

# Characterizing Approaches to Digital Transformation: Development of a Taxonomy of Digital Units

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**Abstract.** Confronted with the imperatives of an increasingly digital world, organizations are challenged to maintain the exploitation of existing revenue sources while simultaneously exploring novel paths for a digital future. One option to manage this organizational ambidexterity and to foster innovation activities within the companies is to implement digital units. However, although the introduction of digital units has increasingly become common practice for organizations, a high uncertainty about the nature of such units remains. Therefore, we develop a taxonomy to characterize digital units by building on pertinent literature in the fields of digital transformation, organizational ambidexterity, and organizational design. In combination with employing a qualitative-empirical research approach, we contribute to existing literature by offering an initial characterization of digital units and a first empirical application of our taxonomy. We also provide descriptive findings on digital units in practice and offer insights for companies that consider to implement such specific units.

**Keywords:** Digital Transformation, Digital Units, Organizational Ambidexterity, Taxonomy Development, Qualitative Case Studies.

## 1 Introduction

Emerging advancements in information technology (IT) continuously facilitate the development of new digital products, services, and business models [1], [2]. Digital technologies impact markets by increasing their transparency, thus resulting in lowered markets' entry barriers and enhanced competition [3]. Consequently, in such a *digital world*, so far successful business models are threatened to be disrupted by new market entrants, forcing incumbent companies to rethink how business value is created [3], [4].

To remain competitive in such a volatile business environment, companies are urged to continuously renew themselves. Besides other aspects, a constant organizational progress includes the adoption of new technological achievements for the development of digital innovations [5-7]. Thereby, a digital innovation can be understood “as the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology” [8, p. 224]. To enable innovation activities and explore paths for a digital future (e.g., trends such as agile methods [7]),

companies increasingly create specific units, so-called *digital units* [9]. Digital units enable companies to realize organizational ambidexterity. While core organizations focus on operating the traditional business and leveraging existing revenue sources (i.e., *exploitation*), digital units focus on innovation and exploration activities in their search for new revenue sources (i.e., *exploration*). Consequently, digital units represent one vital option for managing companies' digital transformation [5], [9].

Existing scientific literature sparsely touched the specific topic of digital units, but addressed essential aspects of the research field. For instance, literature investigates the influence of digital technologies on the nature of innovations and the innovation process itself [2], [8]. Digital units can also be part of digital transformation strategies (DTSS) that aim to govern the digital transformation of companies from a strategic perspective [10], [11]. Additionally, research addresses the question whether companies need to establish the specific role of a Chief Digital Officer (CDO) [12], [13]. However, current literature lacks research on how to engage and anchor the digital transformation in organizations – besides the introduction of a single management position such as the CDO. With digital units representing one option to structurally embed the digital transformation within companies, the emerging organizational designs appear to be an interesting and current research topic from a scientific as well as practical perspective.

A related research field where the necessity for ambidextrous approaches is already addressed is literature on the restructuring of companies' IT functions. Such *bimodal IT organizations* typically encompass a *traditional IT function*, which is responsible for the operation of companies' core IT systems, and a *digital or agile IT function*, which focuses on digital innovation activities [14], [15]. Whereas Horlach et al. [14] clarify the concept of bimodal IT, Jöhnk et al. [15] develop a taxonomy for agile IT design options. Although this research is akin to the approach of implementing digital units, the topic of bimodal IT and agile IT setups has a distinct perspective focusing on the organizational IT function. However, such an IT-focused lens may miss out on some of the diverse forms of digital units realized in practice (e.g., innovation labs, incubators) [9], [16]. In contrast to this focus on the IT function and the related IT ambidexterity, we aim to employ a broader lens that captures the digital innovation activities in light of the entire company and considers approaches to realize organizational ambidexterity.

