

BEYOND THE FAST LANE NARRATIVE – A TEMPORAL PERSPECTIVE ON THE UNFOLDING OF DIGITAL INNOVATION IN DIGITAL INNOVATION UNITS

Research Paper

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Abstract

To develop and implement digital innovations many incumbent companies have set up digital innovation units (DIUs) primarily as part of their digital transformation journey. Despite a steadily growing body of knowledge, however, extant literature is in a nascent stage to explain the unfolding of digital innovations in such units. Drawing on empirical data from a multiple case study we adopt a temporal perspective to contribute to a better understanding of digital innovation in DIUs. To do so, we studied the DIUs of five manufacturing companies and were able to identify several other temporal aspects besides speed that influence or result from DIU's digital innovation activities. We generalize our findings in the form of five propositions that depict the special role of time to inform extant literature.

Keywords: Digital innovation units, digital innovation, manufacturing industry, temporal perspective.

1 Introduction

The clock is ticking. At least that is what it feels like for companies today as they operate in rapidly changing market environments triggered and driven by the use of digital technologies (Agarwal et al., 2010; Majchrzak, Markus and Wareham, 2016). This phenomenon referred to as digital transformation gained increasing importance in both information systems research (Bharadwaj et al., 2013; Piccinini, Gregory and Kolbe, 2015) and practice (Westerman et al. 2011) over the last decade. Digital technologies often change the core of businesses (Bharadwaj et al., 2013) and have very distinctive characteristics with important implications for companies' innovation management practices (Fichman, Dos Santos and Zheng, 2014). Especially pre-digital organizations – those “belonging to traditional industries [...] that were financially successful in the pre-digital economy” (Chanas, Myers and Hess, 2019) – are challenged by the need to quickly and continuously integrate digital technologies into products, processes, and business models to successfully develop and implement digital innovation (Fichman et al., 2014). Unlike born-digital companies (e.g., Google, Amazon, or Facebook) they often have to change their entire business model, processes, and organizational structure for this purpose and have therefore tried to do so by setting up so-called digital innovation units (DIU) (Bharadwaj et al., 2013; Sebastian et al., 2017; Tumbas, Berente and vom Brocke, 2017; Holotiuk and Beimborn, 2019; Barthel et al., 2020; Raabe et al., 2020a). DIUs are (often) separated from the firm's remaining organization (e.g., in terms of location, mindset, collaboration, communication, etc.) and bundle their

exploration efforts and knowledge-based work to foster digital innovation (Holotiuk and Beimborn, 2019). These digital innovation “fast lanes” as they are regularly referred to (Hellmich, Raabe and Schirmer, 2021; Raabe et al., 2021) are a booming topic in practice especially in the last five years – 60% of German DIUs have been established since 2016 (Sindemann, Lau and Münch, 2020) – as well as a topic of growing interest in information systems research (Fuchs et al., 2019; Barthel et al., 2020; Göbeler, Schaar and Hukal, 2020; Raabe et al., 2020b). Naturally, the approach does not come without challenges as both a recent paper by Raabe et al. (2020b) and an increasing number of negative headlines in the press about the failure, dissolution (Hässig, 2020), or sale (Tödtmann, 2020) of DIUs show. However, as these units are one of the key initiatives of incumbents’ digital transformation efforts (Matt, Hess and Benlian, 2015; Wiesböck and Hess, 2019; Jöhnk et al., 2020; Meyer-Blankart, 2020) and are expected to drive the development of digital innovation on the basis of digital technologies (Holotiuk and Beimborn, 2019; Barthel et al., 2020; Raabe et al., 2020b), it is even more important to better understand how DIUs alter and create incumbents’ digital innovation practices.

In this context, there is a growing call for more in-depth analysis on DIUs, as most existing case studies are cross-industry and cannot take into account any industry-specific circumstances (Barthel et al., 2020; Hellmich, Raabe and Schirmer, 2021; Raabe et al., 2021). Fuchs et al. (2019) for example, have identified the manufacturing industry as particularly relevant for DIU research, as they are typically slow to respond to the impact of digital transformation, but are now increasingly setting up such units. These companies are permanently challenged between maintaining the traditional business – building large, physical machines and plants – and meeting the demands of the digital age in parallel (Hylving and Selander, 2012). Product development and production are characterized by robust time frames of up to 10 years (Dremel and Herterich, 2016), while, at the same time, time and speed seem to play a central role in the development of digital innovation (Gerster et al. 2020), for example, as the use of the fast lane narrative for DIUs shows. Our research aims to identify these and other temporal tensions and influences in order to deepen the knowledge of manufacturing DIUs in information systems research, especially with respect to the unfolding of digital innovations. To this end, we adopt a temporal perspective to better understand the temporal role of digital innovation and its interplay with DIUs and seek to answer the following research question:

RQ: How does digital innovation as a form of value creation unfold in manufacturing companies’ DIUs from a temporal perspective?

The paper is structured as follows: First, we introduce the relevant theoretical background including the current state of DIU research as well as the temporal perspective, which we used as an inspiration for the data analysis. Second, we explain the process for data gathering from five different DIUs in the manufacturing industry and how we analyzed the qualitative interview data. Third, our results are presented in the form of five propositions on the unfolding of digital innovation in manufacturing DIUs from a temporal perspective including a graphical presentation of the relationships. Fourth, we summarize and discuss these results with the argument to move beyond the digital innovation fast lane narrative for DIUs and rather see them as an additional lane for value creation and business-model innovation in the course of digital transformation of manufacturing companies.

