6-14-2021

Performance Measurement in Digital Innovation Units - An Information Asymmetry Perspective

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PERFORMANCE MEASUREMENT IN DIGITAL INNOVATION UNITS - AN INFORMATION ASYMMETRY PERSPECTIVE

Research Paper

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Abstract

Digital Innovation Units (DIU) are dedicated organizational units that companies increasingly set up to explore and develop new digital innovations. Despite the growing scholarly attention on DIUs, there is little evidence about their actual performance and, specifically, about the importance of information alignment between the DIU and the main company. To address this gap our study focuses on the concept of information asymmetries to investigate the factors that enable or hinder the reduction of information asymmetries between members of the DIU and the main company. Based on 21 exploratory interviews with both sides, we propose a framework showing three barriers (Exploratory Goal Setting, Outcome Uncertainty and Assessment Misfit) and subsequent enablers that can reduce information asymmetries between them. Our findings expand knowledge on the relationship between DIUs and their main company and the role that Performance Measurement Systems play to align and steer the digital innovation efforts of DIUs.

Keywords: Digital Innovation Units, Performance Measurement System, Information Asymmetries

1 Introduction

Digital innovation and the accompanying rise in new competitors challenges the market positions of incumbents, and forces them to review their business models (Hess *et al.*, 2016; Vial, 2019). Many companies have taken on this challenge by initiating activities designed to strengthen their digital capabilities and achieve greater agility (Hess *et al.*, 2016). One approach to developing more user-centered digital innovations in a shorter period of time is the establishment of Digital Innovation Units (DIUs) (Hess *et al.*, 2016; Barthel *et al.*, 2020). While these units have been gaining increasing attention from academia in recent years (Holotiuk and Beimborn, 2019; Barthel *et al.*, 2020), the management press has questioned the effectiveness of DIUs (Unger, 2018; Kyriasoglou, 2020) and research has as well pointed DIUs struggle to meet objectives (Raabe *et al.*, 2020b).

As far as existing knowledge about this phenomenon is concerned, research seems to be at an early stage and focuses on topics such as the development of typologies of DIUs (Fuchs, Barthel, Herberg, *et al.*, 2019; Barthel *et al.*, 2020), their role in the context of ambidexterity (Holotiuk and Beimborn, 2018, 2019) or how DIUs facilitate knowledge recombination (Hund *et al.*, 2019). Recently, the misalignment

between a company's objectives and the activities of their DIU has been identified as a critical issue for determining the success of DIUs (Mayer, Haskamp and de Paula, 2020; Raabe *et al.*, 2020b; Haskamp *et al.*, 2021). To prevent this misalignment, performance measurement systems have been investigated, alongside the challenges that DIUs experience in using these systems (Mayer, Haskamp and de Paula, 2020). In the context of DIUs, the concept of performance measurement systems as a mechanism that reduces information asymmetries could be understood in two ways. Firstly, the incumbent organization (called 'main company') which is setting up the DIU needs to find ways of assessing their performance and ensuring that resources are spent accordingly. Secondly, the DIU itself needs to look for ways on how to steer its actions to achieve its goals. For both intentions, organizations typically rely on Performance Measurement Systems (PMS), which include metrics and indicators to assess performance and reduce information asymmetries between different stakeholder groups (Lambert, 2006; Schermann, Wiesche and Krcmar, 2012; Tuulikki, Laine and Korhonen, 2019). These systems and their role in successfully achieving innovation is facing both criticism and support (Ylinen and Gullkvist, 2014; Bedford, Bisbe and Sweeney, 2019). For example, while advocates argue that PMS reduce information asymmetries as they foster information exchange (Bedford, Bisbe and Sweeney, 2019) and provide direction for innovation activities (Merchant and Van der Stede, 2007), opponents argue on the detrimental effects that such systems can have for innovation activities as they diminish creativity and encourage egoism, hierarchical dependence, and risk aversion (Lövstål and Jontoft, 2017). This is particularly the case for early innovation activities, where information asymmetries can quickly occur due to a high level of uncertainty, and where PMS are hard to apply (Koen *et al.*, 2001; Berghaus and Back, 2017; Arikan and Borgman, 2020). In addition, impact measurement of digital innovation presents a challenge which may require new forms of measurement (Fichman, Dos Santos and Zheng, 2014); (Hund, Drechsler and Reibenspiess, 2019).

To summarize, while companies increasingly adopt DIUs to foster their digital innovation capabilities (Barthel *et al.*, 2020), the alignment on common objectives between the DIU and the main company seems to be a pressing issue which can determine the success of DIUs (Mayer, Haskamp and de Paula, 2020; Raabe *et al.*, 2020b). While management controls such as PMS are sometimes adopted to mitigate this problem, the effects of such systems as a way to decrease information asymmetries between the DIU and the main organization remain under-investigated. As van der Meer-Kooistra and Scapens, (2015) have pointed out: *"We must recognise that management accounting, and management controls more generally, can both constrain and encourage creativity/innovation at the same time" (p.88).* Taking the example of PMS, we aim to investigate barriers and enablers for the reduction of information asymmetries between DIUs and their main organization. Thus, we pose the following research question that we aim to investigate:

RQ: Which factors enable or hinder the reduction of information asymmetries between DIUs and their main company?

To answer our research question, we gathered data from 21 interviews with representatives of DIUs and their main companies. Based on the analysis of this data, we propose a framework that helps to understand the effects on information asymmetries posed by the use of PMS in DIUs. In this way, we make a contribution to two main research streams. First, we advance research on DIUs as we further investigate the role of PMS as mechanisms for reducing information asymmetries between DIUs and their main company (Barthel *et al.*, 2020; Raabe *et al.*, 2020b). Second, our findings extend the understanding of how to measure early digital innovation efforts and their impact (Fichman, Dos Santos and Zheng, 2014; Berghaus and Back, 2017; Hund, Drechsler and Reibenspiess, 2019).