Although scientific literature discusses important aspects of the fields of digital transformation and bimodal IT, empirical research focusing on the specific issue of digital units and their establishment in companies is still sparse. Therefore, we aim to contribute by developing an initial understanding of what digital units are and how they can be characterized. It appears fruitful to start with a descriptive approach and build initial knowledge in a novel research field [15]. Consequently, we can provide a theoretical basis for future research that examines digital units through an explanatory lens. We derive as a guiding research question: *How can digital units be characterized?*

To answer this question, we aim to develop a taxonomy of digital units. This taxonomy shall reflect pertinent organizational design options of digital units as they are realized in practice. The taxonomy's frame is initially derived from literature by deducing relevant categories. These are then revised and broken down into dimensions and corresponding characteristics based on observations of real-world digital units. To examine these units, we employ a qualitative approach by compiling five case studies.

## 2 Underlying Research Foundations

### 2.1 Impact of the Digital Transformation

Specific environments require specific *organizational designs*, for example in times of rapid technological change [17]. The implications of an ongoing digital transformation for markets and companies (e.g., products, business models, operations) reach beyond resource digitization and process automation by means of IT [1], [5]. Consequently, the digital transformation resembles an *IT-enabled organizational business transformation* [18], [19] that can be interpreted as a specific environment which necessitates a unique organizational design such as the implementation of digital units.

It may also be of interest to examine whether the implementation of a digital unit in an organization is part of a holistic DTS [11]. This refers to the origin of digital units and represents a specification whether the units' implementation results from a top-down plan or emerges bottom-up from individual initiatives [20].

### 2.2 Digital Transformation and Organizational Ambidexterity

Organizational ambidexterity describes the ability of companies to be successful in competing in mature markets while at the same time exploring new markets with flexibility and experimentation [21], [22]. These challenges of ambidexterity can also be transferred to the digital transformation context. Companies need to, for instance, invest in the development of innovative digital business models (i.e., exploration), while at the same time operating their (mostly) non-digital core business (i.e., exploitation) [23]. A prominent approach to achieve organizational ambidexterity is the alteration of the companies' *organizational design* by means of creating separate units for exploration and exploitation [24]. These units are not only structurally separated, but also differ with regard to, for instance, competencies and processes [22], [24]. Exploratory units, such as digital units, typically show higher degrees of freedom and autonomy from the core organization and allow companies to escape the inertia of existing business operations and organizational structures [24], [25]. Accordingly, the creation of separate units in the context of the digital transformation can be observed in practice and sparks organizational units such as innovation labs and incubators [12].

### 2.3 Understanding the Organizational Design of Digital Units

To examine how digital units can be characterized, we consider design parameters that determine organizational units. As a result, we assume that organizational units require 1) an *objective*, 2) *resources*, and 3) a *structure* to exist within companies [26], [27]. The objective describes the purpose for which the units are created and represents the central determinant for the overall design. This is especially true for units that are designed for a specific purpose, such as in the case of digital units [27]. Subsequently, units require resources to be capable of operating. Besides the financial resources, organizational units also need access to human resources, since the personnel's skills,

knowledge and experience are a critical determinant of the effectiveness of units [26], [28]. Additionally, there is also a need for structure, both in the internal (inside the organization) and external (outside the company) function of organizational units [28].

## 2.4 Practical Approaches to Digital Units

Practitioners have made initial efforts to characterize digital units. For instance, the consulting company eventure offers a differentiation into four types: innovation labs, company builders, incubators, and digital units [16]. The main differences are whether the innovation activities happen within (e.g., innovation lab) or outside of the core organization (e.g., incubator). A similar categorization is offered by Ramus and Velten [29] referring to innovation labs, company builders, accelerators, and incubators. There also exist more fine-grained categorizations that use several layers to define various types of digital units. For instance, Sindemann and von Buttlar [9] separate between digital innovation units (e.g., innovation labs, accelerators) and special forms (e.g., customer co-creation labs, digital venture capitalists). Although these contributions by practitioners are relevant, the proposed characterizations are neither consistent nor theoretically sound. Therefore, we explore the characterization of digital units on a general level without specifying types and thus refer to the general term of *digital units*.

## 2.5 Initial Grasp of Digital Units

To summarize, the specific organizational design of exploratory units, here digital units, represents one approach to address the digital transformation of companies. Based on the discussed research foundations, we derive an initial understanding of such digital units that guides our study and our qualitative-empirical research approach. Consequently, we comprehend digital units as organizational units that 1) primarily focus on *innovation* and *exploration activities* to pave the companies' paths for a digital future, 2) have *secured access* to financial as well as personnel resources, and 3) possess high degrees of freedom within the respective companies to operate *autonomously*.

