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# **Building Dynamic Capabilities through Digital Innovation Units? - An analysis of their contribution and the spill-over effects to the main organization**

*Completed Research*

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## **Abstract**

To meet the challenge of digital transformation and remain competitive in an increasingly volatile business environment, many incumbent companies have set up digital innovation units (DIUs). Despite a steadily growing body of knowledge, research explaining the value contribution of such units is still at an early stage. Drawing on empirical data from a multiple case study, we adopt a dynamic capabilities perspective to better understand how DIUs also contribute to building dynamic capabilities as part of their role in the digital transformation of the main organization. To this end, we examined the DIUs of six manufacturing companies and were able to identify several DIU activities and skills that feed into the development and expansion of dynamic capabilities. Moreover, with respect to these activities and skills, we also uncovered positive spillover effects from the DIU to the main organization.

## **Keywords**

Digital innovation units, digital transformation, dynamic capabilities.

## **Introduction**

The digital innovation unit (DIU) hype is sweeping over the corporate landscape like a wave. Over the past decade, more and more incumbent companies have set up such units to meet the challenges of digital transformation and to remain competitive in an increasingly volatile business environment (Barthel et al. 2020; Fuchs et al. 2019; Göbeler et al. 2020; Jöhnk et al. 2020). As DIUs are often an essential building block for incumbents' digital transformation (Jöhnk et al. 2020; Matt et al. 2015; Wiesböck and Hess 2019), it is important to understand which aspects their value contribution comprises, to be able to set up and use a DIU efficiently. The "dynamic capabilities" (DynCaps) approach - initially introduced by Teece et al. (1997) - provides an important response to the crucial question of how to manage a company to achieve long-term competitive advantage in hypercompetitive or high-velocity environments (Barreto 2010; Eisenhardt and Martin 2000). As DIUs are implemented to improve the manageability of this same environment (Fuchs et al. 2019), DynCaps offers a promising path to better understand DIUs' value contribution. So far, DynCaps have already been considered in a broader context of digital transformation (Marx et al. 2021; Warner and Wäger 2019), with Warner and Wäger (2019), for example, listing DIUs - they use the term "digital innovation lab" - as part of the "digital seizing" capability of the main organization in the course of their data structure. In terms of research with specific attention on DIU and DynCaps, there are only two contributions in information systems research so far. One of them focuses on ambidexterity as a DynCaps in the financial services sector (Göbeler et al. 2020). The other looks into the relevance of DynCaps for agility and digital innovation extending the traditional approach of Teece et al. (1997) by adding capabilities and concepts based on its foundational clusters of sensing, seizing, and transforming (Hellmich et al. 2021). What remains unclear so far is the contribution of DIUs to the development of DynCaps, focusing on the core aspects of the approach. To this end, we decided to adopt the perspective of Barreto (2010), who developed an understanding of DynCaps as a multidimensional construct referring to "four distinct but related dimensions or facets (i.e., the propensities to sense opportunities and threats, to

make timely decisions, to make market-oriented decisions, and to change the firm's resource base)" (Barreto 2010, p.271). Using this approach, we intend to explore whether and how DIUs help to intensify one or more of these propensities and thereby build DynCaps that could play an essential role in the course of digital transformation. Our focus here is on DIUs in the manufacturing industry, which, for example, Fuchs et al. (2019), identified as particularly relevant for DIU research because it is typically slow to respond to the impact of digital transformation but is now increasingly establishing such entities. Manufacturing companies constantly face the challenge of maintaining their traditional business - building large, physical machines and plants - while meeting the demands of the digital age (Hylving and Selander 2012). For that matter, they implement DIUs to meet this challenge. By answering the following research question, we intend to contribute to closing the research gap presented: *How do DIUs contribute to building dynamic capabilities in manufacturing companies?*