2 Theoretical Background - Digital Innovation Units

By investing in digital transformation incumbent firms aim to successfully develop digital innovation solutions (Vial, 2019). One can define digital innovation "*as the carrying out of new combinations of digital and physical components to produce novel products"* (Yoo, Henfridsson and Lyytinen, 2010, p.

725). This definition implies an understanding of digital innovation as an outcome (types of digital innovations) or as a process that involves to initiate, develop, implement and exploit an idea using digital technology (Yoo, Henfridsson and Lyytinen, 2010; Hund, Drechsler and Reibenspiess, 2019; Kohli and Melville, 2019). Compared with non-digital innovation, digital innovation seems to be a less bounded phenomena. Thus, the difference between outcomes and processes in the development of digital innovations is less clear. Furthermore, one can observe a shift towards a more decentralized and collaborative approach in developing digital innovations (Yoo, Henfridsson and Lyytinen, 2010; Nambisan *et al.*, 2017). To translate these differences into a concrete developmental path, many companies aim to set up organizational units or laboratories that make use of exploratory and agile methods (e.g. Design Thinking, Scrum) for digital innovation in a shorter time (Berghaus and Back, 2017). In theory, the concept of an innovation unit or lab has been on the agenda for years, but recently a literature stream has emerged that specifically discusses DIUs (Holotiuk and Beimborn, 2019; Barthel *et al.*, 2020; Raabe *et al.*, 2020a).

In this stream, scholars are investigating these units as a mechanism for ambidexterity (Holotiuk and Beimborn, 2018, 2019), from the perspective of bi-modal IT (Raabe *et al.*, 2020a) and through a knowledge recombination lens (Hund *et al.*, 2019). While definitions of DIUs are still rather vague, we 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* (Barthel *et al.*, 2020, p. 5)*"*. This may refer to either separate innovation departments in firms or innovation labs specifically set up by companies. Existing research on DIU has identified different activity areas and objectives (Fuchs, Barthel, Herberg, *et al.*, 2019; Raabe *et al.*, 2021). Raabe et al. (2021) extending the work by Fuchs et al. (2019) distinguish between DIUs following a business problem-based Digital Innovation Selection Approach and those following a Digital Innovation-driven Business Change approach. In the former, DIUs pursue objectives such as developing Digital Innovations, building Digital Expertise and fostering Cultural Change, while in the latter, DIUs drive Organizational Design Change and contribute to building a Digital Innovation Ecosystem.

Recent research on DIUs has identified the relationship between the main organization and the DIU as a key impediment for the success of DIUs (Svahn, Mathiassen and Lindgren, 2017; Wulf, Mettler and Brenner, 2017; Gimpel *et al.*, 2018; Holotiuk and Beimborn, 2019; Jöhnk *et al.*, 2019; Mayer, Haskamp and de Paula, 2020; Raabe *et al.*, 2020b, 2021). In particular, research has pointed out that the governance of demands issued by different organizational units during digital transformation activities can conflict due to differences in strategic vision (flexibility vs predictability) and collaboration (integration vs autonomy) (Jöhnk *et al.*, 2019; Kiselev and Winter, 2020). Regarding the DIUs themselves, a lack of clear objectives has been identified as a main challenge for collaboration between the DIU and the main company (Mayer, Haskamp and de Paula, 2020; Raabe *et al.*, 2020b).

In this study we harness the concept of information asymmetries to conceptualize these misalignments between DIUs and their main organization. The concept stems from the Principal-Agent Theory (PAT) (Eisenhardt, 1989a; Shapiro, 2005). In her seminal article, Kathleen Eisenhardt describes PAT as being *"directed at the ubiquitous agency relationship, in which one party (the principal) delegates work to another (the agent), who performs that work*" (Eisenhardt, 1989a, p. 58). The theory identifies two key problems: the potential mismatch between the objectives of the principal and the agent, and the difficulty the principal has to verify what the agent is actually doing. PAT has been used extensively in IS to investigate the relationship between IS systems to reduce information asymmetries between stakeholders (Choudhury and Sabherwal, 2003; Melville *et al.*, 2004; Mahaney and Lederer, 2011). We follow this stream and use PMS as one of the approaches available to organizations aiming to manage information asymmetries between different parties (Schermann, Wiesche and Krcmar, 2012; Wiesche, Bodner and Schermann, 2013). With regards to the use of PMS in the context of innovation, early research has been much more critical than it is today (Lill, Wald and Christoph, 2020). While earlier scholars have pointed out the negative effects of measurement on creativity and motivation (Amabile *et al.*, 1996), more recent research suggests that properly designed systems based on the type of innovation (Ylinen and Gullkvist, 2014) can guide the direction of innovation (Davila and Ditillo, 2017). Thus, PMS can help to drive transparency in the principal-agent relationship (Wiesche, Bodner and

Schermann, 2013) and reduce the trade-off between the cost of measuring behaviour and measuring outcomes (Schermann, Wiesche and Krcmar, 2012).

To understand the relationship between the main company and the DIU, we apply the concept of information asymmetries (Figure 1). When setting up a DIU the corporate company defines the unit's objectives and provides the resources it needs to perform the innovation activities. The first potential for information asymmetry occurs when the main organization seeks to check the accountability of the resources it invested. By looking for ways of how to do so, representatives from the main company ask for information concerning progress, which the DIU may follow up on by using a PMS.