# 3 Research Method

## 3.1 Taxonomy Development Approach

We develop a taxonomy for the characterization of digital units, because this research approach enables us to offer initial theoretical and empirical insights in an area that is currently predominantly shaped by consulting articles (e.g., [9], [29]).

In our approach, we followed the taxonomy development method proposed by Nickerson et al. [30]. In a first step, it is essential to determine the meta-characteristic of the taxonomy which should “reflect the purpose of the taxonomy” [30, p. 343]. Consequently, reflecting our research question, we defined as our meta-characteristic: *Characteristics of digital units*. Additionally, we assumed that *dimensions* exist that contain a spectrum of coherent characteristics. With the taxonomy development

approach being of iterative nature, it is crucial to define *ending conditions* – distinguished into *objective* and *subjective* – that determine a stop to the iteration cycles. We defined the following objective ending conditions: a) No new characteristics were added in the last iteration, b) no characteristics were merged or split in the last iteration, and c) every characteristic is unique and not repeated. In accordance with prior research [15], we did not follow the objective ending condition that characteristics need to be mutually exclusive. Otherwise, combinations of characteristics would need to be included by means of individual characteristics what contradicts the prerequisite of taxonomies to be comprehensive and parsimonious [30]. Therefore, we allowed for combinations of characteristics within one dimension to portray the nature of digital units. Regarding the subjective ending conditions we built on the suggested conditions of Nickerson et al. [30] (i.e., taxonomy is concise, robust, comprehensive, extendible, and explanatory) and formulated a holistic subjective ending condition. This end was represented by the point where all observed real-world cases could be classified in the taxonomy and where we did not have to implement further alteration in the taxonomy.

Since little data about the phenomenon is available, we followed the recommendation of Nickerson et al. [30] and began with a *conceptual-to-empirical* iteration. Here, we reviewed general literature on organizational ambidexterity (e.g., [22], [23], [25]) and organizational design (e.g., [17], [28]), as well as specific articles on digital transformation (e.g., [11]), and practical contributions on digital units (e.g., [9], [29]) to define a frame for the taxonomy. We searched the literature for elements commonly considered as relevant for characterizing organizational designs in general (e.g., objective of organizational units) and digital units in specific (e.g., possible origin from DTSs). Next, we clustered these elements according to their *thematic fit*, resulting in superordinate *categories*. These categories were then extended and refined in the subsequent *empirical-to-conceptual* iteration by identifying coherent dimensions and corresponding characteristics of digital units.

### 3.2 Case Study Research Approach

For this second, *empirical-to-conceptual*, iteration, we selected an explorative, qualitative-empirical research approach by conducting five case studies on organizations that implemented digital units. Case studies are especially suitable for recent phenomena that should be studied within their real-life context such as the phenomenon of digital units [31]. To increase the study's robustness and enable cross-case analysis, a multiple-case design was selected [31]. We followed a theoretical replication logic to generate contrasting results by choosing diverse cases, thereby enhancing the external validity of the study [31]. Our case selection process was primarily guided by our initial understanding of digital units (see 2.5). We employed a criterion sampling logic and searched for companies that implemented digital units as part of their organizational digital transformation. Additionally, we looked for organizations where the operations of the digital units reached beyond their conceptualization [31]. We identified the manufacturing industry as especially relevant. Respective companies are usually slow to react to the implications of the digital transformation since the mostly non-digital business models are not yet threatened [32].

Our sample consists of five cases that stem from the manufacturing industry, but have distinct areas of operations. Although all companies have a business-to-business focus, they differ in size, experience with and approaches to the digital transformation and their digital units. An overview is shown in Table 1.

Our data collection took place January 2018 – March 2018. We conducted between one and three semi-structured interviews per case. For each case, we aimed to capture the insights of a position responsible for the digital unit (e.g., CDO, head of digital unit) and (if possible) one permanent employee (PE) of the unit. Interviews ranged 45 – 60 minutes and were conducted face-to-face or via telephone. The interviews followed a guide with open-ended questions comprising sections about the digital transformation of the companies, the implementation history of the digital units, and the units’ work processes. All interviews were recorded and transcribed verbatim [33]. We triangulated our primary data by secondary data (e.g., firm websites, press releases) to increase the validity of the study [33]. ATLAS.ti was utilized to pool and analyze our gathered data.