## **Theoretical Background**

### ***Digital Transformation and Digital Innovation Units***

Digital transformation is a much considered and discussed phenomenon, both in research and practice as the diverse and extensive academic literature and a multitude of practitioner conversations show (Hanelt et al. 2020). It is a complex topic that affects many or all areas of a company and deals with the "changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes." (Hess et al. 2016, p.124). To fill the gaps in understanding this comprehensive phenomenon and its implications at multiple levels of analysis, Vial (2019, p.121) develop a conceptual definition of digital transformation as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies". DIUs can be seen as a part of one building block - the "structural changes" block - of the digital transformation process that concerns changes in the value creation paths of a company enabled by the use of digital technologies (Vial 2019). This classification is in line with the designations of other researchers, who, for example, refer to DIUs as one of the various initiatives of digital transformation (Jöhnk et al. 2020), or as part of the digital transformation strategy of a firm (Wiesböck and Hess 2019). DIUs foster an innovation-friendly culture and strengthen digital competence in an incumbent company. They have a structured organizational embedding as well as secured access to financial resources and carry out projects together with the core organization. Acting autonomously within a predefined framework, DIUs introduce digital solutions and are part of a company-wide digital transformation strategy (Fuchs et al. 2019). In addition, they also build and leverage digital, customer-centric expertise and agile methods as well as maintain digital innovation ecosystems (Raabe et al. 2021). 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". A DIU can be either a department within the main organization or a separate legal entity and is usually established as a permanent unit (Fuchs et al. 2019). Consequently, a DIU represents an important option for managing digital transformation, especially for pre-digital companies (Fuchs et al. 2019) those belonging to traditional industries such as retail, manufacturing, automotive, or financial services (Chaniyas et al. 2019). For these companies, the digital economy poses an existential threat and they are particularly challenged in dealing with the transformative impact of digital technologies, as they often have to adapt their entire business model, processes, and organizational structure (Bharadwaj et al. 2013; Chaniyas et al. 2019; Sebastian et al. 2017). In this context, the manufacturing industry, for example, is particularly interesting for DIU research, as it usually is slow to respond to the impact of digital transformation, but is now increasingly setting up such units to meet these challenges (Fuchs et al. 2019). For this reason, we focus on DIUs in the manufacturing industry and intend to find out about their contribution in the course of the digital transformation of these companies. One question, in fact, that has resonated with DIUs from the beginning is that of their value contribution. This can be seen, for example, in papers on performance measurement in DIUs (Haskamp et al. 2021) and the call to examine their success factors more closely (Barthel et al. 2020). To this end, we use the theoretical angle of DynCap and intend to find out what role DIUs play in manufacturing companies' digital transformation even though they may be "a day late and a dollar short" as a recent paper by Hellmich et al. (2021) suggests.

## **Dynamic Capabilities**

Since the 1997 landmark article on DynCaps by Teece et al. (1997), this view has generated an impressive stream of research (Barreto 2010). After a systematic review of the literature, Barreto (2010, p.271) suggests a new conceptualization of DynCaps as an “aggregated multidimensional construct” and defines DynCaps based on previous articles, as a “firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base” (Barreto 2010, p.271). The *propensity to sense opportunities and threats* comprises the continuous analysis of the internal and external capability landscape and the review of environmental changes (Schreyögg and Kliesch-Eberl 2007). Both the *propensity to make timely decisions* and the *propensity to make market-oriented decisions* look at the important field of decision making from two different but related angles. The former emphasizes the need for efficient reconfiguration of existing resources within a reasonable response time to account for the fact “that the potential for long-term competitive advantage lies not only in the ability to change existing resources but also in doing so ‘sooner’” (Barreto 2010, p.272). The latter refers to how a given firm, through market orientation, systematically pays attention to how it can most effectively and efficiently provide superior value to its customers (Priem 2007). The fourth dimension - the *propensity to change the firm's resource base* - includes the propensity to create, extend, and reconfigure the existing resources being in line with both early and more recent proposals (Eisenhardt and Martin 2000; Helfat et al. 2007; Teece et al. 1997).