2 Theoretical Background

2.1 Current Body of Knowledge on Digital Innovation Units

Incumbent firms strive for becoming “digital” or more specifically for creating value in the form of digital product, service, process, or business model innovations in order to remain successful in today’s rapidly changing business environment (Fichman, Dos Santos and Zheng, 2014; Nambisan et al., 2017). As value creation in the digital realm has changed considerably compared to the non-digital era (Yoo, Henfridsson and Lyytinen, 2010), companies began to establish DIUs to enhance and accelerate their digital innovation activities (Fuchs et al., 2019; Holotiuk and Beimborn, 2019; Raabe et al., 2021). DIUs bundle a company’s exploration efforts to promote digital innovation and are often separated from the main organization in terms of location, mindset, collaboration, and communication (Holotiuk and

Beimborn, 2019). At the same time, they still remain “connected through the transfer of knowledge, exchange mechanisms, and people moving between the new and ‘old’ units” (Holotiuk and Beimborn, 2019, p. 2). DIUs can be characterized by high degrees of freedom, interdisciplinary teams (permanent employees, employees from the main organization, and external partners), a fully explorative and agile way of working even across company boundaries, participation in all digital innovation management levels, and the function as an enabler for the integration of digital innovation into the main organization (Fuchs et al., 2019; Holotiuk and Beimborn, 2019; Raabe et al., 2020b). Their reduced socio-technical organizational complexity helps these units to scale the development of digital innovation, which makes them very valuable especially for pre-digital companies (Yoo, Henfridsson and Lyytinen, 2010; Arvidsson and Mønsted, 2018) those belonging to traditional industries such as retail, manufacturing, automotive, or financial services (Chanias, Myers and Hess, 2019). For this paper, we follow Barthel et al. (2020, p.5) and define DIUs as “organizational units with the overall goal to foster organizational digital transformation by performing digital innovation activities for existing and novel business areas”. With regards to the concept of digital innovation we apply Nambisan et al.’s (2017, p.224) definition and view digital innovation “as the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology”.

Research on DIUs and their role in digital innovation of non-digital natives has been steadily increasing over the last two to three years, as evidenced by the growing number of publications, especially in the field of information systems research (Fuchs et al., 2019; Holotiuk and Beimborn, 2019; Barthel et al., 2020; Göbeler, Schaar and Hukal, 2020; Raabe et al., 2020a). The theoretical angles and lenses they are viewed from are manifold such as analyzing DIUs in the context of a company’s (IT) ambidexterity (Holotiuk and Beimborn, 2019; Holotiuk, 2020; Jöhnk et al., 2020), their role in a bimodal IT setup (Raabe et al., 2020a), applying a loose-tight coupling lens (Barthel et al., 2020), a dynamic capabilities lens (Hellmich, Raabe and Schirmer, 2021), as well as taking a performance management perspective (Haskamp et al., 2021). What most research to date has in common, however, is the understanding of a DIU as a kind of “fast lane” of innovation, which creates the essential conditions for the development and implementation of digital innovation through high speed, flexibility, and agility (Fuchs et al., 2019; Raabe et al., 2020a, 2021; Hellmich, Raabe and Schirmer, 2021; Holsten et al., 2021). Especially in the context of a bimodal IT setup, the narrative of the “digital innovation fast lane” (Raabe et al., 2021, p. 9) is dominant, as a DIU is seen as a possible manifestation of the “fast-IT” mode - also called “digital-IT” or “agile-IT” (Horlach, Drews and Schirmer, 2016). In this context, aspects of the temporal work structures of DIUs are already touched upon, but not addressed in greater depth (Raabe et al., 2020a). For instance, the influence of temporal aspects on digital innovations can also be found in a contribution by Holotiuk and Beimborn (2019), who derive the concept of temporal ambidexterity with the inclusion of DIUs. DIUs take on the role of the exploration unit, where people from the main organization are transferred for a certain period of time to work full-time on the exploration of digital innovations (Holotiuk and Beimborn, 2019). In this context, however, there is no special consideration of the temporal peculiarities within the DIU and the interconnection of DIU and main organizations. Specifically, the manufacturing industry is particularly interesting in terms of temporal aspects, as manufacturing companies are generally slow to react to the implications of digital transformation, as their mostly non-digital business models are not yet threatened (Hanelt et al., 2015; Fuchs et al., 2019). Further, scholars call for a better understanding of the unfolding of new organizational structures, such as DIUs, their work routines and characteristics (Fuchs et al., 2019; Wiesböck and Hess, 2019; Holotiuk, 2020). Therefore, we take this as an opportunity for specific consideration of the unfolding of digital innovation in manufacturing DIUs from a temporal perspective.

2.2 Temporal Perspective

Current information systems research on DIUs is dominated by implicitly focusing on time through the emphasis on speed, for instance, the “slow-” and “fast-IT”, with their respective slow and fast speed of service delivery and the goal of “fast-IT” regarding agility and speed (Horlach, Drews and Schirmer, 2016). However, time has notably more dimensions and categories to consider, as demonstrated by the research of Ancona, Okhuysen, and Perlow (2001) as well as recent publications (e.g., Mousavi Baygi,

Introna, and Hultin 2021, Gerster et al. 2021; Conboy, Dennehy, and O’Connor 2020) in the field of information systems. All advocate using time as a research lens (Ancona, Okhuysen, and Perlow, 2001) and moving from an actor-centered orientation to a flow-oriented approach and vocabulary when studying socio-technical transformation in the digital world (Mousavi Baygi, Introna, and Hultin, 2021). The Ancona, Okhuysen, and Perlow (2001) temporal framework includes different categories of time – namely *conceptions of time*, *mapping activities to time*, *actors relating to time*, and *category spanning variables* – and serves as a guide for researchers that intend to integrate a temporal perspective with the goal of better understanding and explaining organizational behavior (Ancona et al., 2001; Ancona, Okhuysen and Perlow, 2001). Tempo or speed is only one of several variables taken into account, as the lens also includes aspects such as “timing, [...] cycles, rhythms, flow, temporal orientation, and the cultural meanings of time” (Ancona et al., 2001, p. 646). With the help of this approach and its additional (temporal) dimensions, the possibility opens up to better understand DIUs, their ways of working, and their capability to create digital innovation. We specifically focus on the temporal categories *mapping activities to time* and *actors relating to time* – illustrated in Figure 1 – because the former “directly links the work of organizations, though activities, to the temporal continuum” (Ancona, Okhuysen and Perlow, 2001, p. 524) and allows us a closer look into activities with regards to the unfolding of digital innovation. The latter – with the subcategories *temporal perception* and *temporal personality* – opens the opportunity to integrate the DIU’s and/or DIU employees’ relation to time and to identify a potential temporal style of manufacturing DIUs. Since *conceptions of time* strongly depends on geographical and cultural backgrounds – in Western society, for example, clock time is the most common way to describe the continuum of time – and our five companies under consideration hardly differ in this respect, we have refrained from analyzing this category separately, since we do not expect any great progress in knowledge (Ancona, Okhuysen and Perlow, 2001, p. 524). This also renders the consideration of *category spanning variables* obsolete, which is why we also do not focus on this category in the course of this paper.

