transmission, and processing technologies—potentially shattering the dominant service model and the stability of the industrial organization*". Most traditional businesses fine-tuned their structures and processes to the laws of an analog environment and are now under pressure to adapt to the new reality of a digitized world (Iansitit and Lakhani 2014). This pressure is intensified by the rapid improvements of IT performance as described in Moore's Law (Schaller 1997) and the concomitant drop in communication and coordination costs (Altman et al. 2015). The low cost of digital technology and the nearly vanished marginal costs reduce the inhibition for change, as the costs associated with experimentation are correspondingly low (Nylén and Holmström 2015; Rifkin 2015). Thus, our understanding of organizing and innovating "[...] may be challenged or fundamentally changed by the digital revolution" (Benner and Tushman 2015 p. 498).

Digitization appears to facilitate cooperation beyond organizational boundaries. Companies can no longer afford to rely on internal resources exclusively and, therefore, must open their organizational boundaries to engage with external expertise and skills (Saldanha et al. 2017). Due to the pressure to meet the ever shorter product and innovation cycles, many companies focus on their core competencies and rely on the access to external resources for everything beyond these core competencies (Rifkin 2000). This new way of cooperation is only feasible due to the radical reduction of IT costs and the increasing modularization of products, which pushes marginal costs close to zero (Altman et al. 2015; Rifkin 2015; Yoo et al. 2010).

Shifting the paradigm from closed to open innovation processes is well documented in several literature streams. The most popular connotations are open innovation (Chesbrough 2003) and user innovation (Hippel 2006; Hippel and Katz 2002). According to Chesbrough (2015 p. 1), open innovation is the

"antithesis of the traditional vertical integration model in which internal innovation activities lead to internally developed products and services that are then distributed by the firm." Open innovation makes "use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation" (Chesbrough 2006 p. 1) with the focus on creating a financial surplus for the producer. User innovation is about outsourcing "need-related innovation tasks to the users themselves" (Hippel and Katz 2002 p. 1) and meeting the demands of the user. A good example to illustrate the differences between open and user innovation is crowdsourcing. It refers to the outsourcing a task to a large, undefined crowd of contributors to solve a diverse set of problems such as innovation initiatives or talent matching (Boudreau and Lakhani 2013). Depending on the characteristics of the goal, crowdsourcing can be an example of open, as well as user innovation (Bogers and West 2012). If the primary purpose is to achieve a company goal it relates to the open innovation paradigm, if the main purpose is to engage with customers to find out about their needs, it refers to the user innovation paradigm. Such an environment frequently pushes the process beyond the control of the original innovator (Bogers and West 2012).

In essence, while there is disagreement between proponents of open innovation and user innovation, both views agree that opening the organizational borders to include external resources and knowledge is inevitable to sustain high rates of innovations (Chesbrough 2015). This view is supported by Han et al. (2012) who found that the market valuation of a company increases when publicly joining an IT-based open innovation alliance. Interestingly, the evaluation of other companies within the same ecosystem increased as well. This mechanism markets hand out pecuniary rewards for the expected innovation boost of companies that open their organizational boundaries. Accordingly, and consistent with extant literature it is reasonable to formulate proposition 1:

P1: Digitization leads to blurring organizational boundaries.

Second, process and outcome are increasingly merging. Nambisan et al. (2017) argue that traditional innovation management viewed process and outcome as clearly distinct from each other (e.g. Grönlund et al. 2010). However, the digitization of previously analog products, processes and services infused them with new characteristics such as openness and edit-ability (Yoo et al. 2010; Zittrain 2009). Paired with the substantial amount of user data and real-time customer feedback manufacturers are enabled to frequently adapt and update their offerings (Fichman et al. 2014). For example, by receiving valuable information about user behavior, Amazon can fine-tune its offering to what the customer wants and starts receiving new feedback about the change immediately after the implementation (Yoo 2010).

Furthermore, updates and changes require only neglectable financial expenditure as computation and communication are very low-priced (Altman et al. 2015) and can be implemented within minutes. The merger of process and outcome can also be observed in the increasing popularity of agile working methods, which incentive instant releases and fast updating (Huang et al. 2017). Accordingly, and consistent with extant literature we formulate the following proposition:

P2: Digitization leads to the fusion of process and outcome.

Lastly, as a direct result of the first two propositions, the rate of change overall is increasing. Digitization facilitates quick re-programming and changing of processes and products, thereby, increasing the overall flexibility (Yoo et al. 2010). Furthermore, digitization enables the integration of external expertise into internal innovation processes, thereby, increasing the heterogeneity of knowledge (Nambisan et al. 2017). Thus, the increased flexibility and the increased heterogeneity offer more room for experimentation and innovation through recombination (Yoo et al. 2010). This, in conjunction with increased pressure from competitors, leads to shorter innovation cycles (Fichman et al. 2014) and an acceleration of change overall (Balogun et al. 2016; Todnem By 2005). Accordingly, and consistent with extant literature we formulate the following proposition:

P3: Digitization leads to shortened innovation cycles.