With regards to digital transformation, Vial (2019) argues that information systems research could benefit from further engaging with the perspective of DynCaps as „there is an interesting fit between [DynCaps] as a conceptual foundation and [digital transformation] as a phenomenon of interest“ (Vial 2019, p.133). This perception stems from the fact that digital transformation is highlighted in the literature as a source of continuous change and disruption in a company's competitive environment. DynCaps offer a solution approach to the question of firms' ability to develop mechanisms that enable repeatable, continuous adaptation despite such rapid change. The approach has proven particularly useful in contexts characterized by environmental turbulence or hypercompetition, as ordinary capabilities alone cannot explain how firms build and sustain competitive advantage (Teece 2014; Vial 2019). Due to this fact, the consideration of DynCaps is also relevant with respect to DIUs, since they are implemented in the course of digital transformation and operate in such highly volatile environments. Compared to the growing stream of literature dealing with building DynCaps for digital transformation (e.g., Marx et al. 2021; Warner and Wäger 2019), contributions with a focus on the interface between DIUs and DynCaps are still sparse. So far, only two publications in information systems research specifically address this topic (Göbeler et al. 2020; Hellmich et al. 2021). Göbeler et al. (2020) argue for ambidexterity as a DynCap and focus their research on the financial services sector. Hellmich et al. (2021) look into the relevance of DynCaps for agility and digital innovation extending Teece et al.'s (1997) traditional approach by adding capabilities and concepts based on its foundational clusters of sensing, seizing, and transforming. Especially the latter deviate from the view of DynCaps as a unified, composite phenomenon - described by Teece (2018, p.364) as “three clusters of entrepreneurial activities [...]: sensing, seizing and transforming” or by Barreto (2010, p.271) “as a multidimensional construct [...] refer[ing] to four distinct but related dimensions or facets [...] treated as a single theoretical concept” - by indicating further capabilities as DynCaps instead of subordinating them in accordance with existing views. Therefore, what remains unclear so far is the contribution of DIUs to building DynCaps, focusing only on the core aspects of the approach. To this end, we adopt the perspective of Barreto (2010) and argue that DynCaps may help us to better understand the role and value contribution of DIUs in the course of digital transformation.

## **Methodology**

For the research design, 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 August 2021, we conducted a total number of 16 interviews with six DIUs of manufacturing companies in Switzerland and Germany to gain an understanding of their activities and skills in the context of the main organization's digital transformation and how they can contribute to building DynCaps in the course of this. We chose a multiple case design to increase the robustness of the study and to allow cross-case analysis (Yin 2018). Using a literal replication logic, we searched for non-digital-native companies from the manufacturing industry such as machine and plant engineers with a business-to-business focus that

implemented a DIU as part of their organizational digital transformation (Yin 2018). All six companies had more than 2,000 employees at the time when the interviews were conducted and were founded at least 50 years ago. The six DIUs have been established within the last four years and their operations go beyond their conceptualization (Yin 2018). What additionally unites them is their core business-related mandate and a manufacturing industry-specific focus on digital innovation “around the machine”. According to the typology of Barthel et al. (2020), they fall into the category of so-called “external enhancers”, as they develop digital products, services, and business models that complement and expand the traditional business with a clear external focus on the customer. To obtain a realistic picture of their contribution to building DynCaps in manufacturing companies, we interviewed either two or three people per case at both the DIU leadership level and the operational level. In all but one case, the interviewee group also included at least one person who still or formerly belonged to the main organization. The interviews all took place via video call, lasted an average of 63 minutes, and were tape-recorded and transcribed. As we decided on a qualitative and interpretive research approach following Gioia et al. (2013), we worked with a semi-structured interview guide with open-end questions. The interview guide included both more general questions about the interviewee's perception of the propensity of the DIU and the main organization regarding one of the four dimensions of DynCaps, as well as more specific questions about particular aspects within these dimensions. 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). We collected, stored, and analyzed the interview data with the computer-supported qualitative data analysis tool ATLAS.ti. Table 1 gives a condensed overview of the cases considered.

ID	Founded in	DIU Size	Main Org. Size	Number of interviews	Interviewee Positions
DIU1	2018	17	> 20,000	3	Head of DIU, Principal Consultant, Vice President Digital of one division (main organization)
DIU2	2018	40	≈ 35,000	3	Director Digital Transformation, Interim Head of Digital Customer Interaction, Head of Technology & Architecture
DIU3	2018	60	> 11,000	2	COO (DIU) and Head of Digital Innovation & Data Science (DIU & main organization), Innovation Manager
DIU4	2018	130	≈ 10,000	3	CEO & Managing Director DIU, Head of Innovation, Digital Project Lead
DIU5	2019	25	> 10,000	2	Global Head of DIU, COO of one division (main organization)
DIU6	2020	7	> 2,500	3	CDIO (main organization) & Head of DIU, Director Global IT Governance and Digital Transformation (main organization & DIU), Consulting Manager