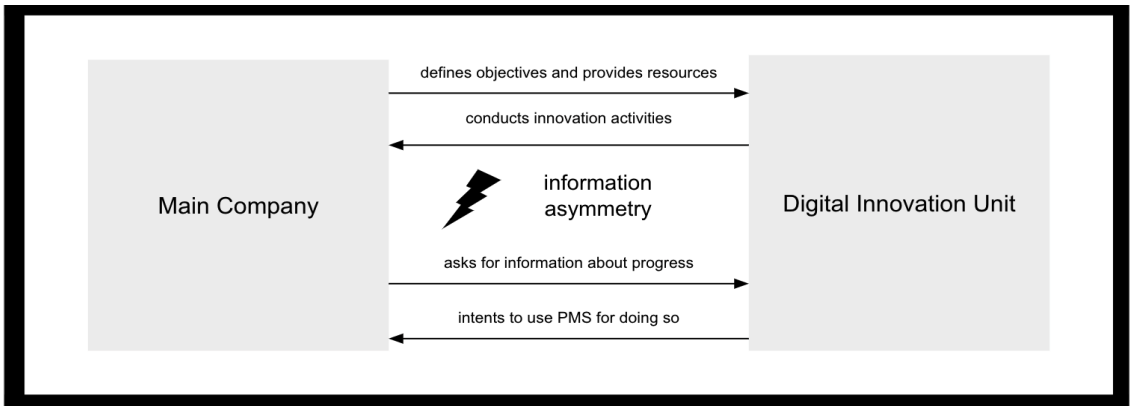

Figure 1. Information Asymmetries between the Main Company and the Digital Innovation Unit.

Within the context of DIUs, there is little research on the use and effects of PMS (Barthel *et al.*, 2020; Frey, Holotiuk and Beimborn, 2020), barring a few exceptions (Mayer, Haskamp and de Paula, 2020; Seeher, Beimborn and Holotiuk, 2020; Haskamp *et al.*, 2021). Although this is hardly surprising, given that many units have only recently been set up, it is nevertheless problematic as it complicates discussions on the success of a DIU. Moreover, its relationship with the main company and its objectives varies depending on the DIU's objectives and its activities (Barthel *et al.*, 2020; Raabe *et al.*, 2021). Additionally, research has found that DIUs often adopt exploratory innovation practices such as Design Thinking and agile working methodologies such as Scrum (Barthel *et al.*, 2020; Mayer, Haskamp and de Paula, 2020). In regards to both of these methodologies, research has questioned the appropriateness of traditional performance measurement of these activities, given their shorter time cycles and their exploratory nature (Carr *et al.*, 2010; Schlauderer and Overhage, 2013; Hund, Drechsler and Reibenspiess, 2019; Micheli *et al.*, 2019; Tuulikki, Laine and Korhonen, 2019).

3 Methodology

The aim of the study is to investigate, with the help of an exploratory, qualitative approach, which factors hinder or enable the reduction of information asymmetry between the DIU and the main company (Strauss and Corbin, 1998). We conducted 21 interviews with DIU staff and management of main companies across industries. Adopting the grounded theory approach and Gioia method, we followed rigorous and established qualitative data analysis steps, deriving first and second order codes through an iterative analysis that identifies potential patterns and only continues conducting additional interviewing until saturation is reached (Strauss and Corbin, 1998; Edmondson and Mcmanus, 2007; Gioia, Corley and Hamilton, 2013).

3.1 Sample Selection and Collection

We opted for targeted sampling because the phenomenon of interest has only recently emerged and the number of research subjects available for the sampling strategy is limited (Eisenhardt, 1989b; Edmondson and Mcmanus, 2007). Between March and August 2020, we sampled 21 interviewees from DIUs in Germany and Switzerland. An overview of the industries, role, length of interview, and organization size is shown in Table 1. The average interview duration was 51 minutes and the interviews

were conducted in German or English due to preference of interviewee. All interviews were transcribed and translated into English. Five of our interviewees held management positions supervising the DIU. The other 15 were DIU employees who had to report their activities to upper management from different backgrounds and functions within the DIU. The interviews followed a semi-structured interview guide, which was adapted constantly as emerging categories in the analysis informed further data collection (Eisenhardt, 1989b; Gioia, Corley and Hamilton, 2013). The interview guideline was structured into five consecutive parts. We started by introducing our research endeavor. Participants were then asked to give us an overview of the DIU, their own role, and the DIU's overall goals and strategy. Then interviewees were asked to describe specific projects and activities they were involved in, and how they measure and report them. Finally, we asked participants whether they felt that there were any specific factors that they felt either helped or hindered them in their endeavors.

ID	Industry	No. Employees	Role of Interviewee	Country	Length of Interview (min.)
IA	Pharma	>100.000	Business Transformation Manager	GER	52
IB	Pharma	>50.000	DIU Lead	GER	57
IC	Pharma	>100.000	Innovation Manager	GER	58
ID	Insurance	>10.000	Business Development Manager	GER	38
IE	Pharma	>50.000	CTO	GER	32
IF	Insurance	>10.000	Business Development Manager	GER	35
IG	Pharma	>50.000	CIO	GER	34
IH	Consumer Goods	>5.000	DIU Lead	CH	121
II	Mobility	>10.000	Business Development Manager	CH	30
IJ	Energy	>1.000	CEO Office	CH	50
IK	Consumer Goods	>5.000	Director Development Manager	CH	83
IL	Energy	>1.000	Business Development Manager	CH	83
IM	Insurance	>10.000	DIU Lead	CH	100
IN	Insurance	>100.000	Business Transformation Manager	GER	53
IO	Finance	>1.000	Customer Experience Manager	GER	48
IP	Mobility	>50.000	DIU Lead	GER	71
IR	Pharma	>5.000	Business Transformation Manager	GER	46
IS	Pharma	>50.000	Innovation Manager	GER	49
IT	Insurance	>5.000	Business Transformation Manager	GER	36
IU	Real Estate	<500	Innovation Manager	CH	71
IV	Energy	<500	DIU Lead	CH	41

Table 1. Overview Interviewees.

