Digital Innovation Units as a Vehicle for Innovating Incumbent Firms:
A Nexus for Digital Innovation Management

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Abstract

Motivation: VUCA (volatility, uncertainty, complexity, and ambiguity) is a commonly used moniker to describe the current state of the world, characterizing (1) situations in which novel phenomena appear perpetually and capriciously and (2) novel and multifaceted challenges that incumbent firms face arising from these phenomena. Recently, digital transformation has emerged as such a novel phenomenon. As firms operate in a VUCA world permeated with and vigorously influenced by digital technologies, digital transformation induces digital technologies to define or redefine a firm's value proposition. Managing digital transformation in general poses crucial tasks with high opportunities that confront incumbent firms with a variety of involute ways to address. However, many firms have failed to implement such a setting or have overlooked the desideratum of change and have been ineluctably disrupted by (incipient) competitors. The challenges that firms face may further constitute and promote novel innovations, engendering novel technological and organizational phenomena. Digital innovation units (DIUs) portray such phenomena. DIUs are dedicated organizational units that represent a potential vehicle or nexus for the ideation, development, and integration of digital innovation in organizations. However, despite the increasing popularity of establishing DIUs in practice, no existing research has described the phenomenon of DIUs or provided formalized guidance on their design and setup. In particular, knowledge about their internal organization, structures, processes, or their interaction with and integration within the main organization is scarce.

Research Design: This dissertation takes a cumulative research approach and follows the phenomenon-driven design science research approach that integrates design science research (DSR) and phenomenon-driven research (PDR). It provides an amalgamated and holistic perspective of knowledge utilization and contribution over the course of a research process that commences with the initial observation of a novel phenomenon. The phenomenon-driven DSR approach contains five enhanced activities of PDR, accentuating their utilization, contribution, and refinement of Ω and/or Λ knowledge, which falls traditionally into the DSR realm. The publications included in this dissertation have been meticulously set along each activity of the research approach to answer the overlying research goal of gaining a better understanding of situating DIUs in the main organization to drive and foster (digital) innovations across the whole organization. The phenomenon-driven DSR approach utilizes several research methods, including literature reviews, qualitative-empirical analyses, taxonomy development methodologies, and propositions for defining design principles. To evaluate the design theories and design entities

contributed herein, this dissertation sketches three evaluation activities (two ex-ante episodes as well as one ex-post evaluation episode) via qualitative-empirical interviews and literature reviews.

Results: This dissertation contributes descriptive Ω and prescriptive Λ knowledge on DIUs, introduced as knowledge chunks precisely positioned along the activities of the phenomenon-driven DSR approach. The Ω knowledge contributed to the human knowledge base entails, in particular, knowledge on the nature of DIUs, including archetypes, objectives, areas of activity, integration mechanisms, and addressed types of digital innovations. Λ knowledge entails design theories, which includes four overarching meta-requirements as well as eleven design principles for DIUs. This dissertation also contributes design entities in terms of good practices and a taxonomy to the human knowledge base as Λ knowledge. As knowledge about suitable research approaches is also part of Λ knowledge, this dissertation also contributes the phenomenon-driven DSR approach to the human knowledge base.

Contribution: This dissertation makes several theoretical and practical contributions. First, along with the partly isolated knowledge chunks made within each activity of the research approach, this dissertation highlights three major contributions: (1) Demystification: "White-Boxing" DIUs and Their Nature, (2) DIUs Interaction with and Integration within Incumbent Firms, and (3) DIUs and Incumbent Firms being in a Constant Flux. By highlighting DIUs and bringing the phenomenon to the center of attention, this dissertation describes how they are established and situated in the main organization over time and makes further implications for digital innovation management in incumbent firms. The three major contributions address diverse multi-layered levels: within a DIU, at the level of the core organization (integration through novel digital products and processes; internal diffusion), to current and incipient markets (external diffusion through novel business models), and over time. Furthermore, incumbent firms and their DIUs are circumvented by sundry digital innovation ecosystems accentuating vigorous interactions with different customers, suppliers, competitors, etc. These multi-layered levels evince the high socio-technical complexity of this dissertation. On the one hand, these levels show the arduousness of establishing and situating DIUs within incumbent firms over time. On the other hand, the contributions within these layers help to manage, reduce, and even avoid these high complexities. These contributions to DIU research are considered and perceived as utilizable since they incentivize scholars conducting Information Systems (IS) research to deepen the emerging phenomenon of DIUs and adjacent research streams. By publishing one of the first peer-reviewed articles

addressing DIU archetypes, their integration mechanisms, and their lifecycles, an incipient community of DIU research has been framed, which is steadily growing. This research has spurred IS research by introducing the concept of DIUs as a nexus or vehicle for conducting digital innovation management within firms.

Second, as this dissertation highlights DIU structures, potential integration mechanisms in firms, and addresses the shift from an intraorganizational toward an interorganizational ecosystem perspective, it has several managerial implications that may guide practitioners in (1) establishing and positioning DIUs in firms as well as in (2) refining currently established DIUs. These mechanisms termed greenfield (1) and brownfield (2) approaches lead incumbent firms toward deriving a DIU strategy to drive and foster digital innovation.