Considering the data analysis approach, we followed a two-step approach. First, two researchers independently evaluated the interviews and jointly condensed the collected data to cases. Secondly, we analyzed the cases in terms of the taxonomy development. Hereby, we followed a descriptive coding approach with codes deduced from the categories (i.e., result of the conceptual-to-empirical iteration). During this second step, codes for the derivation of dimensions and characteristics were inductively added. This step was performed by three researchers independently, whereas significant differences in code application were discussed collectively and resolved consensually [33].

Finally, the resulting taxonomy was employed to classify the digital units of the five case studies. To consistently match statements from our data to the dimensions and characteristics, we defined coding guidelines which we refined in the coding process. All classifications were again carried out by three researchers independently, whereas varying assessments of the units’ characteristics were discussed and resolved collectively. To complement this empirical-to-conceptual iteration, we reached out to our interview partners and presented them the results of our taxonomy development and the characterization of their digital unit. The subsequent discussions only sparked minor alterations in terms of, for instance, wording of dimensions or characteristics.

**Table 1.** Overview of the sample

	<b>Case A</b>	<b>Case B</b>	<b>Case C</b>	<b>Case D</b>	<b>Case E</b>
Focus within Manufacturing Industry	Steel Processing	Machines for Food Industry	Specialty Chemicals	Investment Holding	Tools
Revenue (2017)	≈ 41 bn. €	≈ 3.7 bn. €	≈ 14 bn. €	≈ 3.6 bn. €	≈ 1 bn. €
Employees (2017)	≈ 160,000	≈ 15,000	≈ 36,500	≈ 17,700	≈ 3,000
Foundation Year DU*	2016	2016	2017	2016	2017
Employees DU*	3	≈ 8	30	8	≈ 20
Number/Dates of Interviews	2/01.2018	1/02.2018	2/01.2018	2/03.2018	3/01.2018
Interviewees by Position	· Head of DU · Project Member (Core Org.)	· Head of DU	· CEO of DU · PE	· Project Lead · PE	· Head of DU · Project Lead · PE
*DU is short for Digital Unit					

## 4 First Iteration Cycle: Foundation for the Taxonomy

Reflecting the conceptual-to-empirical iteration cycle, we derived an initial set of categories as foundation for our taxonomy. In this section, we discuss the identified categories against their literature background and in light of digital units.

**Objective & Scope.** As we are concerned with exploratory units, we set a special focus on the digital units' scope in the innovation process [34]. In addition, the orientation of the units' innovation activities – whether they are directed to external markets or to internal organizational improvements – needs to be specified. Owing to the specificity of the digital transformation, organizations with primarily externally directed digital units may also face the decision whether the focus of innovation activities lies on exploring solutions for existing business areas, discovering new markets, or a combination of these two alternatives [4], [5]. Besides innovation activities, there can be further objectives such as the renewal and expansion of existing core competences and the exploration of current management trends [7].

**Staffing & Collaboration.** Staffing of digital units and respective projects is expected to be critical. Deploying employees from the core organization may provide company-specific knowledge and an intra-organizational social network, which can be valuable for integrative activities. Delegated employees of the core organization can also acquire novel digital capabilities and transfer them back to the organization. However, often, not all knowledge and capabilities required for exploratory activities can be found within the company. Therefore, external collaborations may be important and a combination of internal and external personnel appears fruitful [24], [25], [35].

**Funding.** As digital units' projects affect companies as a whole, a logical choice is to offer central funding from the core organization. Digital units would then be cost centers like other support functions, whereas the units' budget is regularly reviewed and the units' heads have to justify spending [25]. A decentralized alternative would be to make different departments provide a share of their budget to the digital units. A third option is that if the units' projects include the commercialization of innovations and thus generate external revenues, it is possible to set them up as profit centers [24].