Furthermore, Ancona, Okhuysen and Perlow (2001) argue for “designing an organization based on [three] ‘temporal zones’” (Ancona, Okhuysen and Perlow, 2001, p. 525). These zones each include activities that share the same temporal parameters of e.g., speed/tempo, cycle, and time horizon. Following this rationale, and with regards to the previous introduction of DIUs as “fast-IT” in a bimodal IT setup, DIUs can be understood as the fast-paced, short-term, short-cycle temporal zone with a culture of speed that “should be made up of employees with a high sense of time urgency, a present time orientation, and a short-term time horizon” (Ancona, Okhuysen and Perlow, 2001, p. 525). Accordingly, the second and third time zones are located in the main organization, have a medium- and long-term time frame, and are more future-oriented (Ancona, Okhuysen and Perlow, 2001). With this approach, we can look beyond the focus on IT – “fast” and “slow” or “traditional” and “agile” IT – in a bimodal setup and aim for a more comprehensive approach to organizational design. The resulting implications for DIUs as well as their value creation in the form of digital innovations have not yet been investigated.

Category	Subcategory	Sample Variables
Mapping activities to time	• Single activity mapping	• Scheduling, rate of completion, duration
	• Repeated activity mapping	• Cycle, rhythm, frequency, interval
	• Single activity transformation mapping	• Life cycles, midpoint transitions, jolts, interrupts, deadline behavior
	• Multiple activity mapping	• Relocation of activities, allocation of time, ordering, synchronizations
Actors relating to time	• Temporal perception	• Experience of time, time passing, time dragging, experience of duration, experience of novelty
	• Temporal personality	• Temporal orientation, temporal style

Figure 1. Temporal Framework based on Ancona, Okhuysen and Perlow (2001).

3 Methodology

3.1 Research Design and Data Collection

As we try to answer a “how” research question we decided on an explanatory, interpretive case study that is particularly suitable for investigating a contemporary phenomenon within its real-world context (Yin, 2018). Between January and July 2021, we conducted a total number of 30 interviews with five DIUs of manufacturing companies in Germany and Switzerland to gain deeper insight into the unfolding of digital innovation from a temporal perspective. The multiple-case design was chosen to increase the robustness of the study and to allow cross-case analysis (Yin, 2018). We searched – using a literal replication logic – for manufacturing companies that implemented a DIU as part of their organizational digital transformation and to drive their digital innovation efforts (Yin, 2018). All five companies are non-digital-native from the manufacturing industry – machine and plant engineering as well as systems for the production of raw materials – with a business-to-business focus, were founded at least 50 years ago and have more than 2,000 employees today. At this age and size, we assume a high level of complexity in terms of existing structures and (IT) systems as well as non-agile processes within the organization, which is in clear contrast to a DIU, its tasks, and workflows. The DIUs themselves all have a core business-related mandate, are of similar age and their operations go beyond their conceptualization (Yin, 2018). All five focus on innovation “around the machine”, i.e., digital products and services that complement and enlarge the existing business – such as remote support or predictive maintenance solutions, and building e-commerce platforms for spare parts – and are to build a digital innovation ecosystem consisting of diverse internal and external partners. All except DIU4 also play an essential role in the digital transformation of the parent company. For DIU4, this is currently a secondary goal; it is intended to achieve spin-off companies – similar to a company builder – that become independent but 100% subsidiaries of the main organization. To obtain a realistic picture and understanding of the respective DIU, we interviewed people with various roles and hierarchical levels within the DIU as well as at least one representative from the main company for each case (e.g., CEO, CDIO, COO, Director Digital Transformation, Head of Innovation, Innovation Manager, Product Owner, etc.). In this way, we have the opportunity to better understand the operations and peculiarities of DIUs in the manufacturing industry than a multiple-case study across different industries is able to do. The interviews all took place via video call, lasted an average of 59 minutes, and were tape-recorded and transcribed. Furthermore, we gathered secondary data for the data triangulation including information from company websites, press releases and internal documents (e.g., management reports, and presentations).

ID	DIU Size	Founded in	Legal Entity	Main Org. Size	# of interviews	Interviewee Positions (# of interviews, if >1)
DIU1	7	2020	No	> 2,500	6	CDIO (main organization) (2) & Head of DIU, Director Global IT Governance and Digital Transformation (main organization & DIU), Digital Ambassador, Consulting Manager (2)
DIU2	60	2018	Yes*	> 11,000	7	COO and Head of Digital Innovation & Data Science (2), Head of Data Science, Product Owner, Head of Data Integrations & Digital Innovation (main organization) & Head of Application Development & Platforms (DIU), Innovation Manager, Global Head of Sales & Marketing (main organization) & Managing Director DIU
DIU3	40	2018	Yes	≈ 35,000	6	Director Digital Transformation, Principal & Interim Head of Digital Customer Interaction DIU, Head of Digital Excellence

						DIU & Digital Head - Central Europe (main organization), Head of Technology & Architecture, Product Manager, Product Portfolio Manager
DIU4	130	2018	Yes	≈ 10,000	6	CEO & Managing Director DIU, Head of Innovation, Digital Ideation and Innovation Manager (main organization), Product Design and Strategic Innovation, Senior Venture Architect, Digital Project Lead
DIU5	25	2019	No	> 10,000	5	Head of Operations, Global Head of DIU, Senior Program Manager Digital Sales, Program Manager Operations, COO (main organization)
Total					30	

Table 1. Case Overview.