Limitations: This dissertation faces some limitations rooted in the research design, the phenomenon-driven DSR approach, and its evaluation, which abbreviates the rigor and relevance of the results. Owing to this dissertation's vigorous utilization of qualitative-empirical analyses, the interpretation of data might be derived predicated on personal biases and the researcher's opinions, which constrain objectivity. The multitude of different names for DIUs elevates another constraint, especially during the structured review of the literature. Despite including a wide range of utilized DIU terms in the search queries, there are certainly many more utilized in the research literature that would have further refined the results. The applied research approach encompasses further constraints. Despite the many opportunities to conduct research with this plenarily novel approach, some limitations already described in DSR apply to this research approach. Research is conventionally triggered predicated on diverse starting points that focus, for example, on a concrete problem or project, which makes it context-specific. Although this dissertation strived to maximize projectability and fitness by conducting several formative and summative evaluation episodes with experts for applicability proof, the contributed and refined knowledge chunks on DIUs and their situating in incumbent firms lack an opportune real-world application, such as implementing a DIU in a genuine scenario-setting within an incumbent firm, which reduces the level of confidence. A further limitation comprises quantifying the usefulness of DIUs. Although the research highlights and introduces indicators for quantifying a DIU's efficacy, it has been deliberately omitted, due to the arduousness of quantifying the performance of innovations in general.

Future Research: This dissertation yields multiple avenues for future research that could examine the collaboration of multiple concurrent DIUs and further collaborations with novel founded ventures. The connection between DIU research and the adjacent research

streams is cutting edge and incentivizes further investigations. Further research on shaping the IT function beyond bimodal or trimodal IT constructs, such as agile unimodal or multispeed approaches, and analyzing the role of DIUs within such a setting may be promising. Moreover, future research should analyze the temporal and contextual factors of DIUs including whether DIUs are a worldwide phenomenon or just a European phenomenon that is inapplicable to other regions. Furthermore, as no application of the knowledge chunks, for example, in terms of an action design research project, has taken place in a genuine scenario setting, it may be fruitful to demonstrate and validate the phenomenon-driven DSR methodology, DIU good practices, digital accelerator taxonomy, and/or the contributed meta-requirements and design principles.

Keywords:
Digital Innovation Units, Digital Innovation Management, Digital Transformation.

Kurzfassung

Motivation: VUCA (Volatilität, Ungewissheit, Komplexität und Mehrdeutigkeit) ist ein häufig verwendeter Begriff, um den aktuellen Zustand der Welt zu beschreiben, der (1) Situationen, in denen neuartige Phänomene ständig und unvorhersehbar auftreten, sowie (2) neuartige und vielschichtige Herausforderungen für etablierte Unternehmen, die sich aus diesen Phänomenen ergeben, charakterisiert. In jüngster Zeit hat sich die digitale Transformation als ein solches neuartiges Phänomen erwiesen. Da Unternehmen in einer VUCA-Welt tätig sind, die von digitalen Technologien durchdrungen und stark von ihnen beeinflusst werden, führt die digitale Transformation dazu, dass digitale Technologien das Wertversprechen eines Unternehmens definieren oder neu definieren. Die Bewältigung des digitalen Wandels stellt die etablierten Unternehmen vor entscheidende Aufgaben mit großen Chancen, die sie auf verschiedene Weise angehen können. Viele Unternehmen haben es jedoch versäumt, einen solchen Rahmen zu schaffen, oder sie haben das Desiderat des Wandels übersehen und wurden unweigerlich von der Konkurrenz disruptiert. Die Herausforderungen, mit denen Unternehmen konfrontiert sind, können jedoch neuartige Innovationen hervorbringen und fördern, die zu neuen technologischen und organisatorischen Phänomenen führen. „Digital Innovation Units“ (DIUs) stellen solche Phänomene dar. DIUs sind spezielle Organisationseinheiten, die ein potenzielles Vehikel oder einen Nexus für die Ideenfindung, Entwicklung und Integration digitaler Innovationen in Unternehmen darstellen. Trotz der zunehmenden Beliebtheit von DIUs in der Praxis wurden in der Forschung jedoch weder das Phänomen selbst noch formale Anleitungen zu deren Gestaltung und Aufbau beschrieben. Insbesondere das Wissen über ihre interne Organisation, Strukturen, Prozesse oder ihre Interaktion mit und Integration in der Kernorganisation ist rar.