Research Method

To examine how digitization impacts innovation management along the propositions highlighted in the previous section, we used a multiple case study design (Yin 2011). Since case studies are the preferred way to investigate *how* and *why* questions, this approach is particularly fitting (Eisenhardt 1989; Yin 2011). By testing a priori derived propositions, we follow a positivist research approach (Dubé and Paré 2003). However, unlike a survey-based study, which aims at statistical generalizability by analyzing various data points, we follow a case-study approach, which aims at establishing generalizability by replicating previously established theories. This approach resembles the replication logic such as in experimental designs and is well established (e.g., Dibbern et al. 2008; Yin 2011).

In the process of collecting data, we conducted interviews with 11 companies that currently undergo digital-related changes. Thus, our sampling efforts were focused on identifying whether or not organizations were already conducting digital initiatives. In total, we interviewed 27 senior managers and followed a semi-structured questionnaire with open-ended questions. The interviewed managers held positions in departments such as R&D, IT, strategy or innovation as we expected these positions to be especially interesting in the context of change and digitization. Generally, we aimed for at least three senior managers per company to ensure a detailed insight into the company, however, depending on company orientation and size sometimes one person was in charge of every important area of interest. Table 1 gives an overview over the conducted case studies, the industry or each case, the ID we assigned to each interviewee, their respective job title and the length of each interview:

Case	Industry	ID	Interviewee Position	Length [min]
A	Manufacturing	IP01	Innovation Manager	59
B	Banking	IP02	Innovation Manager	68
		IP03	Head of Product Management	66
		IP04	Chief Technical Officer	57
		IP05	Head of Business Development	72
C	Publishing	IP06	Deputy General Manager	70
		IP07	Chief Technical Officer	66
		IP08	Marketing Manager	72
D	Banking	IP09	Head of IT & Organization	83
		IP10	Chief Executive Officer	45
		IP11	Product Group Manager	91
E	Manufacturing	IP12	Head of Automation and Controls	121
		IP13	Director of Technology Management	54
F	Banking	IP14	Chief Digital Officer	57
G	Banking	IP15	Chief Executive Officer	65
		IP16	Chief Digital Marketing Management	53
		IP17	Chief Financial Officer	46
		IP18	Chief Marketing Manager	53
H	Manufacturing	IP19	Chief Executive Officer	45
		IP20	Chief Digital Officer	60
I	Banking	IP21	Vice President Sales	63
		IP22	Product Manager	33
		IP23	Team Lead Electronics	109
J	Manufacturing	IP24	Vice President Systems Development	70
		IP25	Vice President IT Solutions	60
		IP26	Director Corporate Strategy	35
		IP27	Director Product Management	45

Table 1. Case Study Overview

To gain a better understanding of the interviewee, we started with a short summary of the interviewee's background and also inquired about the current position and job description. Following up, we asked for their personal understanding of digitization. Subsequently, we shifted our focus to a current digitization project into which the interviewee had close insights. After having a better grasp about the person, their personal understanding of digitization and about current digitization projects, we went on to inquire about how resources are allocated, how innovation processes are set up and whether there are innovation co-operations or networks. The majority of the interviews was conducted onsite and was structured as follows: First, the interviewees described their background and area of responsibility. Subsequently, we asked about their personal definition of digitization and then inquired about current projects regarding digitization. Additionally, we asked about internal processes, structures, and decision hierarchies. After finishing data collection in 2016, the tape-recorded interviews were transcribed and analyzed. For coding, we used MaxQDA Plus 12 (Release 12.3.3) and built upon on the recommendations of Miles and Huberman (2013) to establish patterns and refine our understanding of the emerging results through constant iterations – ruling out unviable explanations and further sustaining established patterns. To avoid possible biases, the first author, which was not present in the interviews, read and analyzed the transcripts with the context of digitization and change in mind. This resulted in a total of 302 coded statements.

The findings were discussed with the second author and subsequently organized in three main categories of *blurring organizational boundaries*, *fusion of process and outcome* and *shortened innovation cycles*. In order to be categorized into the first category (blurring organizational boundaries), the statement must indicate in some form how a company's boundary is blurring either through changes in a company's environment (e.g., knowledge, freelancers, customers) influencing a company's internal work or through a company's strategic moves transcending the company's boundary (e.g., a unit spin-off). In total, we allotted 154 statements to this category. In order to be categorized into the second category (fusion of process and outcome), the statement must describe how process and outcome of a product/service/process are increasingly getting closer. Examples mentioned by interviewees include agile methodologies, in which the outcome is constantly and iteratively improved through new insights or customer feedback. In total, we allotted 55 statements to this category. Finally, in order to be categorized into the third category (shortened innovation cycles), the statement must mention how time pressure is increasing such as shortened, internal procedures and processes. In total we allotted 53 statements to this category.