**Governance & Structure.** The concept of organizational ambidexterity builds on the assumption that exploratory and exploitative units should be separated to be successful [25], [35]. Both objectives can thus be pursued simultaneously in appropriate settings spanning distinct management concepts, organizational structures and even organizational cultures [23]. However, the approaches to achieve this separation and the degrees of freedom the exploratory units have can vary. Therefore, diverse modes for structurally embedding digital units are possible, ranging from their integration in the core organization to spinning them out as separate legal entities [24], [35]. Exploratory units can also be dissolved or re-integrated after a certain time-span [23]. Besides an organizational separation of units, the physical separation of exploratory units (e.g., distinct location from the core organization) has been considered as a relevant measure to shield innovation activities from the constraints and routines of the core organizations [36]. Additionally, the degrees of freedom of digital units are majorly related to the decision-making power of the digital units' management teams (e.g., power over project topics, applied management concepts, or resource use) [25].

**Origins.** DTSs are supposed to coordinate, prioritize, implement, and govern a company’s digital transformation. Next to the changes in value creation, use of technology, and financial aspects, one important element of DTSs is the aspect of structural changes within the organizations. These changes can, for instance, comprise the implementation of a digital unit. Therefore, we consider companies’ DTSs as prevalent origins of digital units, reflecting top-down decisions. Digital units can also emerge from bottom-up initiatives that are later incorporated into a DTS [10], [11].

## 5 Second Iteration Cycle: Refinement and Application of the Taxonomy

In the following, we present the results of the empirical-to-conceptual iteration cycle and thus the developed taxonomy (see Table 2) as well as its application on our cases. This includes the individual description of all five cases as well as a cross-case analysis.

**Table 2.** Taxonomy of digital unit’s characterization

Category	Dimension	Characteristic				
Objective & Scope	Main Objectives	Digital Innovation		Cultural Change		Development of Digital Expertise
	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
Staffing & Collaboration	Staffing (Project)	Digital Unit Employees		Core Organization Employees		External Partners
	Importance of Ext. Partners	None	Low	Medium	High	
Funding	Funding (Project)	Central Funding	Business Department	Sponsorship Model	Internal Cost Allocation	External Revenue
Governance & Structure	Embedding	Integrated	Separate Department	Separate Legal Entity	Virtual	
	Permanent	Yes			No	
	Location	Onsite			Offsite	
	Degrees of Freedom	Very Low	Relatively Low	Balanced	Relatively High	Very High
Origins	Origin from DTS	Yes			No	
	Formation	Top-Down			Bottom-Up	

**Case A.** The digital unit of case A focuses on the development and implementation of digital, digitally enriched and non-digital innovations to explore novel business areas. The unit also aims at accelerating the core organization’s cultural change and at building up and transferring digital expertise to the rest of the company. However, no specific activities are undertaken to achieve these additional goals. The projects of the digital unit are initialized and funded by the core organization’s higher-level managers. Due to this sponsorship model, the digital unit’s degrees of freedom are limited, for



instance, the unit does not decide on its project portfolio. Instead, only projects that are sponsored by the core organization's managers are undertaken. Every six months, the sponsors decide on the follow-up financing of projects based on their market chances. The projects of the digital unit are carried out by employees of the core organization who work part-time in the unit's projects. Thereby, the project teams are guided by the digital unit's managing team. The work on the innovation projects takes place in the premises of the core organization and in the co-working space of the digital unit, which is located offsite. The digital unit of case A is not a separate entity, but is a virtual organization<sup>1</sup> located within the company's internal training unit. Consequently, every six months, the continuation of the digital unit's program depends on the availability of core organization managers who are willing to fund projects. The idea to establish a digital unit was launched bottom-up by two members of the core organization and the decision to implement the digital unit was not taken by the executive management.

**Case B.** The innovation activities of case B's digital unit are limited to the early stages of the innovation development process (i.e., idea generation, selection and prototype development) and focus on existing business fields and the customer side. Additional objectives of the unit include the acceleration of the core organization's cultural change and the acquisition as well as transfer of digital expertise to the core organization. While the former is pursued by conducting workshops, the latter is not pursued by any dedicated activities. Projects to develop innovations are carried out by PEs of the digital unit and employees of the core organization, which are involved part-time in the unit's projects. A central committee consisting of members of the core organization decides on the undertaken projects in the unit. The digital unit is not provided with a budget to carry out projects independently, but instead only approved projects (by the committee) are funded centrally. From an organizational point of view, the digital unit of case B is embedded in the core organization's research and development department, but is physically located offsite in an entrepreneurship center together with other companies. The decision to set up a digital unit was taken at a strategy conference by the organization's board of directors.