**Table 1. Case Overview**

For the data analysis, we began creating first-order codes from the transcripts, attempting to “adhere faithfully to informant terms” as suggested by Gioia et al. (2013, p.20). This first step resembled an open coding step (Gioia et al. 2013; Strauss and Corbin 1998) and was performed by the author of the paper. Subsequently, we discussed and validated the first-order codes within a team of three researchers and ended up with a total number of 185 codes. Based on our comprehensive compendium of first-order codes the author distilled the second-order codes, which were again discussed and validated by the research team. In total, 73 second-order encodings emerged. The four dimensions of the DynCaps approach by Barreto (2010) guided us in these steps allowing us to cluster certain activities and skills that we observed and assign them to one of the dimensions. In the course of the development of the resulting artifact, we decided on 51 particularly interesting and relevant second-order codes with regard to our research questions. We hereby applied the following two criteria: First, each code needed to have a direct connection to the perception of activities and skills in the context of the DIU. Second, each code should have the explanatory power to indicate the peculiar contribution of these activities or skills to one of the four DynCaps dimensions. Based on this selection of second-order codes, we developed 20 aggregated dimensions according to Gioia et al. (2013). Each of the aggregate dimensions is grounded in the statements from at least three different DIUs with regard to activities and skills and two with regard to spill-over effects to ensure that they provide a

sufficient foundation for the findings that build upon them. On the basis of the aggregated dimensions, we incorporated our background knowledge of theories related to digital transformation, DIU, and DynCaps and formulated DIU activities and skills that pay off on one of the four propensities that make up DynCaps according to Barreto (2010) or lead to any positive spill-over effects from the DIU to the main organization. An overview of this is provided in Figure 1 of the results, where we derived the column headings of the figure from theory whereas the row headings emerged inductively in the course of the data analysis.

## Results

We present our findings in two steps. First, we describe activities or skills of a DIU that we identified along the four DynCaps dimensions *propensity to sense opportunities and threats*, *propensity to make timely decisions*, *propensity to make market-oriented decisions*, and *propensity to change the firm’s resource base* and explain how they contribute to the respective propensity’s development and expansion. Second, we show positive spill-over effects from the DIU into the main organization helping to build DynCaps there as well. Manufacturing companies have no expertise in the digital area and implement DIUs as part of their digital transformation to establish a second growth muscle in addition to their traditional business of selling machinery and equipment. In the course of this, DIUs contribute with their activities and skills to the development and expansion of the four DynCaps dimensions that are crucial to surviving in an increasingly digitized world. In total, we were able to determine 15 activities or skills, with four being accounted for the *propensity to sense opportunities and threats*, three each for the *propensity to make timely decisions*, and the *propensity to make market-oriented decisions*, and five for the *propensity to change the firm’s resource base*. Furthermore, we describe five positive spill-over effects from the DIU into the main organization. Figure 1 summarizes our results, using the abbreviations P1, P2, P3, and P4 for the four DynCap dimensions and numbering the presented aspects per dimension in ascending order. For the spill-over effects, we chose the abbreviation SO and proceeded in an equivalent way. The same abbreviations are subsequently used in the text.