Results

Regarding our first proposition (“*Digitization leads to blurring organizational boundaries.*”) our results indicate that this issue was mentioned in every single case. IP20 framed the impact of the increasing digitization as: "I believe the digitization is a massive stroke of luck for the industry because it forces us – in a positive way – to think more about our customers and our market." Various factors drive this trend. First, companies realize that they cannot master all the challenges of digitization by themselves. "So far, the value creation was in our own hand. This will not stay the case with digitization because we already know that we cannot do it by ourselves" (IP12). Thus, companies look for skills and expertise outside their industries by "trying to hire people from other industries. Especially from digital industries." (IP06). Another option for many companies is networking with other companies for example, IP05 describes the "Digital News Initiative, where we sit together with the big tradition newspapers in Europe. Furthermore, there are many conferences in the digital field or the field of digital strategy. So I believe there is much networking going on [...]". Beyond networking, many companies foster active co-operation and open innovation with other companies, startups, users, universities and research facilities (e.g. IP02, IP05, IP07, IP09, IP14, IP15, IP21) to get access to external expertise and feedback. Second, the underlying market conditions already changed drastically as interactions with customers and other market actors are successively taking place online. In the real world "I walk by a kiosk by accident [...], in the digital world I don't pass by anywhere by accident [...]. There only these two ways actually. The "Google way" or the "Facebook way". Either I am looking for it, or someone recommends it to me. Otherwise, I will not find it" (IP06). Thus, many of the interviewees stated that their companies are closely watching the market developments to position their offerings in a way that customers can find it. Overall, we found strong support for Proposition 1 in the case studies.

Regarding our second proposition (“*Digitization leads to the fusion of process and outcome.*”), 16 out of 27 interviewees mentioned that the fusion of process and outcome is an important phenomenon. “One comes

to the conclusion, especially when you look at our products now [...], we never have projects that start and come to an end because all of our products are maintained and further developed. As a result, we always have this principle of actually having endless projects” (IPO4). This statement made by the chief technical officer of a large financial service institution outlines the third trend emerging from the interviews, which is the continuous merger of process and outcome. The interviews underscored that the successive digitization of formerly analog processes and products renders them editable and malleable (Fichman et al. 2014; Yoo 2010) allowing companies to upgrade and adapt their offers continuously. Therefore, companies quickly release the first version of a product to receive feedback from users and further improve their offerings. For example, IPO6 stated "that you can easily develop faster and more market-driven products, because you go faster with something to the market and quickly notice, whether the market accepts it or not" and IPO2 described how it is possible to quickly test the relevance of ideas by questioning "3000 customers on our advisory board. It's a digital platform. So, if we have an idea, we can get feedback back within a week to see whether it's relevant". Through this process, companies can tailor their offerings to the needs of the customer and add value by digitally engaging with their customer base (Hippel and Katz 2002). To cope with the fusion of process and outcome most of the companies we interviewed introduced some elements of agile management approaches by relinquishing detailed plans and instead relying on fast prototyping. IPO3 described it as follows: "The idea is to develop a concept for us here and to break it into phases, to see what could be the smallest part of this product idea – what could it look like? And to directly produce a relevant customer benefit in order to receive feedback from the customer: Is it already on the right track? [...] Even though the product vision may never be achieved because in between, there will certainly be other impulses [...] that require a change in the plan". In summary, while there are numerous benefits to "release early, release often" approaches (Fitzgerald and Stol 2015) the rapid merger of process and outcome caused by digitization is challenging traditional organizational workflows. Overall, the results of the analysis strongly support Proposition 2.

Our third proposition ("*Digitization leads to shortened innovation cycles.*") is subject of 17 out of 27 interviews. One of the most dominant patterns is that change occurs at a higher pace than in the past. The development of quickly and frequently changing customer needs challenges the established timelines and work processes in companies (Hippel and Katz 2002). The interviewees underscored this notion through numerous statements saying that their companies are confronted with more and faster-occurring change. For example, IPO5 stated that while developing new models and "[...] trying to integrate them into the company, you often realize that you are not able to keep up the pace that the environment dictates". IPO6 added that "[...] the demands placed on us from the outside are increasing and come faster" and noted that things are changing faster than we can understand them. The rapidly changing environment influences how companies structure their processes as they strive to release solutions to quickly emerging user problems and demands. The head of automation and controls (IP12) of a large manufacturing company highlighted the importance of time to market by saying: "[...] you cannot afford to come with a solution four to five years later [...], therefore, we focus on the topic of time to market and are really fast". Furthermore, an innovation manager (IPO2) described the internal changes as: "In the past, it was like, if you had an idea then you had to write a 70 page concept, a business plan and in the business plan you had to write what happens with the product when it comes to the market three years later. Today, nothing can take three years; it can maybe take three months, and you don't need a case anymore, only an assumption. You don't need those 70 pages of concept anymore, one page is enough". In conclusion, the environment in which companies operate is quickly changing and forces companies to adapt established processes to keep up with the dictated speed. Overall, the analysis supports Proposition 3.