Forschungsdesign: Diese Dissertation verfolgt einen kumulativen Forschungsansatz und folgt dem „Phenomenon-driven Design Science Research“-Forschungsansatz, der Design Science Research (DSR) und Phenomenon-driven Research (PDR) verbindet. Er bietet eine zusammenfassende und ganzheitliche Perspektive der Wissensnutzung und des Wissensbeitrags im Verlauf eines Forschungsprozesses, der mit der anfänglichen Beobachtung eines neuartigen Phänomens beginnt. Der „Phenomenon-driven Design Science Research“-Ansatz umfasst fünf erweiterte Aktivitäten des PDR und betont deren Nutzung, Beitrag und Verfeinerung von Ω- und/oder Λ-Wissen, das traditionell in den Bereich des DSR fällt. Die in dieser Dissertation enthaltenen Veröffentlichungen wurden sorgfältig entlang jeder Aktivität des Forschungsansatzes positioniert, um das

übergeordnete Forschungsziel zu erreichen, ein besseres Verständnis für die Positionierung von DIUs in der Kernorganisation zu erlangen, um (digitale) Innovationen ganzheitlich voranzutreiben und zu fördern. Im Rahmen des „Phenomenon-driven Design Science Research"-Ansatzes werden verschiedene Forschungsmethoden eingesetzt. Dazu gehören Literaturrecherchen, qualitativ-empirische Analysen, Methoden zur Taxonomieentwicklung sowie Ansätze zur Entwicklung von Designprinzipien. Zur Evaluierung der eingebrachten Designtheorien und Designentitäten werden in dieser Dissertation drei Evaluierungsaktivitäten (zwei ex-ante sowie eine ex-post Evaluierungsepisode) mittels qualitativ-empirischer Interviews sowie Literaturrecherchen durchgeführt.

Ergebnisse: Das Kernergebnis dieser Dissertation ist der Beitrag von deskriptivem Ω- und präskriptivem Λ-Wissen über DIUs, das als Wissensbausteine entlang der Aktivitäten des „Phenomenon-driven Design Science Research"-Ansatzes eingeführt wurde. Das Ω-Wissen, das zur menschlichen Wissensbasis beiträgt, umfasst insbesondere Wissen über die Art der DIUs, einschließlich Archetypen, Ziele, Tätigkeitsbereiche, Integrationsmechanismen sowie angesprochene Arten digitaler Innovationen. Das Λ-Wissen umfasst Gestaltungstheorien, wie vier übergreifende Meta-Requirements sowie elf Designprinzipien für DIUs. Des Weiteren werden Designentitäten in Form von „Good Practices" sowie eine Taxonomie als Λ-Wissen in die menschliche Wissensbasis eingebracht. Da das Wissen über geeignete Forschungsansätze ebenfalls Teil des Λ-Wissens ist, trägt diese Dissertation außerdem den „Phenomenon-driven Design Science Research"-Ansatz zur menschlichen Wissensbasis bei.

Beitrag: Diese Dissertation leistet sowohl theoretische als auch praktische Beiträge. Zum einen entlang der teils isolierten Wissensbausteine, die in jeder Aktivität des Forschungsansatzes erzeugt werden, hebt diese Dissertation drei Hauptbeiträge hervor: (1) Entmystifizierung: „White-Boxing" der DIUs und ihrer Natur, (2) Interaktion der DIUs mit und Integration in etablierte Unternehmen und (3) DIUs und etablierte Unternehmen im ständigen Wandel. Indem DIUs hervorgehoben werden und das Phänomen in den Mittelpunkt der Aufmerksamkeit gerückt wird, umfasst diese Dissertation ihre Etablierung und Verortung in der Kernorganisation im Laufe der Zeit und weitere Implikationen für das digitale Innovationsmanagement in etablierten Unternehmen. Die drei Hauptbeiträge befassen sich mit verschiedenen, vielschichtigen Ebenen: innerhalb einer DIU, auf der Ebene zur Kernorganisation (Integration durch neuartige digitale Produkte und Prozesse; interne Diffusion), zu bestehenden und neuen Märkten (externe Diffusion durch neuartige Geschäftsmodelle) und im Zeitverlauf. Darüber hinaus werden etablierte Unternehmen

und ihre DIUs von verschiedenen digitalen Innovationsökosystemen umgangen, die intensive Interaktionen mit verschiedenen Kunden, Lieferanten, Konkurrenten usw. hervorrufen. Diese vielschichtigen Ebenen verdeutlichen die hohe sozio-technische Komplexität dieser Dissertation. Einerseits zeigen diese Ebenen, wie schwierig es ist, DIUs innerhalb etablierter Unternehmen im Laufe der Zeit zu etablieren und zu verorten. Andererseits tragen die Beiträge innerhalb der Ebenen dazu bei, die hohe Komplexität zu bewältigen, zu reduzieren oder sogar zu vermeiden. Diese Beiträge zur DIU-Forschung werden als nutzbringend angesehen und wahrgenommen, da sie die Information Systems-Forschung anregen, das aufkommende Phänomen der DIUs und der angrenzenden Forschungsrichtungen zu vertiefen. Durch die Veröffentlichung eines der ersten wissenschaftlichen Artikel, die sich mit DIU-Archetypen, ihren Integrationsmechanismen und ihren Lebenszyklen befassen, wurde eine DIU-Forschungsgemeinschaft ins Leben gerufen, die stetig wächst. Darüber hinaus wurde die Wirtschaftsinformatik-Forschung durch die Einführung des DIU-Konzepts als Nexus oder Vehikel für eine mögliche Durchführung des digitalen Innovationsmanagements in Unternehmen angeregt.