3.2 Data Analysis

In order to provide *"rich descriptions of new phenomena"*, we analysed our qualitative data following the grounded theory approach (Wiesche *et al.*, 2017, p. 686). We coded passages of interest in the transcribed interview data with first order codes and derived second order themes following the Gioia methodology (Gioia, Corley and Hamilton, 2013). An overview of the structure is given in Figure 1. For the analysis we pursued a step-wise approach including, as recommended, multiple grounded theory procedures (Wiesche *et al.*, 2017, p. 686). We started with open coding, deriving initial codes inductively, as our phenomenon of interest (i.e. DIUs) and their context are rather new and emergent. Each interview was analysed by one researcher first.

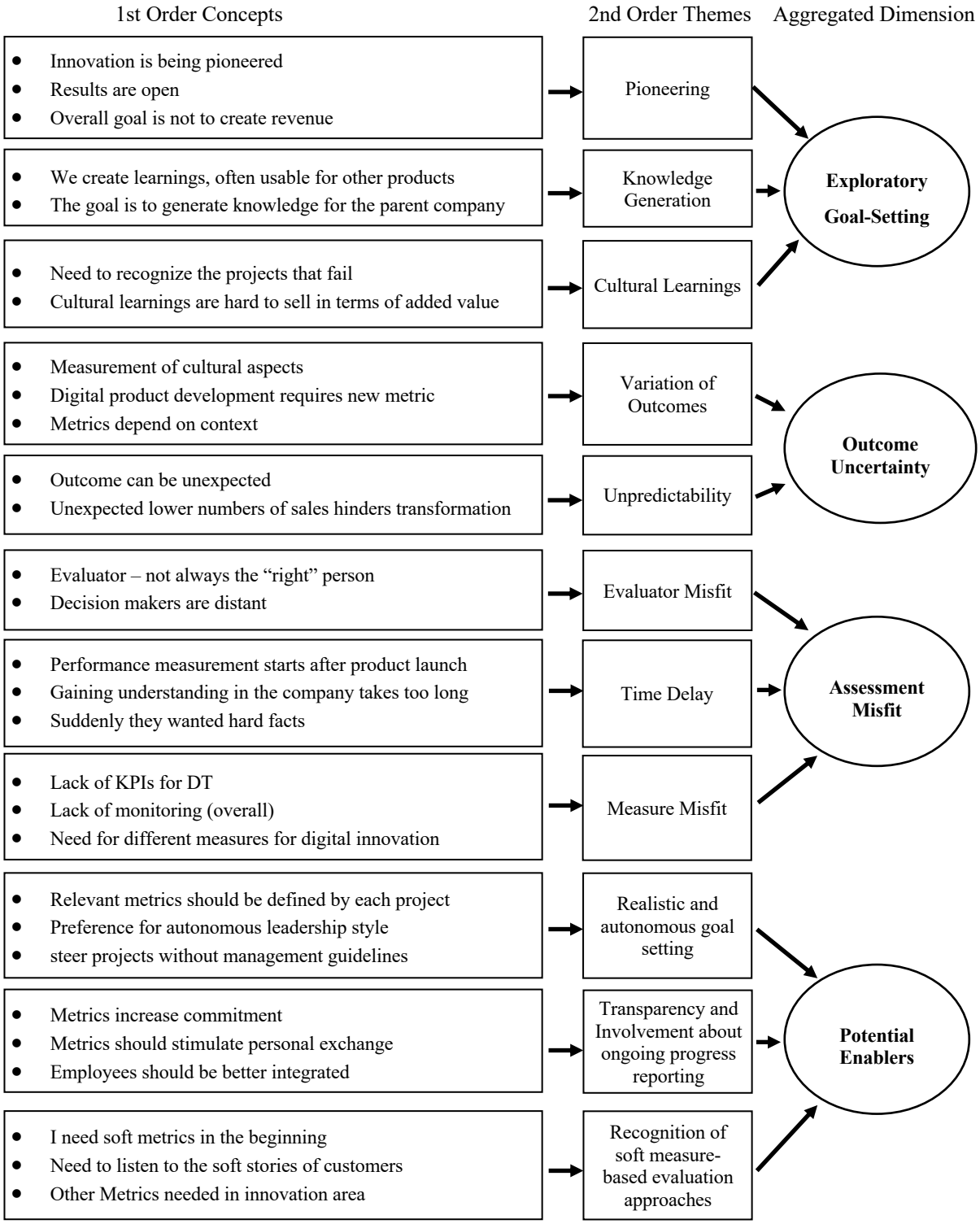

Figure 2. Data Structure.

To enhance the validity of our study, and to avoid subjective interpretation (Strauss and Corbin, 1998; Gioia, Corley and Hamilton, 2013), a second researcher validated the coding. We applied axial coding, where we reduced and clustered our codes based on insights from the principal agent theory and the broader performance management literature. In addition, the coding scheme was iterated multiple times based on an in-depth discussion within the research team to provide a rigorous analysis, including constant comparison (the process of comparing the results between the different units of analysis).

4 Results

Our analysis allowed us to identify three barriers that hinder the reduction of information asymmetry between the main organization and the DIU, namely 'exploratory goal setting', 'outcome uncertainty', and 'assessment misfit'. We understand barriers as encompassing decisions, behaviours, processes, or events that impede information exchange between the DIU and the main organization, thus increasing information asymmetries. In addition, we identified 'potential enablers', which support information exchange between the DIU and the main organization in the given context. We call them potential because we noticed a difference between barriers and enablers. In the case of barriers, participants often described real experiences, whereas in the case of enablers, participants articulated wishes or assumptions far more often than real events. We therefore find that the label potential enablers more adequately captures this theme. The following section first describes the three barriers and the related sub-themes in more detail, alongside the different phases of innovation activities in DIUs. We also identified differences in the timing of the barriers' emergence. The goal-setting and therefore the barrier 'exploratory goal setting' seems to occur early on in the process, sometimes even before the project has started. However, it does not end there, because if the goal is not clarified at the beginning, the assessment of potential outcomes may appear to be random as they might not fit the (assumed) goal. The barrier 'outcome uncertainty' becomes most prominent during the innovation process as soon as the first results are achieved. Assessment misfit, as described under exploratory goal setting, is closely connected to earlier steps, but appears foremost in the later stages or even after the innovation process when management asks for outcomes to be presented. We explain each barrier by contrasting the main organizations' expectations and objectives with those of the DIUs. Based on this, we explain the effect of the barriers on information asymmetry. For each barrier we then show an enabler which reduces the information asymmetries between the two different parties.

