

Embedding Digital Innovations in Organizations: A Typology for Digital Innovation Units

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Abstract. Embedding digital innovation into existing organizational structures poses a critical challenge to many established companies across all industries. One option that has drawn increased attention lately is the implementation of dedicated digital innovation units. However, it is yet unclear, how these units are designed to fit their specific objectives. Therefore, we develop a typology for these digital innovation units, identifying different types based on the objectives and respective design option patterns of these units. To do this, we follow a qualitative-empirical research approach, covering 23 real world instances of digital innovation units. We employ the loose-tight-coupling perspective as a theoretical lens to interpret and classify the observed design choices. We contribute to literature by identifying three ideal types of digital innovation units and provide insights for practitioners on how to set up this specific type of organizational units.

Keywords: Digital Innovation, Digital Innovation Units, Typology Development, Loose-Tight-Coupling

1 Introduction

Few topics have been discussed by academia and practice as intensively as the radical changes caused by digital technologies and resulting digital innovation. The successful development and implementation of innovations related to digital products, services, processes, and business models is no longer solely relevant for firms from technology-centric industries, but essential for companies across all industries [1-4]. Therefore, being able to continuously innovate in the digital space becomes a central organizational capability [4]. While innovating has always been a challenging task for organizations, the specific properties of digital innovation require a dedicated consideration. For example, we see a shift in innovation agency, getting redistributed and potentially more diverse with several organizational units engaging in innovation activities [1, 5]. Consequently, studying these units appears to be highly relevant.

Research in the area of digital innovation so far has covered the topics of enablers [4], organizational capabilities [6], activities [3], and management roles [7]. However, there is still a lack of understanding *how* digital innovation can be embedded into established organizations, thus allowing them to continuously generate and integrate

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digital innovation. An approach that has been increasingly adopted by organizations in recent years is the introduction of dedicated organizational units that are responsible for the ideation, development, and integration of digital innovation in organizations [8, 9]. In the following, we refer to these units as digital innovation units (DIU). So far, literature regarding DIUs is sparse. Some authors refer to the activities of DIUs, however a characterization of these units is rarely done in detail [7, 10]. Fuchs et al. [11] developed a taxonomy of DIUs, however they focused on the description and did not analyze suitable design options, for example based on fitting means-ends-relations. Insights regarding combinations of objectives, design dimensions, and underlying mechanisms appear to be crucial for understanding how DIUs *are* designed and for advising on how they *should be* designed to fulfill their respective purpose. This gap in knowledge regarding underlying mechanisms and types of DIUs is sought to be narrowed with this study. We argue that DIU objectives are determined as the generation and implementation of different types of digital innovation. To pursue these objectives, different design options for DIUs are possible. As we seek to understand the *means-ends-relationship* between objectives (*ends*) and design options (*means*), we formulate two research questions (RQs):

RQ1: *How can DIU types be differentiated by their objectives?*

RQ2: *How are DIUs designed to create a fit to the given objective?*

To answer these research questions, we develop a typology of DIUs. This typology aims to demonstrate the different objectives of DIUs and the unit designs that are applied to achieve the respective objective. The typology's dimensions are derived from literature and the underlying mechanisms are explained through the lens of loose-tight-coupling (LTC). To identify the relevant DIU types and designs, we employ a qualitative approach building on 23 case studies. We contribute to digital innovation research by offering an initial typology of DIUs and by systematically demonstrating how organizational design can support the embedding of digital innovation in established firms.

2 Underlying Concepts

2.1 Digital Innovation

We follow Nambisan et al. [1] and define digital innovation “as the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology” [1, p. 224]. This definition comprises innovation outcomes with an internal (organizational) focus, e.g. process innovation, as well as outcomes with a primarily external (market) focus, such as product, service, or business model innovation [1-3]. Digital innovation outcomes are thereby constituted by the combination of two artifacts, an innovative digital solution and a complementary business concept, thus involving technological and organizational dimensions of change [3, 4, 12]. Corresponding, either possibilities offered by new digital technologies, and/or new business requirements can be drivers of digital innovation [4].