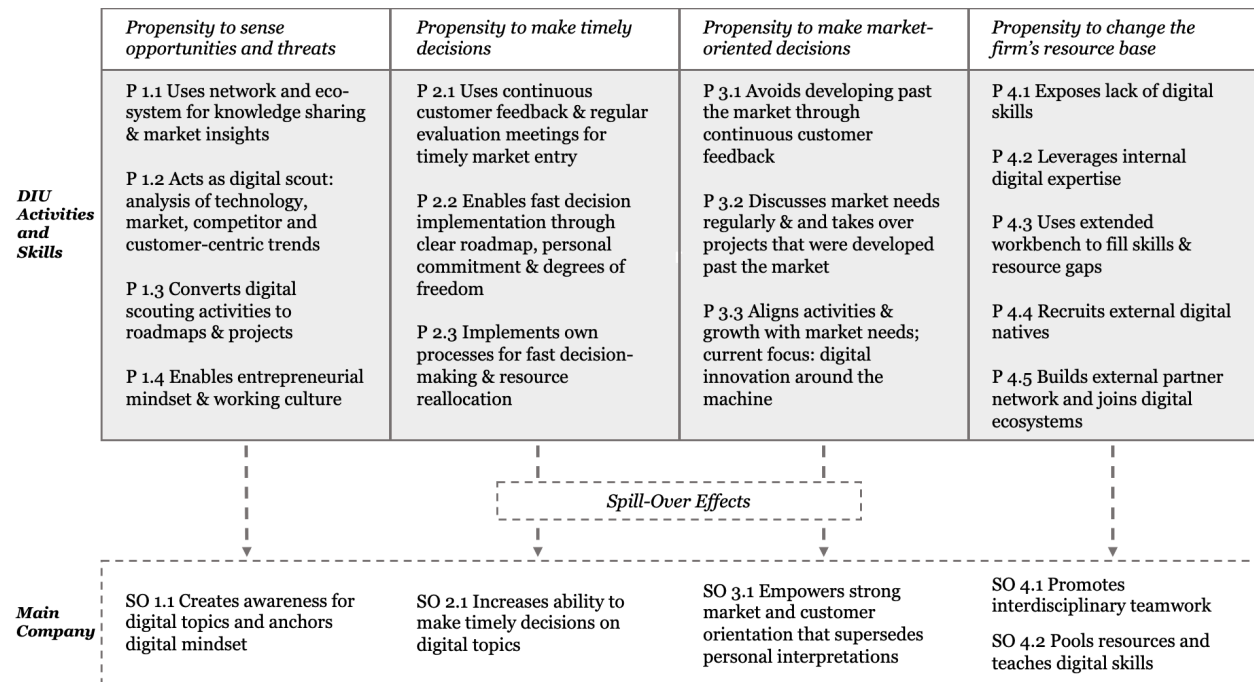


Figure 1. DIU Activities, Skills and Spill-Over Effects

### DIU activities and skills contributing to building Dynamic Capabilities

**Propensity to sense opportunities and threats.** With regard to the propensity of a DIU to sense opportunities and threats, we identified four activities/skills that contribute to its development and expansion. P 1.1 expresses a key activity of the considered DIUs which is building an external partner

network and joining digital ecosystems, which they intensively use to inform themselves about and exchange information on market and technology trends. This exchange allows them to stay abreast of market events and develop a good sense for changes that present potential opportunities or threats as a quote from DIU 4 shows: “[M]y role [in the DIU] is actually primarily to build up all ecosystem activities. That means getting in touch with other industry partners, getting in touch with startups. To build up various formats and activities that enable us, on the one hand, to have even more market insights, so that we basically have new ideas [...] for products that we are building up. That we build up [...] low-threshold relationships with industry partners who could possibly become our customers.” In addition, the DIU learns from the experiences and challenges of other DIUs, companies, or partners and can leverage this knowledge in its own work. Both aspects support the expansion of the *propensity to sense opportunities and threats*. In addition to the information from the network, DIUs conduct their own market, competitor, and customer analysis to better understand the impact of the external environment and recognize market dynamics and best practices. Often, they also strive to identify current and future technology trends. These activities can be summarized as digital scouting, i.e., the DIU acts as a digital scout (for itself and thus also on behalf of the main organization) as mentioned in P 1.2, thereby increasing the probability of identifying opportunities and threat. From these digital scouting activities, the DIU then develops future scenarios and tries to derive concrete innovation projects, which are subsequently implemented step by step (P 1.3) as expressed by an interviewee in DIU4: “At the beginning of the year, we conducted a major trend analysis and looked at the future scenarios in the manufacturing sector. And now, as the next step, we [...] have now summarized the topics and will now hold workshops based on these topics.” The activities P 1.1 to P 1.3 are facilitated and encouraged especially by the start-up mentality established in DIUs. As stated in P 1.4 entrepreneurial thinking, high degrees of freedom and flexibility, fault tolerance, a high level of personal responsibility for projects, and interdisciplinary teamwork create a new work culture that has not yet existed to this extent in manufacturing companies. It promotes both the recognition of opportunities and threats and enables the subsequent development of digital products and services.