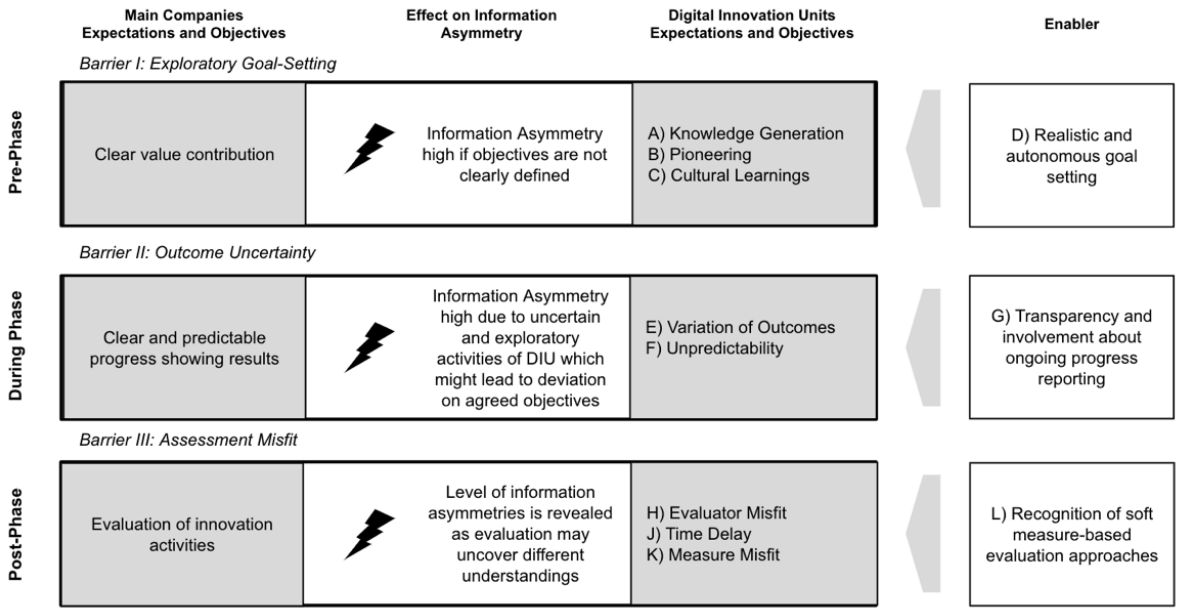

Figure 3. Themes influencing Information Asymmetry Reduction.

While in the beginning, we intended to distinguish between representatives from the main company as a principal providing resources and the DIU representatives as an agent that acts on behalf of the main company, our data revealed that this is an oversimplification. In our synthesis, we did not find any difference between the principal's and the agent's perspective on the individual level. Rather, we discovered that depending on the situation, people can act as either principals or agents (e.g. an Innovation Manager in a DIU acts as a principal towards their team but as an agent when they need to report to their superior in the incumbent firm).

4.1 Pre-Phase: Barrier I - Exploratory Goal Setting

The first barrier that was identified occurs in the early phases in which DIUs pursue innovation activities. When it sets up a DIU, the main company expects it to make a clear value contribution. Our data from the DIU's perspective revealed that the precise definition of a clear objective is critical for managing the expectations between the DIU and the main organization. Especially the first phase of initiating and developing new products is accompanied by many different intentions and goals within the DIUs. Interviews stressed the importance of A) Knowledge Generation, B) Pioneering, and C) Cultural Learning as key in early phases, yet they report difficulties when it comes to their performance being assessed. Our interview data enables us to describe these difficulties in greater detail. An overview of representative quotes per sub-theme is displayed in Table 2.

Interviewees stressed, for example, the importance of a DIU transferring new knowledge or information about new market developments to the company. One interviewee mentioned that it is the task of the DIU to find answers to open questions that may affect the entire industry. This allows the DIU to share new market insights with the company and thus provide value (A1). The generated knowledge can also be very valuable to the overall progress of the DIU as it could be applied to other projects and products, before being assessed in terms of performance (A2). In addition, one participant stated that they are already exploring new ideas, but need more freedom to do this more intensely (A3). Another interviewee emphasized the importance of 'pioneering' by looking beyond financial metrics and highlighting the importance of trying out new things that are valuable for the company (B1). The theme of Cultural Learnings points in a similar direction. For example, one participant mentioned that it is important to recognize the value of failed projects as this is also crucial to the firm's success (C1). Another participant described the immense value of cultural aspects that are developed during projects but are very difficult to sell as a high-performance outcome (C2). All in all, data reveals that the goals for such early innovation activities are very intangible and difficult to capture, which is why they are often not defined before innovation activities are started. This contrasts with later stages of development where the performance of an MVP or prototype can be measured more easily by metrics (e.g. funnel metrics for online services).