Digital innovation research in the context of organizations ranges from corporate entrepreneurship [13] to management roles [7], and organizational capabilities [4]. We especially want to tie in to research on the organizational embedding of digital innovation [3] and innovation agency [1]. We follow the research agenda to focus on the innovation process instead of the innovation outcome as demanded by Fichman and colleagues [2]. Also, as asked by Kohli and Melville [3], we shed light on the relation between the organizational environment and activities of the innovation process. This process does include a range of activities: initiation, development, implementation, and exploitation [3]. These activities do not occur in a vacuum within firms. They are embedded into existing structures, strategies and cultures, are shaped by these and in turn shape the organization itself [2, 3]. Therefore, understanding how digital innovation activities are embedded into organizations is crucial for innovation research.

When taking the perspective of an organization and its decision on how to embed innovation activities in their organizations, an important factor is whether innovations target an organization's existing business/operations, or whether they aim to establish markets new to the company [14]. Digital innovation is applied to both, the extension and change of the existing offer and processes of an organization, or to access completely new markets and ways to operate [1, 3].

2.2 Embedding Digital Innovation in Organizations

The question how to best integrate innovation activities in an organization is a long-lasting challenge. Especially in the context of digital transformation, embedding of innovation poses a significant challenge to organizations. Well-established, traditional businesses that are not "born digital" often struggle with "keeping the lights on" in the existing core business while at the same time committing resources to develop digital innovation [10, 15]. As the application of new (digital) technology creates both, change and inertia, it is argued that digital innovation potentially needs to be decoupled from the organizational logic it seeks to transform [13], e.g. by setting up autonomous organizational units for digital innovation [16, 17]. Intruding effects between the core organization and the innovative unit are sought to be minimized this way [16-18]. It is assumed that this structural separation and the resulting higher degree of freedom fosters creativity and the creation of new knowledge [17].

For example, Kaltenecker et al. [19] demonstrate how companies utilize independent teams to develop cloud related innovation. Likewise, Ebers [10] describes autonomous organizational models for discontinuous innovations based on the example of the development of SAP HANA. However, besides such individual examples, we know little about appropriate organizational design options for embedding digital innovation. Existing research has leaned towards the concept of ambidexterity in order to examine these design options [10, 11]. Ambidexterity describes an organization's ability to exploit existing business models while at the same time exploring new opportunities, which makes them overall more successful in fostering innovation [20]. One central mechanism to achieve this ambidexterity is via LTC [18, 20]. This concept is used as a lens to understand how organizations manage

the tension between designing an organization for exploration and exploitation. This way, new insights regarding the organizational embedding of digital innovation are sought to be gained.

2.3 Digital Innovation Units

DIUs are currently strongly discussed and applied in practice as one approach to embed digital innovation in established organizations [8, 9]. Literature suggests that digital innovation may be embedded in separate organizational units [10, 19]. These units face a reduced socio-technical complexity, helping them to scale development of digital innovation [12, 13]. Therefore, 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 [11]. However, there is relatively little in-depth knowledge regarding the design of these units. Existing typologies in the field of innovation rather focus on the innovation outcome itself [e.g. 21] or do not provide in-depth details on the configuration of respective organizational units in the context of digital innovation [e.g. 14]. An initial proposal for a taxonomy of DIUs presented by Fuchs et al. [11] offers more detailed insights regarding the units' configuration and bundles existing dimensions from previous research relevant to the context of organizational units such as DIUs. Therefore, we build on this taxonomy to analyze DIUs and to identify DIU types.