**Propensity to make timely decisions.** The propensity of a DIU *to make timely decisions* is fostered through three activities/skills. First of all, a DIU’s way of working, which relies heavily on agile, customer-centric working methods such as SCRUM or design thinking, allows them to obtain continuous customer feedback when developing digital products and services. This type of development work with and on the customer enables the DIU to estimate the right time to enter the market and thus avoid entering too early or too late. P 2.1 illustrates this fact, which was expressed, for example, in the course of the interviews with DIU2: “I would say that because of this agile working, [...] you can switch very quickly. [...] You’re not as stuck as you used to be with a waterfall, three-year project, and after three years something came out, and then the customers said, ‘Yes, but now it’s no longer what we need’. So, we always have the flexibility. And of course, [...] [it is required] to talk to the customer: ‘What do you need? What is important? What would you prioritize the most?’ [...] 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.” Furthermore, the high degrees of freedom and the personal commitment mentioned in P 1.4, as well as a clearly defined roadmap, allow a DIU to implement strategic decisions - whether made by the DIU team itself or by the management of the main organization - quickly and efficiently (P 2.2). DIU team members have a strong sense of togetherness and will to implement, with the result that the usual time-eaters such as long coordination processes or lack of consensus do not occur. This creates a good basis for timely decisions towards the market as well as efficient implementation of decisions made, as a quote from DIU5 shows: “I think that what we can fall back on is just an incredible sense of moments of freedom [...]. It’s a high level of commitment in the team. It’s a high sense of togetherness, this ‘glue’ in the team. And it is this will to implement these things now and to bring them to completion and to do them. [...] [T]his then leads to the fact that certain things do not take place, which are normally a problem [...] [like] long coordination processes because everyone wants to be involved in some way [...]. Or because there’s no overall consensus. [...] And that’s why I think we are quite quick, quite fast.” In many cases, DIUs also implement their own decision-making processes that are outside the standard processes of the main organization (P 2.3). This enables them to react and decide more quickly, especially with regard to recruitment, and to adjust the resource base as required.

**Propensity to make market-oriented decisions.** The DIUs’ agile way of working mentioned in P 2.1 and the associated continuous customer feedback enables them to also increase the *propensity to make market-oriented decisions*. Customer requirements can be included in the development process of products or services to avoid developing past market needs. A statement from an interview with DIU6 substantiates

this view: “Then certainly customer-centricity on a completely different quality, [...] talking [...] very openly with customers about their needs, also their business goals and see what you can do for them, how you can create a solution for them. I think that has a quality that has not existed before.” In some cases, the DIU also takes over projects that were initially developed past the market in order to possibly lead them to success. Furthermore, the DIU team holds regular meetings to discuss market needs - some of which go beyond the core markets, as digital transformation has company-wide relevance - to ensure that it is still on track overall as well as with respect to individual initiatives: “As far as the decision for the [DIU] is concerned, I think we have more of a strategy circle. [...] [W]e have a group of four people who, [...] look at each quarter to see whether we are on the right track in terms of the basic structures. And we have [...] such a kick-off topic at the end of the year: ‘What is actually relevant for the next year? [...] What is the strategy requirement from the Group? [...] What do we ourselves believe is most important?’ We then developed overall packages for the two years, [...] to swear ourselves in at the end of the year for the coming year.” (DIU5). In terms of their own activities and growth, many DIUs are also aligning themselves with market needs (and their own ability to implement projects accordingly) to avoid over-promise and under-deliver, both internally and externally. The current focus of the six DIUs considered is hereby on innovation “around the machine”, i.e., close to the core business as mentioned above.

**Propensity to change a firm’s resource base.** For the *propensity to change the firm’s resource base*, we were able to identify five aspects in our data. One of them, expressed in P 4.1, is that by establishing a DIU, it gradually becomes clear what digital skills are lacking in the existing workforce: “So there are two main things that we’ve been able to figure out. One is that you can’t just bring people into IT. [...] [W]e knew we needed new skills, new job profiles, artificial intelligence, big data, new programming skills. And we also need project managers who can follow through on these [...] things.” (DIU5). Through the projects that the DIU undertakes and implements, the organization recognizes that, in addition to mechanical engineering competencies, for example, other aspects are now becoming important for economic success: “I would say that this [the DIU] has opened people’s eyes to the fact that there are other things that are relevant to the business in addition to traditional mechanical engineering skills. [...] [W]e have 2-3 areas where we have skills gaps, we need to build them up and we are doing that right now with hiring [...].” (DIU6). To fill these missing skills, DIUs use three different sources to get the right personnel. First, they leverage internal, digital expertise by hiring employees from the main organization full-time in the DIU or integrating them on a project basis (P 4.2). The former is often accompanied by advancements and/or role changes. Second, DIUs often work with an extended workbench in order to temporarily or permanently fill skill and resource gaps (P 4.3). In particular, resources in software development are filled by freelancers or service providers in order to cushion sales peaks and to have fewer expenses during low phases. In addition, many DIUs are working with consulting firms to establish and further develop the DIU, benefiting transitionally from both additional resources and their expertise. Third, the DIU hires digital natives externally to have its own resources for e.g., software development (including specialists for IoT and cloud infrastructure), data scientists, data analysts, data engineers as well as experts for digital business modeling, digital project management, and agile working methods (P 4.4). A statement summarizing all of the above came from an interviewee in DIU2: “We are filling up right now, [...] via [a consulting company]. We are also extending ourselves via freelancers. And in addition to that, [the main organization] has signed another contract [...], especially for technical services, so software developers, software architects, [quality assurance] people and so on, which are longer-term [...]. And in the meantime, the [DIU] hires its own team [...] via recruiting or via internal transfer as much as that’s possible.” In addition to direct and indirect recruitment, DIUs are often tasked with building an external partner network and joining digital ecosystems (P 4.5). This network includes other DIUs and companies from various industries, as well as universities and startups, and can be used to exchange experiences and information on market and technology trends, as already described with P 1.1.