**Case C.** The digital unit of firm C engages in a variety of innovation activities. Among these are the development and implementation of novel digital products and services for new markets, the ideation and testing of corresponding new business models, the leveraging of existing business fields by enriching the respective products and services digitally, the acquisition of pertinent start-ups, as well as the investment in digital pioneers. With its work, especially with projects that take place in cooperation with employees of the core organization, the digital unit aims to transfer digital expertise to the core organization. The acceleration of the core organization's cultural change is excluded from the digital unit's objectives, since it is considered as a task of the digital unit's Chief Executive Officer (CEO) in his role as the core organization's CDO. The unit, which is established as a Limited Liability Company (LLC), is provided with an overall budget from central funds, but also has a profit responsibility and thus generates revenue that it can reinvest in its own projects. The digital unit manages its

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<sup>1</sup> In this case, it is an intra-organizational virtual organization that arises due to the task-oriented networking of employees of different business departments.

own project portfolio. Additionally, the unit has co-working spaces in the vicinity of the corporate headquarters and near a branch in China. The digital unit was founded to help the realization of the previously devised DTS of company C. Establishing the digital unit in its existing form was a top-down decision by the executive management.

**Case D.** Company D's digital unit aims to improve internal business operations, advance existing business fields, and explore new markets. Its primary focus thereby is on the development and implementation of new business models. By involving employees of the core organization in the unit's work, the digital unit aims to accelerate the cultural change of and transfer digital expertise to the core organization. In the course of an innovation's development, the responsibility for it is gradually transferred from the unit to the respective business area in the core organization. Consequently, the projects are staffed with members of the digital unit (e.g., project leads), employees of the core organization (part-time), and external partners. The latter serve the purpose of relieving the digital unit's employees of their work and thus enable several parallel projects within the unit. Additionally, the external partners contribute required skills that are not available in the company. Projects are selected by managers of the core organization and digital unit members jointly. With company D being an investment holding, its digital unit is funded like a business department whereas the core organization provides the financial resources for each project. The work space of the digital unit is designed as a co-working space and is located offsite. The digital unit of company D is an LLC. The board of directors initiated the digital unit at the same time as the organization's DTS has been developed and the unit was integrated into the DTS.

**Case E.** Company E's digital unit aims to develop novel digital products and services, enrich existing offerings digitally, and establish new digital business models that are related to the organization's core business. Besides this customer centric focus, further activities target internal process improvements. Affecting the company's cultural change and fostering know-how transfer are defined as additional objectives and the digital unit's employees pursue these goals with dedicated activities such as conducting workshops and trainings. The unit engages in the entire innovation process from idea generation to go-to-market strategies and thus is also responsible for the operation of new digital products and services. As a separate unit with responsibilities for its developed products and services, the digital unit operates on a revenue-based model where the core organization provides fixed budgets and treats the digital unit as a profit center. The projects are mostly staffed with PEs of the digital unit and only a small portion of core organization employees. External support is mostly included for missing skills in the project teams. The digital unit of case E is located at the company's headquarter. The unit acts with relatively high degrees of freedom since it determines the products to develop as well as the corresponding development plans autonomously. The decision to establish the digital unit was part of the organization's DTS.