2.4 Loose-Tight-Coupling as Theoretical Lens

The question how loosely or tightly innovation activities are coupled to the core organization is crucial. Taking LTC as a theoretical lens can help us to understand how organizations handle contradictions such as simultaneous exploration and exploitation [22]. Coupling refers to the strength of the connections by which organizational units are linked and is constructed by several design dimension that contribute to either loose or tight connections [22]. Loose coupling is considered to lead to a relative autonomy of units and a higher ability to adapt to a dynamic environment [20, 22]. It is further deemed to foster experimentation and protect minority influence from being overridden by the organization's majority [20, 22, 23]. On the contrary, tight coupling refers to a high degree of dependency and relatedness of different organizational units [20, 24].

The LTC concept has been widely applied in the fields of information systems and innovation before. For example, Yoo et al. [5] explain developments related to distributed innovation using LTC. Ravichandran [25] investigates the relationship between e-business initiatives and the core organization based on LTC. Similarly, Dixon et al. [15] employ LTC to describe dynamic ambidexterity in the context of digital business. More general in the field of innovation, LTC has been used to investigate ambidextrous organizational design [20] and to examine the relation between organizational adaptive capability and firms' innovativeness [26].

Considering research on innovation there is an ongoing discussion on how loose or tight coupling fosters innovativeness. In general, innovation is associated with loose

coupling as it enables companies to search for new markets and technologies, adjust and reconfigure organizational structure and management, and quickly explore new knowledge [23, 26, 27]. However, authors also have argued that tight coupling fosters innovativeness as it allows the leveraging of existing resources for innovation activities [18, 25]. Tight coupling is also seen as a solution to balance the tension between new initiatives and the core organization [25, 28]. As both, loose and tight coupling mechanisms have been described as potentially beneficial for innovation activities, a simple answer is not sufficient. Consequently, we apply the LTC lens for our research on DIUs without a premise regarding their effect on digital innovation activities. Instead, we draw on this concept to understand the relational mechanisms between DIU objectives (*ends*) and DIU designs (*means*).

3 Research Method

3.1 Typology Development Approach

The terms of taxonomy and typology have both been applied in the context of classification and are partly even used interchangeably [29, 30]. However, a typology may offer further theoretical insights supplementary to the rather descriptive classification of topics offered by a taxonomy [30]. Doty and Glick [30] portray a typology as a “unique form of theory building” [30, p. 230], because essential criteria of a theory can be met by a typology. This includes a) the identification of constructs, b) a relationship between these constructs, and c) the possibility to disprove the relationships as well as the included constructs [30]. Consequently, developing a typology can spark intriguing theoretical insights besides the descriptive classification of a phenomenon. In this paper, we aim for a typology that offers a theoretical benefit to the classification of DIUs. More specifically, we not only aim to identify different types of DIUs but also to characterize their composition based on a set of dimensions and to offer an explanation for the relationship between DIU objectives and DIU designs.

Overall, a typology “is generally multidimensional and conceptual” [29, p. 4] and encompasses two distinct kinds of constructs. First, there is the *ideal type*. Ideal types “represent holistic configurations of multiple unidimensional constructs” [30, p. 233]. Such ideal types are theoretically founded abstractions to examine empirically observed real world cases and whether and how much these cases differ from the ideal form [30, 31]. Second, a typology contains so-called *first-order constructs*. These represent unidimensional building blocks or *dimensions* that are “used to describe each ideal type in the theory” [30, p. 234]. In terms of the intended typology of DIUs, we aim to identify possible different ideal types of DIUs that consist of multiple dimensions, whereas these dimensions show different compositions in the characteristics of the dimensions.

Bailey [29] explains that a typology may be achieved *inductively*, starting with “empirical clusters [...], and then subsequently formulating conceptual labels for them” [29, p. 32]. For our research approach, such an inductive strategy is

appropriate, because the conceptual state-of-research in the field of DIUs is still underdeveloped. In contrast to that, firms in practice are already implementing, running, modifying, and assessing DIUs in their everyday organizational life.