Zum anderen zeigt diese Dissertation DIU-Strukturen und potenzielle Integrationsmechanismen in Unternehmen auf und thematisiert den Wechsel von einer intraorganisationalen zu einer interorganisationalen Ökosystem-Perspektive. Insofern hat sie mehrere praktische Implikationen, die Personen in der Praxis bei der (1) Einrichtung und Positionierung von DIUs in Unternehmen sowie bei der (2) Verfeinerung bereits etablierter DIUs unterstützen können. Diese werden als „Greenfield"- (1) und „Brownfield"-Ansatz (2) bezeichnet und vorgestellt. Diese Ansätze helfen etablierten Unternehmen bei der Definition einer DIU-Strategie, um digitale Innovationen voranzutreiben und zu fördern.

Limitationen: Diese Dissertation ist mit einigen Limitationen konfrontiert, die in dem verwendeten Forschungsdesign, dem Forschungsansatz und seiner Auswertung begründet sind, welche die Rigorosität und Relevanz der Ergebnisse einschränken. Da in dieser Dissertation stark auf qualitativ-empirische Analysen zurückgegriffen wird, kann die Interpretation der Daten auf persönlichen Vorurteilen und Meinungen beruhen, was die Objektivität einschränkt. Die Vielzahl unterschiedlicher Bezeichnungen für DIUs stellt eine weitere Einschränkung dar, vor allem bei den strukturierten Literaturrecherchen. Trotz der Einbeziehung einer breiten Palette von verwendeten DIU-Begriffen gibt es sicherlich noch viele weitere in der Forschungsliteratur verwendete Begriffe, die die Ergebnisse weiter verfeinert hätten. Der „Phenomenon-driven DSR"-Ansatz bringt weitere Limitationen mit sich. Trotz der vielen Möglichkeiten, mit diesem völlig neuartigen Ansatz

zu forschen, gelten einige der bereits im DSR beschriebenen Einschränkungen auch für diesen Forschungsansatz. Die Forschung wird in der Regel von verschiedenen Ausgangspunkten ausgehend angestoßen, die sich z. B. auf ein konkretes Problem oder Projekt konzentrieren, was sie kontextspezifisch macht. Obwohl mit dieser Dissertation das Ziel verfolgt wurde, die „Projectability“ und „Fitness“ zu maximieren, indem mehrere formative und summative Evaluierungsepisoden zum Nachweis der Anwendbarkeit durchgeführt wurden, fehlt es den beigetragenen und verfeinerten Wissensbausteinen über DIUs und ihrer Positionierung in etablierten Unternehmen an einer geeigneten Anwendung in der realen Welt, wie z. B. der Implementierung einer DIU innerhalb eines Unternehmens. Eine weitere Einschränkung betrifft die Quantifizierung des Nutzens von DIUs. Obwohl die Forschung Indikatoren für die Quantifizierung der Wirksamkeit einer DIU aufzeigt und einführt, wurde dies aufgrund der Schwierigkeit, die Leistung von Innovationen im Allgemeinen zu quantifizieren, absichtlich ausgelassen.

Ausblick: Aus dieser Dissertation ergeben sich zahlreiche Ansatzpunkte für künftige Forschung. Es könnte ein Blick auf die Zusammenarbeit mehrerer gleichzeitiger DIUs und weitere Kooperationen mit neu gegründeten Unternehmen geworfen werden. Die Verbindung der DIU-Forschung mit den angrenzenden Forschungsströmen ist nur ein kleiner Ausschnitt und gibt Anreize für weitere Untersuchungen. Weitere Forschungen zur Gestaltung der IT-Funktion jenseits bimodaler oder trimodaler IT-Konstrukte, wie z. B. unimodale oder multimodale IT-Ansätze und die Analyse der Rolle von DIUs in einem solchen Umfeld können vielversprechend sein. Darüber hinaus sollte zukünftige Forschung zeitliche und kontextuelle Faktoren von DIUs analysieren. Dazu gehört auch die Frage, ob DIUs ein weltweites oder nur ein europäisches Phänomen sind. Da keine Anwendung der Wissensbausteine, z. B. im Sinne eines „Action Design Research“-Projekts, in einem realen Szenario stattgefunden hat, mag es außerdem sinnvoll sein, den „Phenomenon-driven DSR“-Ansatz, die „DIU Good Practices“, die „Digital Accelerator“-Taxonomie und/oder die Meta-Requirements und Design Principles zu demonstrieren und zu validieren.

Keywords:
Digital Innovation Units, Digitales Innovationsmanagement, Digitale Transformation.