Discussion

Our research question is: "*How does digitization affect innovation management in contemporary organizations?*" We identified three main developments – *blurring organizational boundaries*, *fusion of process and outcome*, and *shortened innovation cycles* -, which challenge extant innovation management. In the following, we discuss how organizations can manage change in a digitized environment by understanding these developments.

Blurring External Boundaries – In every single case study, blurring boundaries and the increasing integration of external resources were mentioned. Many companies already established new processes to connect and work with actors and knowledge outside the company. This trend manifests itself for example

in co-operation with other companies (Chesbrough 2003), merger and acquisitions (de Man and Duysters 2005; Hagedoorn and Duysters 2002), the active involvements of users as co-creators (Hippel and Katz 2002) or crowdsourcing (Afuah and Tucci 2012). Thus, innovation management must consider external factors such as external actors and trends as well. In our case studies, the interviewees mentioned the use of key accountants to test prototypes and partnerships with industry partners and research institutes (e.g., IP21).

Fusion of Process and Outcome – Since change is becoming the status quo rather than a rare occurrence (Burnes 2004), organizations are challenged to fuse process and outcome increasingly. Especially the ramifications of digital innovation further fuel this development (e.g., Nambisan et al. 2017). During the analysis of our case studies, the pressure to continually upgrade existing offers was mentioned numerous times. The need for rapid releases and constant improvements was already identified in the context of rapidly-scaling startups (Huang et al. 2017) and appeared to be equally relevant in the context of incumbent companies, as our results demonstrate. Organizations meet this challenge by implementing agile methodologies and by setting up test panels, in which users can provide instant feedback, which is then used to improve the offering further. This level of flexibility is achieved through the inherent characteristics of digital technology such as malleability (Fichman et al. 2014) and the possibility to postpone the concept freezing point until the very end (Henfridsson et al. 2014; Svahn et al. 2017). Thereby, process and outcome are increasingly fusing. Extant research already identified the fusion of process and outcome, however, these insights await empirical testing (Nambisan et al. 2017). There are just very specific case studies (as in the case of Huang et al. 2017, who investigated one rapidly scaling start-up in China). Our findings extend existing insights by analyzing a broader set of incumbent companies from various industries. In our case studies, the interviewees mentioned agile project management (e.g., IPO3), continuous development and rapid releases (IP15) to deal with the fusion of process and outcome.

Shortened innovation cycles - The vast majority of interviewees stated that the massive impact of digitization enforces literally every company to deal with frequent and significant change. This development is strongly supported by the literature (Burnes 2004; Todnem By 2005). Generally, the phenomenon can be explained by building on the insights of Schumpeter (1934 p. 88) who highlighted the importance of "recombination of conceptual and physical materials" for creating innovations. By combining digital and physical components (Yoo et al. 2010) exactly this process is taking place, speeding up the "the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology" (Nambisan et al. 2017 p. 224). Additionally, companies must not only adapt to a quickly changing environment but also have to keep up with quickly changing customer needs and the pressure to serve 'markets of one' – meaning the trend towards more individualization and customization of products (Hippel and Katz 2002). In our case studies, the interviewees mentioned the willingness to change (IP14) and a focus on improving "time-to-market" (IP12) to account for the shortened innovation cycles and higher levels of change overall.

Limitations and Further Research

Our research investigates how managers entrusted with the innovation efforts of incumbent companies are currently dealing with the ramifications of pervasive digitization. As every research endeavor, we must recognize possible limitations of our work. First, our case studies focus on incumbents and therefore, do not allow us to make any statements about, for example, startups. Furthermore, we strive to generalize on the basis of replication as is common practice in a multiple case study approach (e.g., Dibbern et al. 2008; Yin 2011). Hence, our study uncovers multiple fruitful avenues for future research on innovation management. First, future research should consider the increasing influence of external actors and resources, the constant iterations between process and outcome, as well as the shortened innovation cycles and the generally increasing pace of innovation. An important addition to this study would be the application of the findings upon a broader set of data to test their reliability in different settings. Second, future research may focus on uncovering patterns between certain types of companies or settings. This might allow more granular statements about how specific companies or industries deal with digitization. Third, we leveraged the advantages of a qualitative case study approach to identify current developments. Future research might complement our findings by conducting quantitative research. Lastly, while every single case study mentioned blurring external boundaries, it would be interesting to explore why certain companies/industries did not mention the fusion of process and outcome or shortened innovation cycles.

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