Concluding, practice is ahead of theory in the field of DIUs, which is why we employ an inductive strategy to develop a typology of DIUs. Here, we start with an empirical assessment of real-world DIUs and subsequently derive conceptual and theoretically founded ideal types of DIUs. We build on the taxonomy of Fuchs et al. [11] to ensure a sound conceptual underpinning of our developed typology. For the empirical part of the typology development, we rely on a qualitative multiple case study research approach.

3.2 Case Study Research Approach

We select a qualitative-empirical case study research approach to explore the contemporary and highly complex real world phenomenon of DIUs which does not possess the advantage of an already established literature basis [32, 33]. More specific, we select the case study research approach from Eisenhardt [34]. The inductive process explained by Eisenhardt [34] aims at building theory from case studies which is in line with the argument that a typology can be closely related to theory and that a typology can offer additional theoretical insights besides the classification of a phenomenon. In addition, we employ a multiple-case study design, because the cross-comparison of a bigger set of cases is required to identify first order constructs (dimensions) and ideal types, and thus derive an overall typology of DIUs [33].

Overall, we conducted 23 case studies. We selected the respective firms purposefully in a two-step process [35]. To start with, we followed a criterion sampling logic and chose firms that had an already established DIU. Additionally, we employed a theoretical replication logic to generate contrasting results by selecting heterogeneous firms [33]. Consequently, the 23 case study firms differ with regard to size, industry, and design of DIUs. An overview of the sample is shown in Table 1. The data collection took place from 01/2018 – 07/2019. We collected data from 12 units specifically for this study. Additionally, we utilized existing data on 11 units that was collected as part of previous studies (marked with an asterisk * in Table 1). We conducted between one and three interviews per case, whereas all interview partners had detailed knowledge of the DIUs of their firms. All interviews were acquired through the professional networks of the authors. The interviews were conducted face-to-face or via telephone and lasted between 35 – 90 minutes. We employed a semi-structured interview guide with open-ended questions encompassing sections about a) the digital transformation of the organizations, b) the activities with regard to digital innovations, c) the history and current status of the DIUs, and d) the overall activities of the DIUs. All interviews were recorded and transcribed verbatim [36]. This primary data was triangulated by secondary data including information from firm websites, press releases, management reports, etc. We used ATLAS.ti to gather, store, and analyze our data [33, 36].

For our data analysis, we followed a two-step approach, for which we divided our overall sample of 23 cases into a training set of seven cases and a testing set of 16 cases.

Table 1. Overview of the sample (training & testing cases)

Case	Industry	Employees Total (2018)	Revenue (2018)	Employees DIU	Interviews by Position (Manager/Employee)
Training Case Set					
Alpha_1	Household Appliances	≈ 61,000	≈ 13 bn. €	≈ 15	1/1
Alpha_2				≈ 150	1/1
Beta_1	Retail	≈ 62,000	≈ 21 bn. €	≈ 20	1/1
Gamma_1	Insurance	≈ 900	≈ 0.6 bn. €	≈ 10	1/1
Delta_1	Automotive	≈ 30,000	≈ 22 bn. €	≈ 25	1/1
Delta_2				≈ 125	1/1
Epsilon_1	Autom. Aftermarket	≈ 600	≈ 0.07 bn. €	≈ 5	2/0
Testing Case Set					
Zeta_1	Automotive	≈ 299,000	≈ 167 bn. €	≈ 80	1/0
Eta_1	Banking	≈ 49,000	n.a.	≈ 150	1/1
Theta_1	Telecommunication	≈ 9,000	≈ 7 bn. €	≈ 100	1/0
Theta_2				n.a.	1/0
Iota_1	Machinery	≈ 7,000	≈ 1 bn. €	≈ 75	1/0
Kappa_1*	Chemical	≈ 112,000	≈ 63 bn. €	≈ 5	3/0
Kappa_2*				≈ 25	3/0
Lambda_1*	Plant Engineering	≈ 14,000	≈ 3 bn. €	≈ 15	1/0
My_1*	Instrumentation	≈ 13,000	≈ 3 bn. €	≈ 10	1/2
Ny_1*	Sanitary	≈ 6,000	≈ 1 bn. €	≈ 45	2/0
Xi_1*	Banking	≈ 216,000	n.a.	≈ 35	1/1
Omikron_1*	Automotive	≈ 91,000	≈ 59 bn. €	≈ 10	1/0
Pi_1*	Machinery	≈ 3,000	≈ 0.4 bn. €	≈ 25	2/0
Rho_1*	Tools	≈ 3,000	≈ 1 bn. €	≈ 20	1/1
Rho_2*				≈ 5	1/1
Sigma_1*	Equity	≈ 14,000	≈ 4 bn. €	≈ 15	1/0