### ***Spill-over effects from the DIU to the main organization***

In addition to the activities and skills of a DIU that contribute to one of the four DynCap dimensions, we were able to observe initial positive spill-over effects from the DIU to the main organization - an aspect that has not yet been explicitly examined in the DIU literature - in the course of the data analysis. For example, the DIU’s entrepreneurial spirit is slowly finding its way into the main organization as observed in DIU5 and DIU6. Through continuous communication and the emergence of the first digital products and services on the part of the DIU, as well as in the course of joint projects and workshops between the DIU and the



main organization, the DIU is creating awareness for digital transformation topics and thus beginning to anchor a digital mindset in the main organization (SO 1.1). One interviewee of DIU6 expressed this as follows: *“I think that with what we have done now [in the DIU], many more people see this topic of digitization as an opportunity and also as a risk if we don’t do it. [...] Until now, it was always [...] [the opinion that] you can also not do certain things, which has turned into a claim [...] ‘digitization, if not us, then who else?’. [...] So I think it’s very much an opportunity sentiment. People know what it would mean if we didn’t do digitization. But that wasn’t always the case.”*

The spill-over effects SO 2.1 and SO 3.1 stem from findings in DIU1, DIU3 and DIU6 are somewhat intertwined. Through the DIU’s work, and especially through the involvement of staff from the main organization in DIU projects, the DIU’s customer-centric way of working is slowly finding its way into the main organization as well. As a result, both the main organization’s *propensity to make timely decisions* on digital topics and *to make market-oriented decisions* gradually increases. Previously, this ability rested with a few individuals - primarily from the DIU - who were relied upon. The DIU is now involving more and more know-how carriers in its activities in order to expand this group of people. In the following quote from DIU6, individual aspects of this become visible: *So, I find that lately, [the main organization] takes into account the market more than before. So that’s very positive, normally [...] [the main organization] has always been very engineering-driven. [...] I think that has to do with the DIU. [...] I think the DIU has given great input. Really more strategic thinking in the sense of ‘Is it wanted?’ [...] Is anyone interested in this product?’”* Additionally, the stronger customer-centricity replaces the previously prevailing personal interpretations of customer wishes with regard to digital products and services.

Finally, with regard to the *propensity to change the firm’s resource base* and addressed by SO 4.1 - observed in DIU1, DIU4, DIU5, and DIU6 - it can be said that a major advantage of DIUs in the manufacturing industry is the fact that they strongly promote interdisciplinary teamwork across departments. Through joint projects or by offering open workspaces people with different skill sets and backgrounds can meet and exchange ideas. In this way, representatives from different departments that would normally have no overlap - such as Research & Development and Data Science - come together and discuss technologies and projects or work on ideas as an interviewee from DIU5 described: *“We have projects, [...] we cannot do [...] alone, because [...] we need the R&D specialists plus data scientists [...] to understand the physics and to understand the process. What I think is that we [in the DIU] have managed [to create] a lot of exchange and [...] small, own ideas have emerged. [...] [I]t often happens that the R&D people come to us and ask our R&D specialist [...]. In other words, we can offer these small garage activities in a relatively uncomplicated way and without a large formal process.”* In some cases, DIUs also have a global mandate for the digital transformation of the main organization, bringing not only departments into closer exchange but also company branches from different countries. Both provide a breeding ground for innovative ideas and projects for the main organization. In addition, as SO 4.2 - which is based on data from DIU2, DIU3; DIU4 and DIU5 - expresses, the DIU forms a pool of resources with expertise in digital innovations, digital business models, agile working, and related skills that the main organization can access as needed - for example, for support with projects. DIUs also frequently offer workshops, webinars, or similar formats to train and develop the employees of the main organizations in these skills as mentioned by interviewees from DIU3 and DIU4: *“[A DIU] innovation manager, is now booked as a practitioner for Design Thinking [...] [f]rom the main company, in order to support various projects there.”* (DIU3). *“And at the same time, [...] we’re also involved in it [...] as part of the digital transformation, we offer learning formats. Webinars on the topic of design thinking and so on. There are others, for example data science [...], and then also one-day workshops on design thinking, on user journey mapping [...] to build up knowledge in the Group.”* (DIU4).