Exploratory Goal Setting	
Theme	**Representative Quote**
A) Knowledge Generation	A1: "It is our task to do the homework of the corporate group. It sounds silly, but there are many open questions in our industry we have to face in the next few years. And it is our task to provide knowledge about this. So, we gather insights on the market and share these with the group." (ID) A2: "For us, there are also learning effects applicable to other products. And this learning effect is very important for our work. […] For example […] when we were able to shed a new perspective on a new topic where everyone was shouting that it will kill us. And we went out and explored and tested and forged our own opinion." (ID) A3: "Business development involves exploring, but in our project we can already try it out to a certain extent, but in reality we don't have enough space for it."(IO)
B) Pioneering	B1: "… Innovation is not about financial KPIs, it is about pioneering." (IJ) B2: "We do not work based on sales. We are in a sense a Research and Development Department. As a cost-center, it is not our task to show the financial profit of our activities." (ID)
C) Cultural Learnings	C1: "We measure the number of Pilots and MVPs per year. That shows how much has been experimented. The success rate will always be low. But there is an inherent value in trying out new things. From a psychological perspective, it is important to also recognize the projects that have failed." (IM) C2: "Firstly, you have concrete project results that you can use if you are lucky. But there is another second, more important thing, the cultural aspect. But that one is hard to sell." (IB)

Table 3. Data supporting interpretations of Exploratory Goal Setting.

While many interviewees stressed the difficulties of setting goals in these early stages, our data suggests that a realistic and rather autonomous approach for DIUs mitigates the effect of the identified barrier. DIUs often prefer a high degree of autonomy, especially when it comes to Realistic and Autonomous Goal Setting. Some, for example, do not receive instructions from management and tend to work quite independently, which they prefer (D1). One participant reported that he only gives general directions and enjoys having people working more autonomously in their teams (D2). From a main company perspective, one practitioner explained that it is an advantage to define KPIs yourself and that this should also trigger a questioning of which KPIs are really relevant for each case (D3).

Potential Enabler for Exploratory Goal Setting	
Theme	**Representative Quote**
D) Realistic and autonomous goal setting	D1: "We do not get any directions from management. We define hypotheses and define target values ourselves." (II) D2: "I like to have autonomous people. I just want to give a broad direction." (IH) D3: "It is of advantage to define the KPIs yourself. You should ask yourself every time, which KPIs are even relevant for us?" (IJ)

Table 4. Data supporting interpretations of Potential Enabler for Exploratory Goal Setting

4.2 During Phase: Barrier II - Outcome Uncertainty

The second barrier was identified while DIUs pursued their innovation activities. While DIUs have initiated different activities, often actually running these activities required to pivot direction which resulted in different outcomes. Thus, we identified 'outcome uncertainty' as a barrier, which refers to what is measured and how predictable these outcomes are. Within this barrier, we found the two themes of E) variation of outcomes and F) unpredictability. Representative quotes for each theme are displayed in Table 3. Project activities vary widely, making it difficult to use a standardized set of metrics across projects and leading to a scattered landscape of specified measures (E2). Activities in such phases can vary considerably, so if quantifiable measures are applied, they are valid only for one project, and not comparable to other endeavors (E1). Outcome unpredictability seems to be another challenge. Participants reported the occurrence of unpredictable outcomes, which is desirable for their innovation work, but difficult for the implementation of metrics. For example, in the first initiation and development phase, results may vary due to the exploratory nature of such efforts. One interviewee mentioned the use of Design Thinking at such an early stage of a project and explained in detail how his team started with a particular problem, which eventually ended up in an area that he could never have predicted in advance (F2). Another interviewee explained how an internal transformation process got stopped quite quickly when sales numbers decreased, which was also an unexpected outcome (F1).

Outcome Uncertainty	
Theme	**Representative Quote**
E) Variation of Outcomes	E1. "These are more likely to be quantifiable specifications, based on which we can then really evaluate: "Yes, we have now made it", or not. But they only apply to one project." (IC) E2: "We already measure [it]! But the metrics and very dependent on the specific context." (IH)
F) Unpredicta-bility of Outcomes	F1: "They look at the numbers and see that sales in this area decreased. And then we get cold feet to renavigate. […] And therefore, we end up continuing in the same way as we always have. We close it [Note: refers to the DIU being shut down]." (IA) F2: "It's hard to say that because, the design thinking process causes you to rethink and rethink and rethink as you're going through every stage. So it's quite possible that you may end up with a completely different set of requirements than you started off with." (IG)

Table 5. Data supporting interpretations of Outcome Uncertainty.

In terms of how DIUs could deal with outcome uncertainty, we created the theme 'transparency and involvement about ongoing progress'. Here, participants expressed the great desire for more direct participation, since e.g. several layers of reporting create a lack of transparency (G1). But they also see some potential for the use of metrics, as a higher level of commitment can be created in the team if everyone knows why and on the basis of which information certain decisions are being made (G2). One participant reported a desire for more personal interaction, which should be triggered by performance measurement monitoring systems, to place greater emphasis on learning (G3).

Potential Enabler for Outcome Uncertainty	
Theme	**Representative Quote**
G) Transparency and involvement about ongoing progress reporting	G1: "One problem is that all the reporting steps result in lesser transparency, what exactly got reported. It would make more sense to involve me directly in the decision making." (IL) G2: "The commitment for the team is fostered in this way." (IH) G3: "The platform [for measures] should not just be a database, but allow personal interactions. So that we can learn from each other." (IK)

Table 6. Data supporting interpretations of Potential Enabler for Outcome Uncertainty.

4.3 Post Phase: Barrier III - Assessment Misfit

In the last phase of the innovation activities DIUs often need to present the results of their activities and are assessed by representatives of the main company. In this last phase, the high information asymmetry often became apparent, resulting in a barrier that we termed 'assessment misfit' and which consisted of the subthemes H) evaluator misfit, J) time delay, K) measure misfit. First, DIUs describe difficulties with the person who evaluates their performance. Second, evaluation problems may also arise from a delay between the moment in time when the main organization has started the DIU and its related activities, the timing of the evaluation and of the measures being applied, and when it makes sense for the results to be measured. Finally, a general lack of metrics for the exploratory phase is also a great difficulty for DIUs. An overview of representative quotes for each sub-theme of the Assessment Misfit is displayed in Table 4.