In the first step, we applied a two-cycle coding approach. The first cycle followed a deductive logic, where we coded the seven training cases according to the dimensions and characteristics of the existing taxonomy of Fuchs et al. [11]. Furthermore, our LTC research lens guided us in this step, allowing us to specify individual dimensions derived from the taxonomy. The second cycle followed an inductive logic, enriching the existing taxonomy with empirical insights from our data. Based on the coding results, we adapted the initial taxonomy. Thereby, we eliminated, aggregated, and rephrased dimensions of the taxonomy. The adapted taxonomy, which we rely on in the following, is depicted in Table 2 [41]. We used this adapted taxonomy and

clustered the training cases according to the dimensions. This clustering was performed by three researchers independently, whereas noticeable differences in the classification were discussed collectively and resolved consensually [36]. Thereby we concluded that distinct combinations of dimensions related to the DIU objectives were best suited to differentiate between ideal types. To offer a better overview, we printed all required components and physically classified the cases on an office wall. We also prepared digital reflections of the seven categorized cases. This enabled us to hold the training cases against each other and identify overall three ideal types.

Table 2. Adapted taxonomy

Category	Dimension	Characteristic				
What? Objective & Scope	Innovation Orientation	Purely Internal	Primarily Internal	Balanced	Primarily External	Purely External
	Market Focus of Innovation	Existing Business Areas			Novel Business Areas	
	Scope of Innovation Process	Idea Generation	Idea Selection	Innovation Development	Innovation Implementation	Innovation Commercialization
How? Setting & Design	Embedding	Executive Department		Line Organization	Separate Legal Entity	
	Collaboration	External Cooperation	None	Irregularly	Standard Working Mode	
		Internal Ties	Core Organization Integrated		Regular Liaison	Sporadic Liaison
	Projects	Project Selection	Order	Mixed	Autonomously	
		Location	Onsite	Mixed	Offsite	

In the second step, we applied a deductive coding approach to the 16 testing cases, based on the adapted taxonomy. This allowed us to compile fact sheets for these 16 cases. By means of these fact sheets, we assigned each of the cases to one of the three ideal types identified in the first step. Finally, we compared the case classifications to verify the ideal types of DIUs identified in the first step. This also enabled us to derive specific DIU designs related to the three DIU types.

To conclude, with the first step of our data analysis we provided a frame of three DIU ideal types based on seven training cases. With the second step, we validated these types with the 16 testing cases and enriched the picture with the related DIU designs.

4 Results

4.1 DIU Types

We assigned the 16 testing cases to the three ideal types according to their distinct set of objectives. In the following, the three ideal types are presented in detail.

Type 1 – Internal Facilitator. Ideal type 1 are units that mainly deal with innovations concerning the internal organization, such as business process

innovations. This results in a focus on already existing business areas or existing business processes, respectively. Therefore, their primary objective is the digital transformation of the existing organization. Occasionally, also product or service innovation can be targeted, but this is only seen as a secondary outcome. These units pursue innovation activities to the extent that they generate and select ideas, develop innovations and return the developed solutions to a specialist department that is responsible for the implementation of innovations. For this reason, this first ideal type is called “Internal Facilitator”. Eta_1, for example, develops, tests, and implements concepts for internal business processes such as in the context of human resources, where new paths for talent recruitment and staff development are explored.