*Shortly after the interviews the legal entity was given up

3.2 Data Analysis

As we decided on a qualitative and interpretive research approach while following well-established guidelines (Gioia, Corley and Hamilton, 2013), we consequently worked with a semi-structured interview guide to obtain both retrospective and real-time accounts by those experiencing the phenomenon of creating digital innovation within a DIU from a temporal perspective. The interview guide contained both more general questions about the role of time for a DIU and its innovation process, and more specific questions about the temporal structure or perception of it, and how they differ from the main organization. The interviews were collected, stored, and analyzed using the computer-supported qualitative data analysis tool ATLAS.ti. For the analysis, we started by creating first-order codes from the transcripts while trying to “adhere faithfully to informant terms” as suggested by (Gioia, Corley and Hamilton, 2013, p.20). This resulted consequently in 347 first-order codes which emerged from our first coding step which resembled an open coding step (Strauss and Corbin, 1998; Gioia, Corley and Hamilton, 2013). Based on our comprehensive compendium of first-order codes we distilled our second-order codes (58 in total) and aggregated dimensions according to (Gioia, Corley and Hamilton, 2013) approach. Therefore, our temporal research lens guided us in this step, allowing us to specify theoretical dimensions. The initial first- and second-order coding was hereby undertaken by the first author followed by a discussion and validation within the authoring team. The same procedure was applied to the creation of the aggregated dimensions leading to the resulting coding table. For the sake of clarity, Figure 2 does not show the entire list of first-order codes, but only selected examples.

In the course of a discussion within the authoring team, we decided on 13 particularly interesting and relevant second-order codes by applying the following three criteria. First, each code needed to have a direct connection to the perception and role of time in the context of the DIU. Second, in light of our review of the extant body of knowledge we aimed for including only novel themes and findings. Third, each code should have the explanatory power to explain the peculiar role of time for DIUs’ digital innovation practices. Based on this selection of our second-order codes, we developed five aggregated dimensions (see Figure 2). Each of the aggregate dimensions is grounded in the statements from at least three different DIUs to ensure that they provide the necessary foundation for the findings that build upon them.

Based on the data structure and with a “focus on our ultimate goal of building a vibrant inductive model that is grounded in the data” (Gioia, Corley and Hamilton, 2013, p22) we incorporated our background knowledge of theories related to digital innovation, DIU and time – with particular influence from the temporal framework of Ancona, Okhuysen and Perlow (2001) – and derived five propositions from the aggregated dimension, which are explained in detail in the next section.

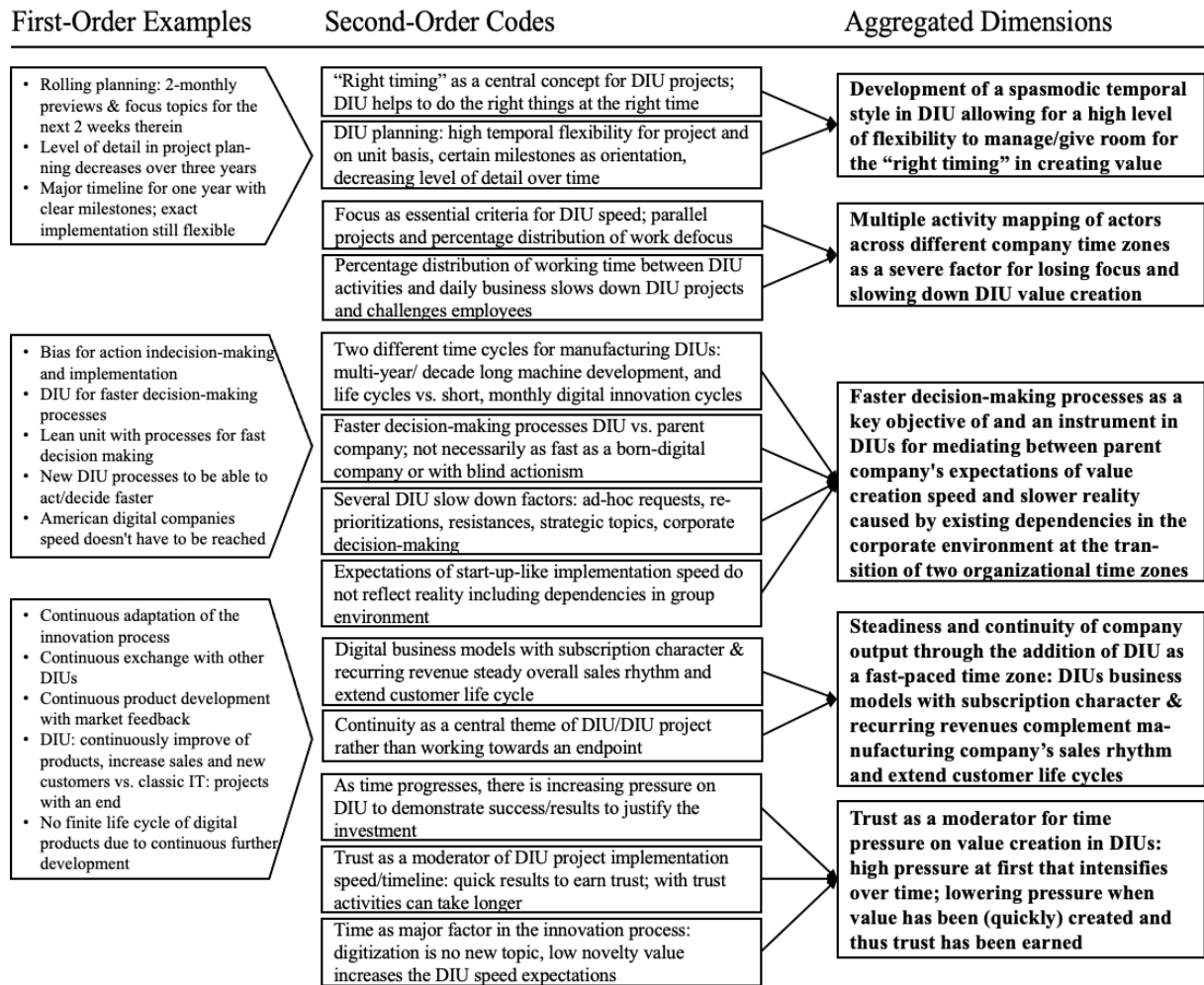


Figure 2. Selected Illustrative Excerpt of Data Structure

4 Results

In the following, we present the role of time on DIU value creation by illustrating five key themes and their links to digital innovation practices in DIUs. Generalizing our findings further, we developed five propositions to inform future research following the suggestions of Gioia, Corley and Hamilton (2013). The aggregated dimensions – 1) Spasmodic temporal style allowing flexibility and “the right timing”, 2) Multiple activity mapping leads to loss of focus and speed, 3) Faster DIU decision making; objective and mediator between speed expectations and reality, 4) Steadiness of company output through DIU business models with subscription character and recurring revenues, 5) Trust as a moderator for the intensity of time pressure on DIU value creation – informed the development of these propositions and are used as a structuring element for our result section. As a side note: The quotations we present in the course of deriving the propositions are only illustrative examples of the particular topic to make our thought processes more tangible. Figure 3 provides a graphical summary of our results.