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III. List of Abbreviations

ActEng ..... *Active Engagement*
AI ..... *Artificial Intelligence*
API ..... *Application Programming Interface*
C&S ..... *Coaching & Screening*
CC ..... *Cultural Change*
CDO ..... *Chief Digital Officer*
CE ..... *Core Organization*
CEO ..... *Chief Executive Officer*
CIO ..... *Chief Information Officer*
CoE ..... *Center of Excellence*
CulChaP ..... *Cultural Change Program*
DE ..... *Digital Expertise*
Dev ..... *Development*
DI ..... *Digital Innovation*
DIE ..... *Digital Innovation Ecosystem*
DIU ..... *Digital Innovation Unit*
DP ..... *Design Principle*
DSR ..... *Design Science Research*
DynCap ..... *Dynamic Capability*
ExC ..... *External Creator*
ExEnh ..... *External Enhancer*
FTE ..... *Full Time Equivalent*
GHC ..... *Gartner Hype Cycle*
Inc ..... *Incubator*
Inno. Mngr. ..... *Innovation Manager*
IntFac ..... *Internal Facilitator*
IoT ..... *Internet of Things*
IS ..... *Information Systems*
MR ..... *Meta-requirement*
MVP ..... *Minimum Viable Product*
ODC ..... *Organizational Design Change*

PasEna ..... *Passive Enablement*
PDR..... *Phenomenon-driven Research*
PST..... *Pioneer, Settler, Townplanner*
R&D ..... *Research & Development*
RG ..... *Research Goal*
RQ ..... *Research Question*
VUCA..... *Volatility, Uncertainty, Complexity, and Ambiguity*

1 Introduction

1.1 Motivation

*"Successful companies in the digital economy will be **digital** (to provide customer value) and **digitized** (to provide for scale and efficiency)."* (Ross 2017)

VUCA—an applied acronym for volatile, uncertain, complex, and ambiguous—is commonly used to describe the current state of the world, characterizing (1) situations in which novel phenomena appear continuously and unpredictably and (2) novel and multifaceted challenges that incumbent firms face arising from these phenomena (Bennett and Lemoine 2014). Thus, becoming "digital" and "digitized" seems to be necessary to withstand potential disruption. Digital transformation—"a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial 2019, p. 118)—has emerged as a nascent but crucial phenomenon for practitioners and information systems (IS) researchers (Bharadwaj et al. 2013; Vial 2019). As firms operate in a VUCA world that is permeated with and strongly influenced by digital technologies (Yoo et al. 2012), digital transformation induces digital technologies to define or redefine a firm's value proposition (Wessel et al. 2021). Therefore, using digital technologies for innovation purposes has led to a new class of innovation: digital innovation (e.g., Fichman et al. 2014; Nambisan et al. 2017; Yoo 2010; Yoo et al. 2012).

In general, while digital transformation and/or digital innovations bring many opportunities for firms, they are complex to implement and manage. The dilemma lies in reacting quickly to market changes and unpredictable situations while improving existing day-to-day business. Thus, firms need "the ability to pursue both efficiency and flexibility while balancing exploitation and exploration" (Park et al. 2020, p. 1376), which is referred to as organizational ambidexterity. However, such a setting is not easy to achieve. Many firms failed to implement such a setting, overlooked the need for change, and were eventually disrupted by (new) competitors. A prominent example of this is Kodak, who missed the revolution of digital photography due to its middle managers, its culture, and its strong bureaucratic organizational design, which led to slow decision-making with high aversions for (digital) innovations not conceivable in a VUCA world permeated with and strongly influenced by digital technologies (Lucas and Goh 2009).

While exploitation is usually very well mastered by incumbent firms, they sometimes struggle to establish suitable exploration channels. Establishing exploratory channels is challenging because many incumbents are very rigid and hierarchical, so radical organizational changes can only emerge at a slow pace. Therefore, organizational agility is seen as a strong promoter for fostering radical changes as well as new exploration channels. Originating from the IT departments, various authors have attempted to define and implement agile (IT) units (Gerster et al. 2019; Horlach et al. 2017; Jöhnk et al. 2019) and created exemplary bimodal IT constructs (Haffke et al. 2017b; Horlach et al. 2016), which show a simultaneous operation of traditional and agile modes as well as further pathways toward fully agile (IT) departments (Horlach et al. 2016). The options for this are manifold: "Different forms of organizational entities are conceivable and partially implemented in practice: the options commence with cross-functional IT-related project teams to work on a temporally limited task, continue with distinct organizational units such as digital innovation labs and departments named 'digital transformation', and end with predominantly externally organized digital incubators and accelerators" (Alt et al. 2020, p. 619).

Especially in a VUCA world, the challenges that firms face may also constitute and promote innovations, creating novel technological and organizational phenomena. Digital innovation units (DIUs) portray such phenomena. DIUs are dedicated organizational units that represent a potential vehicle or nexus for the ideation, development, and integration of digital innovation in organizations (Barthel et al. 2020a; Ciriello and Richter 2015; Raabe et al. 2020a). DIUs may coexist with further DIUs, additional digital divisions, or other bimodal IT modes (Raabe et al. 2020a).

However, despite the high importance of becoming "digital" and "digitized" (Ross 2017) and the increasing popularity of establishing DIUs in practice, existing research has failed to describe the phenomenon of DIUs or provide formalized guidance on their design and setup. In particular, knowledge about their internal organization, structures, processes, or their interaction with and integration within the main organization is scarce (Raabe et al. 2020a). Therefore, this dissertation seizes this promising potential and develops validated descriptive knowledge and prescriptive design knowledge for DIUs by considering various adjacent streams that define and affect the phenomenon of DIUs.