Type 2 – External Enhancer. Ideal type 2 are units that mainly deal with new products and business models and are therefore primarily externally oriented. However, this type focuses on innovations in existing business areas, i.e. targeting existing customer groups. Like type 1 units, they also transform the existing organization, but primarily aim at market offerings and not at internal processes. Type 2 units generate and select innovation ideas and develop prototypes, which then often leave the unit again. Implementation and commercialization of the innovation is usually carried out by other units in the core organization. For this reason, this second ideal type is called “External Enhancer”. Rho_1, for example, develops personalized digital services for their B2B customers, enabling them to identify purchasing requirements early on, thus optimizing their tool ordering and storage processes.

Type 3 – External Creator. Ideal type 3 are units that deal with new products, services, and business models and are therefore externally oriented. In contrast to type 2, this type focuses on innovations in novel business areas, targeting new customer groups and thus creating new business opportunities. Often, these units cover the whole innovation process, starting with idea generation and selection - and in contrast to type 1 and 2 – ranging to the implementation of developed solutions. In some instances, the innovations are also commercialized by the unit itself. For this reason, this third ideal type is called “External Creator”. Kappa_1, for example, develops a mobile app to match users with local automotive workshops for arranging repair services. The accompanying business model is independent from the company’s core business but fits to the overall ecosystem.

A summary of the classification can be found in Table 3. These ideal types do not cover all combinations of DIU objectives that are theoretically possible and still correspond to our definition of DIUs. Hybrid types, e.g. units that put an equal weight on internal and external innovation and extreme forms, e.g. units that solely pursue internal innovations do exist. We did however not focus on these types, as they do not represent ideal types.

Table 3. Assignment of cases to types

Type	Training Cases	Testing Cases
Type 1 – Internal Facilitator	Gamma_1, Delta_1	Eta_1, Theta_2, Kappa_2
Type 2 – External Enhancer	Beta_1, Epsilon_1	Iota_1, Xi_1, Rho_1
Type 3 – External Creator	Alpha_1, Delta_2	Zeta_1, Theta_1, Kappa_1, Lambda_1, My_1, Ny_1, Omikron_1, Rho_2
Hybrid Types	Alpha_2	Pi_1, Sigma_1

4.2 DIU Designs

We expect that each of the different ideal types has specific design patterns that best fit the respective objective. That does not mean that each unit within one type will have the same design, however we expect to see a design pattern of similar characteristics. These different patterns for each ideal type represent an alignment towards either more pronounced loose coupling or more pronounced tight coupling.

Type 1 – Internal Facilitator. Regarding the design options for type 1, we observed that they were usually embedded as an executive department into the organizational structure. External cooperation is rare, while the ties to the existing organization are strongly pronounced. Projects are partly selected autonomously by the DIU, sometimes the units also carry out the core organizations direct orders. Project execution happens both, inside the premises of the DIU, and at the core organization. Surprisingly, also an instance was observed, where a type 1 unit was set up as a separate legal entity with a higher degree of autonomy. While we cannot evaluate whether this design choice is suboptimal as we do not measure DIU success, it seems at least counterintuitive. An overview of type 1 can be found in Table 4. Darker shaded fields were observed frequently, lighter shaded fields represent individual exceptions.

Coming back to our example Eta_1, employees of the core organization transfer to the DIU and its location offsite for the duration of their projects and work in the agile teams full-time. This shows the existing strong internal ties that are shared by all DIUs of this type. Ideas and respective projects are collected in the core organization, but are managed in the DIU. In contrast, unit Kappa_2 targets the transformation of internal processes but represents a separate legal entity that selects its projects autonomously. Kappa_2 also partly involves external partners in their projects to bring in expertise.