Spasmodic temporal style allowing flexibility and “the right timing”. “I don't even know if time is the primary variable. [...] I think flexibility and freedom, those are perhaps the even more important variables”, was the answer of one interviewee in DIU5 to the question on the role of time for the DIU and its innovation process. The fact that these aspects are by no means mutually exclusive and can even be brought into direct connection can be seen in the time category *actors relating to time*. In the course of their introduction of this category, Ancona, Okhuysen and Perlow (2001) specifically give the example of the so-called *spasmodic style*, a temporal style that might be adopted by “an organization in a more unpredictable industry [...], recognizing that the past is not tightly linked to the future. In a

spasmodic style, managers influence the pace of change to make it faster or slower through innovation, which provides freedom for a broader range of action” (Ancona, Okhuysen and Perlow, 2001, p. 519). It stays in contrast to a *clock time temporal style* that might be adopted by “an organization in a slow-moving and predictable industry [...] in which the history of the organization is well understood and the linkage between the past and the future is clear” (Ancona, Okhuysen and Perlow, 2001, p. 519). Both temporal styles are variables of the subcategory *temporal personality* “the characteristic way in which an actor perceives, interprets, uses, allocates, or otherwise interacts with time” (Ancona, Okhuysen and Perlow, 2001, p. 519; Sherman, 2001). The spasmodic style very much resonates with the setup of a DIU as an environment that is supposed to create the conditions for digital innovation (Fuchs et al., 2019). This is reflected above all in workflows and planning horizons in the innovation process of a DIU, which is strongly geared toward flexibility – especially in terms of time. Planning is mostly driven by content, for example in the form of the market launch of a minimum viable product on a fixed date. Starting from this milestone, the smaller-scale planning is usually carried out on a rolling scale, within a SCRUM logic on a quarterly basis and within this on the basis of a two-weekly sprint. The degree of detail in planning thus decreases over time, which also applies beyond the innovation process to the planning horizons of DIU as a whole. On a one-year basis, the goals are formulated quite clearly and typically become increasingly unspecific over the subsequent two to three years with only a few milestones for orientation. In this way, DIU creates sufficient room for flexibility within its processes and can react much better to customer feedback, environmental influences, etc., and incorporate them consistently into planning. This flexibility and freedom and especially the constant exchange with and feedback from the customer within the innovation process help the DIU in finding the “right timing” for e.g., a market entry, further investments in a specific product or service, or rather for value creation in general as expressed by an interviewee in DIU3: “*And then you can see that if we do this planning, then you have to support it accordingly because then our products are also placed there accordingly. So, there is a lot of communication with the different customer groups, I would say. That simply helps us to do the right thing at the right time.*” Another person from DIU3 attributes an even more essential role to the unit in terms of “right timing” and sees this capability as an important addition to the main organization’s skillset in terms of value generation, beyond the innovation process: “*But in the meantime, and especially in the constellation with [DIU3] [...], we have made it our mission to develop things in the right order, centered on the user. [...] And this should ensure that we don’t take the third step before the first and also address the issues that are the most important from the customer’s perspective. And I believe that this is a capability that [DIU3] [...] has had for a long time and that is good for the core organization because I don’t think they have it there.*” The adopted spasmodic temporal style and human-centeredness of the DIU allow for the necessary flexibility and freedom in developing and implementing digital innovation and complementing the clock time temporal style of the mother company leading to an improved way of creating value for the organization as a whole thereby harvesting the capability of the “right timing”. Time, timing, flexibility, and freedom are closely intertwined and interdependent in relation to DIUs, making a DIU an important additional source of value generation for manufacturing companies. This leads to Proposition 1; illustrated with arrow 1 in Figure 3: *By adopting a spasmodic temporal style DIUs create the necessary flexibility and space to sense the “right timing” required for the development and implementation of digital innovations, thus becoming an essential, additional source of value creation.*

Multiple activity mapping leads to loss of focus and thus speed. In all five cases, employees of DIU project teams were faced with the challenge of *multiple activity mapping* across different temporal zones of the organization. In contrast to earlier findings, for example, in a cross-industry case study by Holotiuik and Beimborn (2019, p.10) that “[p]eople are moving on a temporary basis between the [DIU] and their ‘home base’ unit which allows them to focus full-time on exploration in the [DIU] (usually two to four months a year) and on exploitation in their ‘home base’ during the respective time periods.” the interviewees in our cases had to divide their working time on a daily/weekly basis either between several DIU projects and/or between DIU projects and their daily business tasks for the main organization. A quote from DIU1 exemplifies the matter: “*Another challenge-, I would say-, the biggest one is the daily business. The workload. It’s a reality that none of us [...] [has] fifty percent time. So, we*