One difficulty in assessing the actions of DIUs in the early phase stems from a misalignment between the goal and the assessor's expectations. One participant described that the CFO is only interested in the financial factors of the DIU and is therefore the wrong person to evaluate innovation-related pioneering activities (H1). Another described the challenges between centralized and decentralized decision-making in large organizations. Sometimes, decisions are taken by central management driven by the financial performance of entire regions, such as the EMEA region, but lacking knowledge about conditions in local markets (H2).

Barrier III: Assessment Misfit	
Theme	**Representative Quote**
H) Evaluator Misfit	H1: "For [the CFO] the broad KPI reporting is not really exciting. He is a CFO and therefore a finance guy. The CFO is actually the wrong person to check that." (IJ) H2: "The senior gentlemen sat down together and that is basically a problem when you are dealing with such global organizations. [After Germany, the next larger regional layers are DACH, and then EMEA]. They [EMEA] just look at things very differently. Germany is a very specific market and sometimes a very difficult market for players like [our company], which were partly steered by EMEA in directions where [we locally] said "yes, that doesn't make any sense at all." (IA)
J) Time Delay	J1: "No, actually we don't (measure the exploration). So, we start monitoring only once the product is live." (IF) J2: "Whether that will be implemented in 3 or 5 years is so far away." (IT)

	J3: “This is precisely the point, that too few things had been requested. Yes, presented on a qualitative level. But I also found that difficult. And at one point, it came around relatively quickly, and then it was upon us all of a sudden. We have now discovered that you could make a few million, and [only] then they would look at it.“ (IN)
K) Measure misfit	K1: “There are and there were no KPIs, none that were set for everyone. And certainly not for Design Thinking.” (IC) K2: “Well, we thought about it anyway. But I would say that we haven't really found any [appropriate] measurements.” (IA) K3: “The topic [classical measurements] actually threw us back the most.” (IR)

Table 7. Data supporting interpretations of Assessment Misfit.

The next challenge is the time delay between investment and measurable innovation outcomes. One interviewee mentioned that they do not collect any performance measure data before they go live with a product (J1). This means that no measurement mechanisms are in place to assess the actions taken in the early phase. Others describe a time delay of 3-5 years between investments, market readiness, and potential final success (J2). As projects are often evaluated at least annually, this time lag, especially when only hard metrics are applied after a product launch, could mean that there is no way to assess the value of early innovation activities. In addition, one participant explained that in the beginning they were not asked for any metrics but only for qualitative ones. Then, suddenly and, without any warning, hard facts in the form of financial data were requested (J3). The DIU could not provide these as no mechanism for such monitoring had been implemented in the setup phase. This is emphasized by DIUs reporting a general lack of measurement strategy in the early phase of exploration. Our participants explained that the measurements that were used in DIUs during the innovation process can be clustered into financial or customer-oriented metrics, and both types were mainly applicable only after the introduction of a solution into the market. Examples for financial measurements include Gross Margin, Operating Costs, Earnings before interest and taxes (EBIT), Average R&D Burn, Turnover per active User, Net Present Value (NVP), Return on Investment (ROI), New Sales. Examples for customer-oriented measurements include the Net Promoter Score (NPS), the Customer Satisfaction Score (CSAT), Conversion Rate or the Number of Interactions with Customers. However, when working with methods such as Design Thinking, interviewees reported a general lack of KPIs (K1). One participant described how they intended to use measurements for their DIU, but did not find any relevant or appropriate ones (K2). In one instance, classical measurements were named as the one thing that hindered the DIU most in their work (K3). Regarding potential enablers, we found a high desire for the recognition of soft measure-based evaluation approaches. DIUs need them especially in the early stages (L2), as they see the hard measures just as one part of the larger picture when it comes to performance (L1). One participant for example would like the board to recognise customer stories as important (L1). Furthermore, some interviewees were able to present metrics such as Employee Satisfaction and also relied on showing artifacts like a Business Model Canvas or a Persona prove their activities.

	Potential Enabler for Assessment Misfit
Theme	**Representative Quote**
L) Recognition of soft measure-based evaluation approaches	L1: ” That [hard measures] is just part of the bigger picture. You definitely need to show the board the soft measures, such as stories from a customer who likes the product.“ (IM) L2: “Principally, we need soft KPIs in the beginning.”(IL)

Table 8. Potential Enabler for Assessment Misfit.

5 Discussion

To answer our research question of identifying factors that enable or hinder the reduction of information asymmetry between the main company and the DIU, we proposed a framework with three main barriers and potential enablers. We discuss our findings in the next two paragraphs.