Table 4. Design of ideal type 1

Category	Dimension	Characteristic					
What? Objective & Scope	Innovation Orientation	Purely Internal	Primarily Internal	Balanced	Primarily External	Purely External	
	Market Focus of Innovation	Existing Business Areas			Novel Business Areas		
	Scope of Innovation Process	Idea Generation	Idea Selection	Innovation Development	Innovation Implementation	Innovation Commercialization	
How? Setting & Design	Embedding	Executive Department		Line Organization	Separate Legal Entity		
	Collaboration	External Cooperation	None		Irregularly	Standard Working Mode	
		Internal Ties	Core Organization Integrated		Regular Liaison	Sporadic Liaison	
	Projects	Project Selection	Order		Mixed	Autonomously	
Location		Onsite		Mixed	Offsite		

Type 2 – External Enhancer. Looking at the design of type 2 DIUs (see Table 5), we see that these units are usually embedded as departments into the line organizations but can occasionally also be executive departments. Both, the cooperation with external partners and the ties to the internal organization are considered to be relevant. All of the observed units do develop project ideas autonomously and at the same time initiate projects based on the core organization’s order. Execution of projects mainly happens in the DIU’s premises, but in one case also onsite the core organization.

Referring to the initial example of Rho_1, we see that this unit is integrated into the line organizations and executes projects onsite. Additionally, it collaborates with external partners as well as with the company. It selects ideas itself, but also adopts project ideas from the company. Unit Iota_1 carries out projects exclusively offsite and is managed as an executive department. The unit launches projects ideas both on its own and on order of the core organization. Similar to other “External Enhancer”-units, Iota_1 has strong internal relations but also cooperates with external partners.

Table 5. Design of ideal type 2

Category	Dimension	Characteristic					
		Purely Internal	Primarily Internal	Balanced	Primarily External	Purely External	
What? Objective & Scope	Innovation Orientation	Purely Internal	Primarily Internal	Balanced	Primarily External	Purely External	
	Market Focus of Innovation	Existing Business Areas			Novel Business Areas		
	Scope of Innovation Process	Idea Generation	Idea Selection	Innovation Development	Innovation Implementation	Innovation Commercialization	
How? Setting & Design	Embedding	Executive Department		Line Organization	Separate Legal Entity		
	Collaboration	External Cooperation	None		Irregularly	Standard Working Mode	
		Internal Ties	Core Organization Integrated		Regular Liaison	Sporadic Liaison	
	Projects	Project Selection	Order		Mixed	Autonomously	
		Location	Onsite		Mixed	Offsite	

Type 3 – External Creator. Regarding the design of type 3 units (see Table 6), we found that they are usually set up as a separate legal entity, although we have observed the individual embedding as an executive department. Cooperation with external partners happens regularly. While in theory the distance from the core organization is highest for type 3, the ties to the core organization still play an important role for this type of DIU. Projects are selected independently by the DIU and executed primarily offsite of the core organization in separate facilities of the DIUs.

Coming back to the example of Kappa_1, we see that the unit is a separate legal entity and exclusively carries out projects offsite. It selects projects autonomously and unites external collaboration and strong internal ties. In contrast, Rho_2 is an

executive department and executes projects on- and offsite. It selects projects autonomously and cooperates on a regular basis with the company.

Table 6. Design of ideal type 3

Category	Dimension	Characteristic					
What? Objective & Scope	Innovation Orientation	Purely Internal	Primarily Internal	Balanced	Primarily External	Purely External	
	Market Focus of Innovation	Existing Business Areas			Novel Business Areas		
	Scope of Innovation Process	Idea Generation	Idea Selection	Innovation Development	Innovation Implementation	Innovation Commercialization	
How? Setting & Design	Embedding	Executive Department		Line Organization		Separate Legal Entity	
	Collaboration	External Cooperation	None		Irregularly		Standard Working Mode
		Internal Ties	Core Organization Integrated		Regular Liaison		Sporadic Liaison
	Projects	Project Selection	Order		Mixed		Autonomously
		Location	Onsite		Mixed		Offsite