ha[ve] to find time. But there's also a day-to-day. [...] That means there is this balance to be found between new tasks in the [DIU]. But there is a[n existing] world, and it has to go on. That's this workload". With this percentage distribution within the same time frame, the danger of losing focus quickly arises, potentially slowing down value creation in the DIU. In addition, employees involved in both DIU projects and the day-to-day operations of the main organization must divide their time capacities between two different temporal zones. On the one hand, there is the DIU, the fast-paced, short-term, short-cycle organizational temporal zone with a culture of speed; on the other hand, there is the main organization with medium- and longer-term time horizons. Employees who operate in both temporal zones "simultaneously" face the need to constantly adapt to their respective paces, cycles, and time horizons, which actually requires some form of temporal coordination mechanisms, as "[t]here are many examples of executives who, in moving from a division in a stable industry to a more dynamic one, find themselves unable to keep pace" (Ancona, Okhuysen and Perlow, 2001, p. 526). So far, such mechanisms are not yet in place as an example quote from DIU4 shows: "Last year, we staffed the teams in such a way that we said, okay, we need 60 percent a product manager. We need 40 percent a designer [...] and so on. And with these percentages, that just doesn't work, [...] or didn't work for us, because the team just becomes incredibly slow when they're still doing their daily business on the side. And that's where we are now or are currently in a bit of a struggle, to say, okay, we'd rather have a small team, we don't need five people, we'd rather have two or three people who can work full time. Because that leads to focus." What the quote also shows, however, is that instead of developing such temporal coordination mechanisms, current solutions seek to avoid splitting working time between DIU and the main organization and thus being involved in two time zones at the same time, in order to decrease defocus and slow-down of DIU activities. Focus, therefore, obviously plays a central role in creating value in DIUs and requires a sufficient investment of working time on an individual and team level. With this finding, we confirm the validity of the existing body of knowledge from (innovation) project management on the relevance of time investment to ensure focus (see e.g., Kerzner, 2019) for DIU in the manufacturing industry. However, as the five companies we considered (still) engage in *multiple activity mapping* across different temporal zones within the same time frame despite the existing knowledge and also contrary to the observations from previous DIU research (Holotiuk and Beimborn, 2019), we would like to emphasize once again the high relevance of focus – also with regard to the unfolding of digital innovations in DIUs. This leads us to Proposition 2; also illustrated with arrow 2 in Figure 3: *To ensure sufficient focus and thus facilitate DIU value creation, a division of employees' time capacities on a daily or weekly basis - especially between DIU and main organization - should be avoided.*

Faster DIU decision making; objective and mediator between speed expectations and reality. As mentioned in the course of the execution of Proposition 2, DIUs and their main organizations are two complementary temporal zones within the context of the organization as a whole. On the one hand, is the fast-paced, short-term, short-cycle DIU with a culture of speed. On the other hand, is the main organization with medium- and longer-term time horizons. However, in the case of the five DIUs studied in manufacturing companies, we found strong DIU dependencies on the main organization that go beyond the challenge of *multiple activity mapping* of employees across temporal zones as described above. Since all five DIUs focus their digital innovation activities strongly on the main organization's products – all of them operate close to the core business – and develop digital innovation "around the machine" the innovation teams are heavily dependent on the expertise and customer access of the main organization. In addition, there are ad-hoc requests to the DIU, expectations of strategic planning, resistance from other business units towards the DIU, postponement of meetings, etc., which makes it difficult to meet the expectations of the main organization regarding a high implementation speed. Since these dependencies are well known and are also desired or have to be accepted due to the core business-related mission, statements are found in all five cases that a DIU is seen primarily as an agile, lean, decision-friendly unit with noticeably faster decision-making processes than in the main organization: "[...] there is, so to speak, a need for action and a field of action that we definitely take care of and where we then also frequently ensure that quick decisions are made. In other words, as quickly as is necessary for such digital topics." (Head of Operations DIU5). "In theory, the DIU should be faster. I

mean, there are many reasons why we have set up this DIU. [...] And one of those reasons-, many others-, but one of those reasons is to work outside of the official processes. That doesn't mean with the same decision-making process, like all the other processes. Because those are usually very slow." (Director Global IT Governance and Digital Transformation DIU 1). Faster decision-making processes thus become a key objective of DIUs on a process side and, at the same time, an instrument for mediating between the main organization's high expectations of value creation speed and the slower reality caused by dependencies in the corporate environment at the transition of two organizational time zones. This leads us to Proposition 3; illustrated with arrow 3 in Figure 3: *DIUs in high-dependency environments should - in regard to speed - primarily strive for fast decision-making processes in order to meet the high expectations of the main organizations regarding the speed of implementation.*

Steadiness of company output through DIU business models with subscription character and recurring revenues. Due to our focus on DIUs in the manufacturing industry, with its classic machine sell-off and long sales cycles, we also gained some more industry-specific insights when looking at temporality. By creating a DIU, manufacturing companies are able to alter their entire sales and customer life cycle as the newly created digital services around/in addition to the machines – such as online stores for spare parts, predictive maintenance services, or remote assistant solutions – give rise to entirely new business models for the main organization. Since these services are usually offered as part of a subscription model with recurring revenues, they complement the main company's existing sales cycles, mitigating the traditionally strong peaks on the machine sales timeline and resulting in a more consistent revenue stream for the company overall: “[I]f you sell plants or machinery in a classic way, it's a transactional business with [...] a large deal size. You sell it [to someone] for three million [...] [it] lasts 15 years and then maybe after ten years he buys a new machine. That means [...], on the timeline you have huge peaks [...] and that has to be made permanent [...] so that it becomes a continuous business. And that is the core of the [...] [DIU2]: Finding new business models that don't have this transactional character, but that have a subscription character [...] so basically recurrent revenues.” DIU2. Furthermore, the potential to extend the customer life cycle arises as e.g., spare parts are purchased over the DIU's online shop rather than a different supplier. Such benefits can also be created by DIUs for other industries with similar business models, such as the construction and real estate industry or, to a somewhat lesser extent, in the automotive industry or in the sale of major household appliances. Apart from creating these more consistent revenues, DIU activities are generally dominated by continuity. Their agile ways of working come with continuous improvement of their products or services rather than doing projects with a specific endpoint – compared, for example, to the core IT of the main organization – as one of the interviewees in DIU5 expressed: “[W]e want to work in an agile way, and actually we want to continuously improve a product, continuously gain more revenue and more customers, and not do any projects that have an end. For me, that's also kind of the core difference between classic IT and what we do.” This leads us to Proposition 4; illustrated with arrow 4 in Figure 3: *In DIUs, new business models with subscription character and recurring revenues are created that complement the sales rhythm of manufacturing companies and thereby steady the overall business performance as well as extend customer life cycles.*