Reducing information asymmetries between the main company and a DIU: Current research has pointed out that unclear objectives (Raabe *et al.*, 2020b) and a misalignment between the DIU and the main organization (Mayer, Haskamp and de Paula, 2020) can seriously impede the success of DIUs. Our findings advance the understanding of the problem by using the concept of information asymmetries to show where and how this misalignment frequently occurs. We find that even in environments of high uncertainty, the clear definition of targets and objectives and their tracking along the innovation process is essential for the success of the DIU. While innovation activities are inherently defined by high uncertainty, which frequently requires pivoting, a close and trustworthy working relationship between the DIU and the main company is required for being closely aligned in terms of the DIU's objectives and the expectations placed upon it. Concerning the usage of PMS for doing so, existing research would argue that especially in these uncertain environments, PMS can help to reduce information asymmetries between different stakeholders (Henri, 2006; Lambert, 2006) and provide guidance (Merchant and Van der Stede, 2007). This reasoning would also be supported through PAT Theory. Thus, one would expect to find a positive effect of PMS on reducing information asymmetries (Olson, Walker and Ruekert, 1995; Lambert, 2006; Schermann, Wiesche and Krcmar, 2012). However, our data suggests a different answer. In our study, DIUs did not experience PMS as reducing asymmetries, because the adopted PMS seems to be in conflict with the exploratory goals of such endeavors and the high outcome uncertainty of the innovation process. This conflict is often revealed rather late, when the actual assessment (Assessment Misfit) of the DIU's activities take place. The ability of a PMS to reduce information asymmetries seems to be very dependent upon the specific design of the chosen performance measurement instruments. In DIUs where the company relied on specific metrics (ROI, EBIT, etc.) information asymmetries were not reduced, and DIU representatives felt that these instruments (metrics) do not properly represent their activities and value contribution. In cases where both sides – the DIU and the main company - were able to agree on performance management tools (such as metrics and qualitative indicators) that could provide insights into the DIU's actual activities, an information asymmetry effect occurred. A possible explanation could be the timing of different PMS instruments being applied. As the barriers seem to appear in different phases of the innovation process, traditional PMS seems to only make sense in later stages. Thus, the PMS approach might be contingent on the type of innovation phase, and different control approaches may be required for different kinds of innovation activities (Ylinen and Gullkvist, 2014).

Steering DIUs and their exploratory activities: In practice, multiple types of DIUs have been established which defer on the specific goal and setup (Barthel *et al.*, 2020; Raabe *et al.*, 2021). While factors such as physical proximity to the main organization may be decisive in their setup, they also have implications for the governance and steering of the DIU. Our findings suggest that based on the organizational setup of the DIU, different ways of steering and exchanging information between DIUs and the main organization are necessary. While existing project management tools and metrics may be suitable for DIUs that are positioned closer to the main organization, these approaches may be counterproductive for DIUs pursuing more radical innovation endeavors (Ylinen and Gullkvist, 2014). However, our findings reveal that many DIUs, irrespective of the nature of their activities and their objectives, are often benchmarked on standard financial measures and metrics. While our data did not give specific insights into why this is the case, some interviewees came up with the explanation that management representatives simply adopted metrics that they are familiar with from other contexts. This points towards management representatives being unable to switch mental models when assessing exploratory or exploitive activities of the organization (Bedford, Bisbe and Sweeney, 2019). Looking at the activities and objectives that DIUs perform (Raabe *et al.*, 2021), DIUs foster innovation, cultural transformation and change in organizations. While for innovation, many standardized techniques and frameworks (e.g. Balanced Scorecard for Innovation) are available to report and exchange information with different stakeholders, finding appropriate metrics and frameworks that help to convey the impact of transformation and change in organizations seem to be hard to come by (Jöhnk *et al.*, 2019; Kiselev and Winter, 2020). This is especially the case when DIUs deploy popular agile innovation methodologies such as Scrum and Design Thinking in their daily work environment (Fuchs, Barthel, Winter, *et al.*, 2019; Barthel *et al.*, 2020). From their characteristics, such methodologies rely on shorter time cycles,

more iterative processes and predefined roles (Brenner and Uebernickel, 2016; Fuchs, Barthel, Winter, *et al.*, 2019). While for Scrum and other agile methods, performance measurement methods (see for example the GQM Model (Basili *et al.*, 2007; Schlauderer and Overhage, 2013; Boerman *et al.*, 2015; Tuulikki, Laine and Korhonen, 2019)) have been developed, this has rarely happened for early innovation activities which DIUs pursue such as Design Thinking (Rauth, Carlgren and Elmquist, 2014).

6 Conclusion

To conclude, this study investigates the factors that hinder or enable PMS in DIUs, and that can reduce the information asymmetry between the main company and the DIU. We answered our research question by providing rich descriptions of three barriers and potential enablers which contribute insights on how information asymmetries between the DIU and the main organization occur and what role PMSs play in reducing or fostering information asymmetries (Barthel *et al.*, 2020; Mayer, Haskamp and de Paula, 2020; Raabe *et al.*, 2020b). This also advances our understanding of how to manage and assess the impact of digital innovation in organizations in early innovation phases (Koen *et al.*, 2001; Fichman, Dos Santos and Zheng, 2014; Berghaus and Back, 2017; Hund, Drechsler and Reibenspiess, 2019). In discussing these findings, we highlight two issues that emerge and which have implications for practitioners and academia alike. For practitioners, our findings point to the importance of defining clear objectives when setting up a DIU and of developing mechanisms for enhancing transparency about the DIU's innovation activities. In terms of knowledge contribution, our findings challenge the effectiveness of PMS for early innovation activities, and we strongly encourage the exploration of new mechanisms that can be used to reduce information asymmetries between DIUs and their main company. In terms of limitations, although our study investigated the perspectives of both sides, i.e. the main company and the DIU, it might nevertheless be necessary to consider the perspective of the DIU or the main organization in greater detail. Indeed, the barriers we identified are barriers for the reduction of information asymmetries, but not necessarily barriers that the DIU faces in pursuing its own objectives. Furthermore, our data revealed more insights about barriers than enablers. While we present a first set of enablers for specific barriers, further research is necessary to clarify how to improve the information exchange between the two parties. For example, future research could look more specifically on the metrics that are used based on specific types of DIUs. Additionally, some of the major parameters in our study are the specific characteristics of the DIU such as age, country and industry. Our analysis was based on a small sample size of companies in Switzerland and Germany, which did not focus on one industry but rather allowed for a wider perspective. This therefore allows only for a limited and cautious generalization to other contexts, especially those differing in terms of, for example, social, cultural, or economic factors, and thus requires further investigation. Industry-specific elements were also not considered in this study. Further research might want to consider these different characteristics, and develop a taxonomy, grading system or specific requirements for different DIUs.

Acknowledgment: We kindly thank Céline Stalder for her support in gathering data and the Hasso Plattner Design Thinking Research Program for funding our research generously.

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