1.2 Research Goal and Research Questions

While a profound knowledge base on digital transformation, digital innovation, agility, organizational design, and how they affect incumbent firms exists, the current research lacks an in-depth view of special mechanisms (e.g., DIUs) that address and achieve stronger digital awareness in firms. Thus, the underlying research goal (RG) of this dissertation is as follows:

RG: Gain a better understanding of positioning digital innovation units in the main organization to drive and foster (digital) innovations across the whole organization.

By following a novel phenomenon-driven design science research approach (Raabe et al. 2021b), which integrates phenomenon-driven and design science research (PDR and DSR; Research design described in Section 3), the RG is pursued cumulative through four research questions (RQs) that are answered by the publications included. The publications have their own RQs, which are strongly connected to the RQs mentioned in this section, and thus the RQs of the publications contribute directly to answering the RQs of this dissertation. Several knowledge chunks emerge from the publications that contribute to generating descriptive Ω knowledge in the sense of traditional PDR and prescriptive Λ knowledge in the realm of DSR (Gregor and Hevner 2013; Krogh et al. 2012; Raabe et al. 2021b). While answering the first two RQs tends to generate primarily but not exclusively Ω knowledge chunks, the latter two RQs have a propensity to make a contribution to the Λ knowledge base. Some publications produce chunks for both knowledge bases (e.g., Raabe et al. 2020a; Raabe et al. 2020b).

Although many DIUs are currently established or are in the process of being established in numerous incumbent firms, (design) knowledge about types of DIUs, objectives, or tasks is still scarce. Thus, the dissertation is guided by the first research question (RQ1):

RQ1: What kinds of DIUs are established in practice, and what are their objectives, areas of activity, and addressed types of digital innovations?

This RQ is addressed in three steps. First, Raabe et al. (2020a) conducted a qualitative–empirical study to distinguish, explore, and formalize current types of established DIUs in practice. Thus, this research presents the first conceptualizations of DIU archetypes and their focus on specific types of digital innovations. Second, Raabe et al. (2020b) built on

these DIU conceptualizations and explored the current challenges of DIUs by conducting a structured literature review and a qualitative empirical study. Third, based on an identified crucial challenge of DIUs missing clear objectives, Raabe et al. (2021a) analyzed single and multiple case studies of DIUs described in prior research and formalized different foci of objectives and areas of activity DIUs perform.

Although DIUs emerged in various industries, the status quo of DIUs (e.g., dependencies between different DIU archetypes, digital innovation types, or digital trends) remains implicit and unknown. In this regard, it is worth exploring whether certain domains are limited to specific DIUs, types of digital innovations, or digital trends addressed. Thus, to shed light on the above-described research gap, this dissertation addresses the following second RQ (RQ2):

RQ2: For which industries or business sectors are the different archetypes of DIUs and types of digital innovation suitable?

Two of the publications included (Holsten et al. 2021; Raabe et al. A.2) address the research gap and RQ. Holsten et al. (2021) drew on the open data of DAX30 firms that established DIUs and analyzed their status quo by differentiating between the introduced archetypes of DIUs by Raabe et al. (2020a), Barthel et al. (2020a), and Jöhnk et al. (2020). By linking the digital trends addressed with the topics presented within the Gartner Hype Cycle (GHC), it became apparent that DIUs pay particular attention to digital trends in more mature stages and are established by incumbent firms independent of their industry. Raabe et al. (A.2) proposed in their literature synthesis that DIUs occur concurrently and are used industry-independent within large pre-digital incumbent firms in times of economic success. They further highlighted that this seems to be a European phenomenon (Raabe et al. A.2).

The knowledge chunks generated by answering the first two RQs, primarily contributing to the descriptive Ω knowledge base, assist in producing further prescriptive Λ knowledge, such as design principles or meta-requirements for establishing DIUs. Since the number of negative press headlines that address the dissolution of DIUs is increasing, there might be little to no guidance on how to establish DIUs successfully within incumbent firms or on how to connect DIUs with their incumbent firms. Moderating factors or guidance on establishing and integrating DIUs in incumbent firms are needed. Thus, this dissertation is steered by the following third RQ (RQ3):

RQ3: What socio-technical interfaces and other requirements are needed for a DIU to collaborate effectively with the main organization to develop digital innovations?

The five publications included (Brauer et al. 2021; Hellmich et al. 2021; Raabe et al. 2020a; Raabe et al. 2020b; Raabe et al. A.1) draw on answering this RQ. Raabe et al. (2020b) gave initial prerequisites on how to set up DIUs in firms by identifying and analyzing multifaceted challenges for business units of the main organization as well as the DIUs. Hellmich et al. (2021) relied on the current literature on dynamic (socio-technical) capabilities needed for realizing and enabling DIUs. Brauer et al. (2021) showed diverse integration mechanisms for DIUs that assist particularly in fostering digital business model innovations. Raabe et al. (2020a) demonstrated the mechanism of "liaison channeling", one kind of methodological integration mechanism. Drawing on all the previously conducted publications, Raabe et al. (A.1) conducted a single-case study to define the meta-requirements and design principles being acted upon for establishing and integrating DIUs in incumbent firms.