Trust as a moderator for the intensity of time pressure on DIU value creation. Last, we identified trust as a central topic for DIUs in the form of trust being a moderator for time pressure on value creation. Since DIUs are set up as the fast-paced temporal zone of an organization, that higher speed is expected accordingly leading to high time pressure on value creation. The more time that passes without substantial results, the greater the pressure becomes, which is why one of the DIU's most important goals is to achieve initial results quickly as one DIU4 interview partner expressed: “I think that's the most important thing for everyone, to generate a quick win as soon as possible that has a relevant success. Where people can say, a statement like that, that works, they know what they're doing. And that's very successful. And that is, I think, the most important thing. And if you don't manage to do that in a certain amount of time, then I think you've lost.” If these results can be demonstrated i.e., value has been created, the DIU increasingly gains the main company's trust and acceptance which is expressed by the arrow 5a in Figure 3. With increasing trust, the time pressure on DIU value creation does not increase further or even decreases, allowing some projects to take longer than originally planned: “We

still have a bit of a leap of faith that if you say, ‘okay, this is complicated now’ or ‘it’s going to take longer’, that’s fine” DIU5. Arrow 5b in Figure 3 is to express this relationship. This circumstance makes it clear that DIUs are certainly set up to quickly produce (initial) results in the form of digital innovation, but that the core issue is value generation per se and not speed in the first instance. The latter, in the form of higher decision-making and implementation speed compared to the main organization, is to be seen more as a means to an end in order to be able to generate digital innovation, which requires a fast, cyclical, iterative way of working and no waterfall project planning. These findings are hereby independent of the personnel responsible for the DIU, as the heads of DIU1, DIU2, and DIU5 are all well-known and respected individuals who had previously been employed by the main organization for several years, whereas the current lead of DIU3 was hired specifically for the topic of digital transformation and the lead of DIU4 had only been with the company for a very short time before becoming the head of DIU. However, no differences in expectations of the DIU could be identified in the cases under consideration. Trust thus plays a central role with regard to time pressure on DIU value creation as increasing trust reduces time pressure to some extent. This leads to Proposition 5; illustrated with arrows 5a and 5b in Figure 3: *Earning the main organization’s trust is a central goal for DIUs as it moderates the intensity of time pressure on creating digital innovation. Initially, time pressure is high and increases over time in the absence of value creation 5a). Through (rapid) value creation, trust builds up vis-à-vis, which keeps the time pressure stable or also reduces it 5b).*

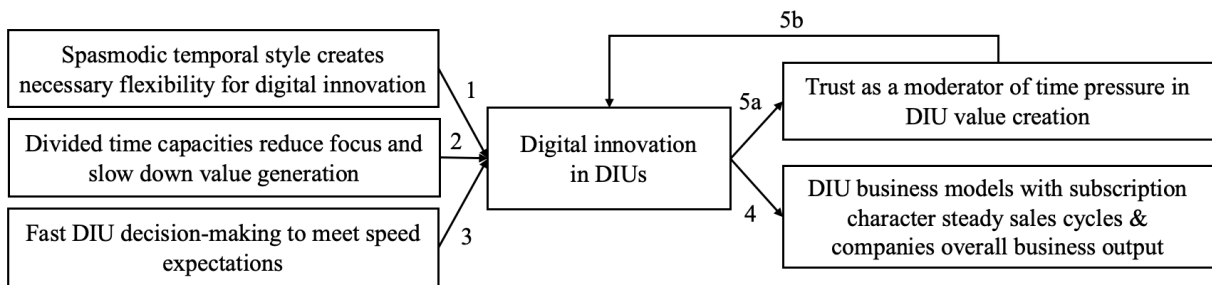


Figure 3. Temporal influences on and by DIU value creation.

Looking at Figure 3 and the five propositions presented, we get a first impression of the complex construct of the interconnectedness of time and the emergence of digital innovation in DIUs. Time in the sense of speed, in the sense of a ticking clock, certainly plays a role as Proposition 3 and 5 show, but to a greater extent than the digital innovation, fast lane narrative suggests. We see specific types of speed in the form of rapid decision-making processes as well as speed as a means to an end for other aspects in digital innovation development such as trust, which can be embedded in the broader picture of organizational time zones. In addition, we see temporal aspects related to DIU value creation in Proposition 1, 2, and 4 that cannot (directly) be attributed to speed. They address other temporal variables such as allocation of time (belonging to subcategory *multiple activity mapping*), temporal style (belonging to subcategory *temporal personality*) or cycle and rhythm (belonging to subcategory *repeated activity mapping*), and influence or are influenced by the unfolding of digital innovation.

5 Discussion

5.1 Beyond the fast lane narrative

Based on our findings, we argue that DIUs should no longer be considered just a fast lane, but an additional lane for the development of digital innovation and digital business models embedded in the larger context of different organizational temporal zones and peculiarities – at least or especially in the context of manufacturing. We see them as the fast-paced, short-term, short-cycle temporal zone – also moving beyond an IT focus – with time in the sense of speed only being one part and means to an end for DIU value creation. Speed of course still plays an essential role in the unfolding of digital innovation but so do focus, flexibility, trust, and steadiness. Particularly because manufacturing DIUs operate close to the core business with their digital innovation activities, additional circumstances with regard to time

or speed must be taken into consideration. For example, focus depends on the individual time investment and time allocation of multiple activities by employees, which in turn influences the speed of implementation of value creation within the DIU. Trust in the DIU, as seen in Proposition 5, comes from (quick) value creation, which in turn potentially decreases time pressure. Since speed and other (temporal) aspects are thus obviously interdependent, a sole consideration of speed would be too one-dimensional. Furthermore, the question arises whether the narrative of a constantly ticking clock is even beneficial, because the designation of a “digital innovation fast lane” creates certain expectations and, as we see in Proposition 2, flexibility is also crucial, which is why unnecessary time pressure can be counterproductive. Our findings suggest that the main objective should be to create the conditions for higher implementation speed with the aim of developing digital innovation. Essential to this, according to our research, are focus, room for flexibility, and the “right timing”, as well as efficient decision-making processes. The fact that individuals must operate across different temporal zones as digital innovation activities of manufacturing DIUs are close to the core business should also be taken into account. Given the findings of Holotiuk and Beimborn (2019), which express that the development of digital innovations requires people to engage full-time in exploration in order to exploit the potential and quickly acquire the necessary knowledge, our results from the five manufacturing DIUs are quite surprising, as we found in all five cases that some employees split their working time between the DIU and the main organization. As stated in Proposition 2, this practice should be avoided whenever possible, as it prevents the necessary focus to generate value. Why this is not (yet) implemented in the manufacturing industry is an interesting question for future research.