## **Discussion and Conclusion**

On the basis of a multiple case study with six DIUs from the manufacturing industry, the present study answers the question of *how DIUs contribute to building dynamic capabilities in manufacturing companies*. For that matter, we identified activities and skills of DIUs along the four dimensions of DynCaps according to Barreto (2010) that contribute to building and expanding the respective propensities. The result is 15 activities and skills related to the *propensities to sense opportunities and threats, to make timely decisions, to make market-oriented decisions, and to change the firm’s resource base*. Furthermore, we found five positive spill-over effects from the DIU into the main organization which may also lead to an

intensification of the four propensities under consideration there as well. We thus show that DIUs, with their agile, customer-centric way of working, digital expertise, and external network, play an essential for - or in some cases even drive - the digital transformation of manufacturing companies and, in parallel, favor the development of DynCap. This obviously positive contribution is made despite the view that DIUs are “a day late and a dollar short” (Hellmich et al. 2021) and they tend to create incremental rather than radical or disruptive innovations (Göbeler et al. 2020; Hellmich et al. 2021; Raabe et al. 2021) - which we also observed in our data. This perception contrasts with other assumptions that “DIUs [...] concentrate on (at least) radical product and service innovations (and not incremental or process innovations)” (Raabe et al. 2020, p14). However, the question that arises, particularly with respect to the manufacturing industry considered in this paper, is: How radical do DIUs even need to be in this environment (for now)? The results of this study show that DIUs have so far made a positive contribution to building DynCaps even without producing radical innovation and have provided important impetus to the main organization. We, therefore, argue that the focus on innovation “around the machine” is sufficient for the time being and also necessary for the manufacturing industry to create the basis for DIUs to focus on radical or even disruptive innovations in the future. Conversely, it could also be argued that they already are radical or disruptive today, but only for their specific industry and not in a broader context. Since this question was not an essential element of this study, the issue cannot be clarified and is a subject for future research. Following on from the previous line of thought, we would also like to argue in favor of a more industry-specific analysis of DIUs. Existing DIU research already shows that there is no such thing as “the one” DIU (Barthel et al. 2020; Raabe et al. 2020). Moreover, each competitive environment has its own characteristics, so that individual capabilities of DIUs may play a smaller or larger role in one industry or another. We would like to encourage future research to validate our results with further observations of DIUs in other industries as well as quantitative analyses to test our call for industry-specific DIU research. Another question that arises from the results of this study is whether DIUs succeed in generating further and stronger, positive spill-over effects, or whether the internal inertial forces of the main organization are too great. If they do not succeed, it would be interesting to understand what the reasons are and whether the DIU is nevertheless making a positive contribution to digital transformation. Equally interesting would be to examine if there are any negative spill-over effects from the DIU into the main organization as existing research already discusses challenges between these two parties (Raabe et al. 2020). We were able to find evidence in our data that there are company internal barriers that prevent the DIU from expanding one of the four propensities, but these are based in part on individual case observations, which is why we were unable to include them in our findings. Since our study is qualitative in nature, our findings need to be validated in the course of quantitative analyses. In further investigations, the geographic focus should also be broadened, as our data analysis was limited to DIUs in Switzerland and Germany. Furthermore, the six DIUs we studied are relatively young, with DIU6 in its first year of operation during the data collection. For DIUs that have been in operation for a longer period of time, deviations from our observations could therefore occur, especially with regard to spill-over effects.

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