Current research on DIUs appears to be static and shows neither their evolution or dynamic interactions with the main organization nor the pathways or evolution strategies, indicating that DIUs are in a constant flux, and highlighting their agile principles (Horlach et al. 2021) or dynamic capability features (Dixon et al. 2017). Thus, the final RQ (RQ4) is formulated as follows:

RQ4: To what extent are DIUs evolving, and what factors influence a change in the structures of DIUs?

To answer this RQ, two publications included address the research gap. Raabe et al. (2020a) showed four evolutionary pathways and strategies for changing DIU archetypes toward a stronger impact on the main organization based on a qualitative empirical study in which DIUs tend to change their structure and processes. Furthermore, Raabe et al. (A.1) defined four phases in which DIUs participate and describe—among generic phase-independent meta-requirements—phase-dependent design principles being acted upon to establish different archetypes of DIUs. Drawing on data from a longitudinal single-case study, the study gives further insights into realizing an ambidextrous setting in firms.

1.3 Outline of the Thesis

This dissertation encompasses a wrapper, the publications, and an appendix (see Table 1.1). The wrapper provides an overview of the research path in general. The publications and the two articles within the appendix (currently under peer review) contribute to answering the four general RQs and the overarching RG.

The dissertation is structured as follows. After the introduction, the second section outlines the theoretical framing connecting DIU research with other adjacent research streams. The third section outlines the research design, including the research strategy and methods. The fourth section presents the included publications. The fifth and sixth sections encompass the overall theoretical and practical contributions of this dissertation. The seventh section addresses major limitations. The eighth section discusses the implications for future research on DIUs. The final sections (Sections 9–15) contain the publications. Publication P7 (Section 15; Raabe et al. 2021b) is specific due to its methodological contribution to PDR and DSR, as it assisted in utilizing, contributing, and refining DIU knowledge. Publications A.1 and A.2 are included in the appendix because they are currently undergoing the peer-review phase. However, these contributions are also included in this dissertation.

For the sake of clarity and consistency, all publications were reformatted to follow the dissertation template used. The references were unified according to the style used in *MIS Quarterly*. The tables and figures are numbered consecutively, but separated from each other, with the section number indicated at the beginning. Where necessary, orthographical changes (e.g., formatting into American English) were made in the publications.

Table 1.1: Thesis Outline

Source: Own Representation

Wrapper	1. Introduction	2. Theoretical Framing	3. Research Design	4. Publications
	5. Theoretical Contribution	6. Practical Contribution	7. Limitations	8. Implications for Further Research
Included Publications	9. Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups (P1)			
	10. 'Forewarned Is Forearmed': Overcoming Multifaceted Challenges of Digital Innovation Units (P2)			
	11. Towards an Intra-and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units (P3)			
	12. Realizing Organizational Ambidexterity: A Taxonomy of Digital Accelerators and Their Integration Mechanisms for Digital Innovation (P4)			
	13. The Status Quo of Digital Innovation Units: "A Day Late and a Dollar Short" (P5)			
	14. Towards a Foundational and Extensional Dynamic Capability Perspective on Digital Innovation Units (P6)			
	15. Towards Phenomenon-driven Design Science Research (P7)			
Appendix	A.1 Meta-Requirements and Design Principles for Digital Innovation Units: A Longitudinal Investigation (P8)			
	A.2 The Digital Innovation Unit: A Silver Bullet for Managing the Digital Transformation? (P9)			

2 Theoretical Foundations

In an initial unstructured literature review of organizational units focused on digital innovation (Brink 2013), this dissertation has been able to identify several adjacent research areas. Prior research connected the adjacent research streams of "Digital Innovation" and "Organizational Theory" (such as design, change, or structures) with research on these organizational units (e.g., Holotiuk and Beimborn 2019; Fuchs et al. 2019). Thus, the theoretical foundations of this dissertation entail the above-mentioned adjacent streams of digital innovation, organizational structures, and change for innovation. Furthermore, a section containing initial theoretical foundations on dedicated organizational units for digital innovation management (later coined DIUs) is introduced. Each subsection introduces the main aspects on which this dissertation builds, illustrates the current state of research, and emphasizes the need for DIU research by highlighting the current research gaps.

2.1 Digital Innovation

Since incumbent firms understand the need to drive their digital transformation (Ross et al. 2019), digital technologies are becoming increasingly important and often lead to changes in the business model of firms (Bharadwaj et al. 2013; Nissen and Rennenkampff 2017). Furthermore, becoming "digital" and "digitized" (as highlighted in the introduction) seems necessary to withstand potential disruption, since digital technologies have salient characteristics that differ significantly compared to non-digital entities (Fichman et al. 2014) affecting incumbents' business processes, especially the process of innovating (Nambisan et al. 2017). Network effects affect digital technologies since they "become more valuable to any individual adopter as the size of the adopter network grows" (Fichman et al. 2014, p. 333). These network effects enable large incumbent firms with huge networks or business ecosystems to decrease costs more rapidly or increase functionality (Shapiro and Varian 1999). Yoo et al. (2010) highlighted that digitalization ("becoming digitized")—the transformation of physical into digital entities—results in highly malleable entities that offer enormous new fields of possible functionality. Furthermore, these highly malleable entities and their range in terms of technical and economic feasibility are continuously expanding, making digital technologies a strong enabler for innovation in firms (Fichman et al. 2014). However, enabling an innovation-friendly setting within firms is a complex task.