**Cross-case Analysis.** By comparing our cases, it can be seen that the primary *objective* of all five digital units is the development of digital innovations. Here, the cases vary accordingly whether these innovations are solely externally directed at the targeted markets (i.e., cases A-C) or include the improvement of internal business operations (i.e., cases D and E). The market focus of the case companies differs. Whereas company A solely aims at innovations in novel business fields and

organizations B and E focus on their existing business fields, the companies C and D emphasize innovation activities in both business areas. Almost all observed companies aim to employ their digital units as vehicle to accelerate the organizational cultural change and to foster digital expertise in the core organization. Only company C excludes the cultural change as topic for the digital unit, however, this goal is addressed in the core organization by the CDO. While companies B and E use workshops to foster organizational change, all companies rely on interdisciplinary projects with PEs of the digital unit and members of the core organization to transfer knowledge and digital expertise. In the cases A, B, and D the respective digital units gradually hand over the responsibility of the digital innovations to the core organization and do not participate in the actual operation of the products and services. Only in the case of company E, the digital unit takes responsibility in the commercialization of innovations by developing respective strategies and operating products and services. Owing to its diverse activities, the digital unit of company C also covers the commercialization step of the innovation process by means of acquiring and integrating start-ups and the respective products in the portfolio of the organization.

For *staffing and collaboration* of the digital units' projects, all case companies rely on interdisciplinary project teams consisting of PEs of the digital unit, the core organization, and external partners. Owing to the sponsorship model in case A, the projects are performed by core organization members but guided by the digital unit.

This *funding* model of company A is unique, since most digital units' projects are centrally funded by their companies (i.e., cases B, C, E). Owing to the nature of company D as an investment holding, the implementation of the digital unit as a business department enables agency within the diverse structures of the company.

Considering the *governance and structures* of the digital units, all digital units with the exception of the ones of company A and E are exclusively located outside the organizations' headquarters and are designed as co-working spaces. Owing to six-months funding cycles of case A's digital unit, it has to be interpreted as the only non-permanent option. Besides the virtual organization of the digital unit at company A, we found diverse structural embedding of digital units across the cases. Whereas the digital unit of organization B is integrated in the research and development department, the units of companies C and D represent separate legal entities manifested in their status as LLCs. The digital unit at company E is also a separate department, however still legally integrated in the core organization. Albeit these diverse structural embedding options, we cannot derive a direct link between the structures and the degrees of freedom that the units possess. For instance, the integrated digital unit at company B does not possess significantly less autonomy than the two LLCs. Since both digital units at company C and E operate as profit centers and generate own revenues by means of the commercialization of their innovations, these units enjoy higher degrees of freedom, for instance by independently deciding on their project portfolios.

In four of five cases the digital units are part of a *DTS* and were installed on basis of a *top-down decision*. Only the digital unit of company A is not part of the company's DTS. Although other companies (i.e., case D) integrated the already existing digital units in their DTS, the digital unit of case A still lacks a board-level decision which also reflects its bottom-up nature. An overview of our findings can be seen in Table 3.

**Table 3.** Overview of the cross-case analysis

Dimension	Case A	Case B	Case C	Case D	Case E
Main Objectives	Innovation Cultural Change Digital Expertise	Innovation Cultural Change Digital Expertise	Innovation Digital Expertise	Innovation Cultural Change Digital Expertise	Innovation Cultural Change Digital Expertise
Innovation Orientation	Purely Ext.	Purely Ext.	Purely Ext.	Primarily Ext.	Primarily Ext.
Market Focus of Innovation	Novel Business Areas	Existing Business Areas	Novel / Existing Business Areas	Novel / Existing Business Areas	Existing Business Areas
Scope of Innovation Process	Idea Generation – Innovation Implementation	Idea Generation – Innovation Development	Idea Generation – Innovation Commerc.	Idea Generation – Innovation Implementation	Idea Generation – Innovation Commerc.
Staffing (Project)	Dig. Unit Emp. Core Org. Emp.	Dig. Unit Emp. Core Org. Emp.	Dig. Unit Emp. Core Org. Emp. Ext. Partners	Dig. Unit Emp. Core Org. Emp. Ext. Partners	Dig. Unit Emp. Core Org. Emp. Ext. Partners
Importance of Ext. Partners	Low	None	Medium	High	Medium
Funding (Project)	Sponsorship Model	Central Funding	Central Funding Ext. Revenue	Business Depart.	Central Funding Ext. Revenue
Embedding	Virtual	Integrated	Sep. Legal Ent.	Sep. Legal Ent.	Sep. Depart.
Permanent	No	Yes	Yes	Yes	Yes
Location	Onsite / Offsite	Offsite	Offsite	Offsite	Onsite
Degrees of Freedom	Balanced	Balanced	Relatively High	Balanced	Relatively High
Origin from DTS	No	Yes	Yes	No (Now Integrated)	Yes
Formation	Bottom-Up	Top-Down	Top-Down	Top-Down	Top-Down