5 Implications, Limitations, and Future Research

The goal of this work is to clarify the *means-ends-relationship* between DIU objectives (*ends*) and DIU designs (*means*) by shedding light on the underlying mechanisms from a LTC perspective resulting in a typology of DIUs. Following RQ1 – *How can DIU types be differentiated by their objectives?* – we identified three DIU types based on their respective objectives: 1) *internal facilitator*, 2) *external enhancer*, and 3) *external creator*. Subsequently, by answering RQ2 - *How are DIUs designed to create a fit to the given objective?* – we found different design patterns that appear to fit to the different innovation objectives. Concluding, the purpose and design of a DIU are related in such a way that a DIU with a primarily internal innovation focus is also more closely linked to the core organization than a unit whose primary objective is external. Type 1 units such as Eta_1 and Theta_2 are often implemented as executive departments, thus being closely bound to the core organization’s top management. While they have some autonomy regarding project selection, they also act on direct order of the executive board and execute these

projects primarily in the core organization. This design set-up fits their overall objective of transforming the existing organization and their current business areas. On the contrary, type 3 units such as Lambda_1 and Omikron_1 are regularly set up as separate legal entities that strongly rely on external cooperation, select their projects autonomously and work on their own premises. This is consistent with their objective of creating novel business areas, extending the core organization's current operations. Overall, we offer an initial comprehensive and consistent typology of DIUs.

We found that the LTC concept can be helpful to understand underlying mechanisms for organizational set-ups to embed digital innovation. This can be seen by the general relationship between objectives and designs. DIUs that target internal processes (type 1) need to leverage existing organizational resources to successfully perform innovation activities. To utilize these existing resources *tighter coupling* appears beneficial [23]. In contrast, when innovation activities depart from previous operations and business areas (type 3), the value of the core company's existing competencies and assets for new ventures diminishes [25]. At the same time, disturbances and impediments from the core organization on new ventures might increase, when they move further away from existing business [23], thus making *looser coupling* beneficial [25]. Concluding, we find that LTC is not to be understood as a unidimensional concept, but organizations apply a set of different measures to achieve both, loose and tight coupling, however with different weightings depending on the units' objectives, which is in line with LTC literature [22]. This is also reflected in the existence of type 2 DIUs and hybrid units.

By giving an overview of DIU ideal types that is reduced to the essential objectives and design options, we also offer relevant implications to practitioners. First, practitioners can gain an initial overview of existing DIU set-ups. Second, we offer an explanation for the relationship between objective and design of DIUs, thus laying the foundation for decision makers to build on and to implement novel DIUs or adapt existing units. Third, we also give some grounds on which set-ups might be better suited for the respective objectives. By applying the LTC lens to our observations, we can derive the recommendation that decision makers should set up the design of their DIUs in a way that include both, loose and tight coupling elements, according to the DIUs' objective. Given that, a stronger emphasis on tighter coupling is recommended for those units that aim to transform the existing business, whereas an emphasis on looser coupling is better suited to develop novel business areas.

Our findings are not without limitations. All observed units originate from one geographical region but many of them operate worldwide. With our study, we only capture the units' current status, as if the units' designs would be static. However, from the interviews we know that organizations see the units' evolution as a dynamic process and for example deliberately set up units according to type 1 with the aim of developing them to type 2 over time. We cannot capture these approaches with our typology, as we look at features, not processes. Further, we leave aside all DIU design characteristics that we see as a prerequisite for any DIU type (i.e. embedding into corporate digital strategy, top management support etc.), as these characteristics are not helpful to differentiate between types. When setting up a DIU, these aspects

should definitely be addressed. We also do not touch upon more “soft” aspects, such as culture, although we know from the interviews that these aspects are seen as main success factors. In-depth longitudinal case studies could account for some of these shortcomings. This way, researchers could seek to better understand the process of DIU implementation, evolution, and potential reintegration. Also, we did not include any measures regarding the actual success of DIUs. Further quantitative research should investigate which design options statistically increase DIU success. Finally, the observed hybrid types might be worth further analysis as they might represent transitional forms in the evolution between two ideal types.

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