An additional argument for us to move beyond the fast lane narrative, are the implications we can draw from Proposition 4. By establishing a DIU as a fast-moving temporal zone to generate digital innovation, manufacturing companies have the opportunity to make their business performance more steady and less dependent on multi-year machine sales cycles. The business model for digital innovation often has a subscription character and recurring revenues that complete the existing sales rhythm and extends customer life cycles. The overall organization becomes less susceptible to crises, as breakdowns in machine sales can be cushioned by the additional source of revenue. Compared to traditional machine sales cycles there is definitely an option for “faster” sales, but most importantly we see additional, more consistent revenue, giving the aspect of speed a rather secondary or partial preparatory role here. For this reason, we are advocating to change the image of a DIU from a “fast lane” to an “additional lane” for digital innovation and business model generation.

5.2 Implications for research and practice

From a research perspective, our contribution is twofold: on the one hand, we extend the existing DIU literature in the field of information systems in general, with a special focus on the manufacturing industry. On the other hand, we provide a more in-depth view of the unfolding of digital innovations from a temporal perspective. We have found that in addition to speed, which is often in the foreground in the DIU context, many other temporal factors – such as allocation of time, temporal style, or cycle and rhythm – also play a role. Thereby, we also shed light on factors related to these temporal aspects that influence or result from the development of digital innovations in DIUs, namely flexibility and the “right timing”, focus, decision-making processes, steadiness, and trust. This applies in particular to the implementation of DIUs in established incumbents whose routine-like (innovation) practices may be interfered with by a DIU. As our research is not without limitations, we would like to address those in the following and present some promising avenues for future research. Even though all five DIUs were from the manufacturing sector, both the main organizations and the DIUs themselves differed in their organizational structures. For example, some main organizations have only one location and one specific product they sell, others are organized into divisions with several different products and sometimes at different locations and DIU3’s main organization even has a completely decentralized structure with subsidiaries operating quite autonomously all over the world. The DIUs themselves differ, for example, with regards their size and whether they are organized as a separate legal entity, as shown in Table 1. These characteristics can influence how digital innovation unfolds in manufacturing companies’ DIUs but were not taken into consideration for the course of this paper leaving room for future research. In

addition, the DIUs we studied are relatively young, with the oldest established in 2018 and DIU1 in its first year of operation. Some of the propositions, therefore, can be less important or have other implications with regard to the unfolding of digital innovation in DIUs from a temporal perspective for a more mature DIU that has established structures and processes. In general, we focus on DIUs in the manufacturing industry in this paper, which in part also leads us to more industry- or business model-specific results – such as in Proposition 4. We therefore encourage the same question to be applied to other industries in future research. Finally, our work represents a first foray into the field of temporality for the unfolding of digital innovations in DIUs, for which we chose a multiple, explanatory, interpretive case study design. To investigate temporality, however, participant observation or ethnography are also particularly well suited. In order to address this weakness, we suggest future research to conduct, for example, narrative interviews to gain insights into the role of time and thus the unfolding of digital innovations in DIUs through stories about concrete projects. Another possibility – if one would like to take a more cross-industry view again – would be to conduct the same number of interviews in a different industry and, on the basis of a comparative analysis, elaborate on the importance of time. All five propositions, therefore, need to be validated in the course of future research both with regards to the manufacturing and to other industries in order to give a potentially wider scope to our plea for DIU as an additional rather than a fast lane for value creation in the form of digital innovation.

Practitioners can use our findings to review, in the case of existing DIUs, whether and to what extent the aspects in Proposition 1-3 are already applied or to inform the set-up process when a new DIU is being planned or established: Is there the required flexibility and the space to identify the “right timing” for development and implementation of digital innovation in the DIU? If not, it is the task of DIU management to create an environment that provides DIU employees with the necessary freedom and flexibility. This includes, for example, trainings in and working according to agile working methods and outside existing corporate structures, or access to customers for continuous feedback on products and services to provide room for iteration and to react to unforeseen events. In addition, DIU management should ensure that DIU employees have adequate time and thus the necessary focus to work on DIU projects. Based on our findings from the manufacturing industry and previous research by Holotiuk and Beimborn (2019), we suggest that DIU project team members should either be full-time DIU employees or be allowed to devote 100% of their working time to the innovation projects for a specified period of time. Splitting work time between the innovation project and daily tasks within the same time frame should be avoided, as it leads to a lack of focus. Lastly, company and DIU management need to ensure sufficiently fast decision-making processes in the DIU – despite high dependencies towards the main organization – to meet the main organizations expectations regarding the speed of implementation. For this purpose, the necessary structures should be created so that the DIU can, for example, dispose of certain budgets and the access to important decision-makers is provided. Propositions 4 and 5, on the other hand, are intended to contribute to a new understanding of DIU as an additional source of value generation and not as a digital innovation fast lane – if this is not yet the case – in order to prevent false expectations and unnecessary, counterproductive time pressure.

6 Conclusion

To answer our research questions of *how digital innovation as a form of value creation unfold in manufacturing companies' DIUs from a temporal perspective* we conducted a multiple, explanatory, interpretive case study with five DIUs. We hereby decided on a qualitative and interpretive approach to research that was based on Gioia, Corley and Hamilton (2013) and guided by “time” as our theoretical angle. We develop five propositions related to the unfolding of digital innovation in DIUs; three of them suggest preconditioning or facilitating factors of it, the remaining two can be understood as a consequence. So, is the clock really ticking as we stated in the beginning? With regards to our findings, the answer is both yes and no. Thus, while we could certainly see the relevance of speed for DIU value creation in our data, at the same time we also identified various other factors that play a role in interaction with other temporal categories in the course of digital innovation unfolding in DIUs. For this reason, we would like to give less space to speed in DIU research and discussion in the future, and advocate viewing a DIU as an additional lane rather than a fast lane for the development of digital innovation.

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