## 6 Implications, Limitations, and Future Research

We contribute to literature by providing a theoretically sound and empirically derived taxonomy for the characterization of digital units. Referring to our research question – *How can digital units be characterized?* – we initially characterized digital units as organizational units that 1) primarily focus on *innovation* and *exploration activities*, 2) have *secured access* to financial and personnel resources, and 3) possess high degrees of freedom within the respective companies to operate *autonomously* (see 2.5).

Referring to characteristic 1), we found that digital units can also have the purpose to support the cultural change of the core organizations and to build up and transfer digital expertise. However, their main focus is on developing and implementing digital innovations for customer markets. These activities can aim to expand existing business fields or explore novel business areas. In light of characteristic 2), all but one observed digital unit (i.e., case A) have secured financial funding for their projects and a stable embedding in the structures of the core organizations. We found that the digital units' projects are typically interdisciplinary staffed with members from the unit and from the core organization. The importance of external partners varied widely across the cases, allowing no general statement. Considering characteristic 3), we found empirical evidence that puts the originally derived high degrees of freedom into perspective. Although most observed digital units were located offsite, only two units (i.e., cases C and E) can, for instance, autonomously direct their project portfolios, whereas the

projects of the remaining digital units are either entirely determined by (i.e., cases A and B) or jointly with the core organizations (i.e., case C). This can be attributed to the observation that almost all digital units result from top-down decision and are integrated in organization-wide DTSs. Therefore, it is appropriate to state that digital units operate autonomously *within* the organizational scope that is given by the companies.

Consequently, we define digital units as organizational units with the goal to foster the organizational digital transformation by 1) performing innovation and exploration activities in existing and/or novel business areas. Digital units 2) possess a structured organizational embedding and a secured access to financial resources, 3) conduct projects together with the core organization, 4) act autonomously within the given scope, and 5) are part of company-wide strategies addressing the digital transformation.

Considering practical implications, on basis of our taxonomy, managers can observe the possible design options for establishing digital units within their organizations. Our data shows that there are diverse setups enacted in practice and we could not identify an overall best practice to establish a digital unit. Instead, responsible managers need to purposefully evaluate their companies' specific requirements and implement digital units accordingly. Thereby, it is important to note that our derived dimensions and thus the respective characteristics are not entirely independent from each other. For instance, an interdisciplinary staffing with members of the digital unit, core organization's members and external partners can foster the development and transfer of digital expertise. Additionally, the selected funding option of the digital unit's projects has implications for its degrees of freedom. A sponsorship model, for instance, limits the opportunity for the digital unit to manage its own project portfolio. However, the implementation of a digital unit as a profit center seems only expedient if the unit can, for instance, decide on undertaken projects and has the opportunity to commercialize its innovations. Also, central funding can lead to conflicts between executive management's rather short-term goals to the digital unit's mid- to long-run profitability.

Our findings are not without limitations. Although we followed the guidelines for the development of a taxonomy rigorously [30] and refined our insights on basis of qualitative data, we cannot guarantee that we captured all categories, dimensions, and characteristics to define digital units. In addition, our empirical findings are derived from large companies located in the manufacturing industry with a business-to-business focus, thus limiting the overall generalizability of our results. Therefore, capturing small and medium-sized companies as well as organizations from different industries and with diverse business focuses may spark further insights for the taxonomy. However, as demanded by literature [30], our taxonomy is extendible in regard to further categories, dimensions, and characteristics. Additionally, although we refer to possible connections of various dimensions and respective characteristics, we do not thoroughly investigate the relationships between certain dimensions and characteristics. Therefore, this appears as a fruitful approach for future empirical research on digital units' characterization. Also, in contrast to existing consulting articles (e.g., [9], [29]), we do not derive archetypes of digital units that follow a specific categorization in terms of our developed taxonomy. The development of such a typology requires additional empirical data applied on our taxonomy. Such archetypes of digital units may also potentially be used as blueprints for establishing digital units.

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