The specific type of innovation enabled by digital technologies and their salient characteristics is defined as digital innovation. "Digital innovation has radically changed the nature and structure of new products and services, spawned novel value creation and value appropriation pathways, enabled innovation collectives that involve dynamic sets of actors with diverse goals and capabilities […] and, more broadly, transformed entire industries in its wake" (Nambisan 2013, p. 223).

Various attempts have been made in research to characterize (digital) innovations. While Fichman et al. (2014) differentiated innovations according to type, Christensen (1997) divided innovations according to their intended impact between sustaining innovations (incremental or continuous innovations) and disruptive innovations. A consideration by type is also made by Hauschildt and Salomo (2007), Thom (1992), Pleschak and Sabisch (1996), and Disselkamp (2012). Additionally, Pleschak and Sabisch (1996) considered the innovation trigger ("Pull vs. Push" factors) as another dimension. Hauschildt and Salomo (2007) introduced a subjective dimension regarding the reference unit for determining novelty. Although the differentiations of the abovementioned authors are different, they are not mutually exclusive, but rather complementary (Vahs and Brem 2015). Thus, as in this dissertation, all the mentioned dimensions are used to characterize digital innovations and are clustered into three dimensions: (1) the type, (2) the intended impact measured using the adopting unit, and (3) the scope in terms of the process or stages for conceiving digital innovations. Further dimensions exist to classify digital innovations based, for example, on their context (social or responsible digital innovations), as suggested by Edwards-Schachter (2018). However, these are excluded because they are a kind of subdimension of the digital innovation types. Table 2.1 lists the digital innovation dimensions, the differentiations, and the definitions that are utilized in this dissertation. The following paragraphs describe each dimension and its differentiations in depth.

Table 2.1: Digital Innovation Dimensions

Source: Own Representation

Dimension	Differentiation	Definition/Explanation/Sub-activities
(1) Digital Innovation Type	Digital Product	"Digital product innovations are significantly new (from the perspective of a particular community or market) products or services that are either embodied in IT or enabled by IT. Examples include new enterprise platforms (ERP, CRM), new consumer products (smartphones, Amazon's Instant Video service), and existing products substantially enhanced by the addition of digital technology (GM's OnStar service)." (Fichman et al. 2014, p. 334)
	Digital Process	"Digital process innovations are significantly new (from the perspective of the adopter) ways of doing things in an organizational setting that are embodied in or enabled by IT. Research on digital process innovation uses adopting firms as the focal point (i.e., organizational innovators), and investigates when and why firms adopt new technologies, and how they can successfully assimilate them. Such firms could be adopting technologies supplied by the market, or developing and deploying internally developed technologies." (Fichman et al. 2014, p. 334)
	Digital Business Model	A digital business model innovation is "a significantly new way of creating and capturing business value that is embodied in or enabled by IT." (Fichman et al. 2014, p. 334)
(2) Intended Impact	Incremental	Minor improvements that assist in making current products, processes, or business models better. (Christensen et al. 2015)
	Radical	Novel and unique, significantly different from other innovations, as well as used by the adopting unit. (Dahlin and Behrens 2005)
	Disruptive	Building on radical innovations, disruptive ones need to create completely new markets while disrupting other existing ones. (Christensen et al. 2015)
(3) Scope in Terms of the Process or Stages	Discovery	Including "Invention" and "Selection" as Substages (Fichman et al. 2014)
	Development	Differentiating between "Packaging" and "Configuring" (Fichman et al. 2014)
	Diffusion	Comprising "Deployment" and "Assimilation" (Fichman et al. 2014)
	Impact	Measuring "Value appropriation" and "Transformation" (Fichman et al. 2014)

The digital innovation type: Based on Fichman et al. (2014), the type of innovation is categorized as either a digital product, digital process, or digital business model. There has been a distinctive view of process and product innovations within the last few decades (Utterback and Abernathy 1975; Fichman et al. 2014). While some digital innovation scholars motivate a stronger focus on product innovations (e.g., Swanson 1994; Yoo et al. 2010), others emphasize a stronger process orientation (e.g., Svahn et al. 2017) to embrace

digital innovation as a whole instead of just the outcome. In the "Product versus Process" discussion, business model innovations appeared as a third digital innovation type and are increasingly gaining importance (Fichman et al. 2014). A business model "defines how the enterprise creates and delivers value to customers, and then converts payments received to profits" (Teece 2010, p. 173).

The intended impact: The intended impact for all the mentioned types of digital innovations may be incremental, radical, or even disruptive. To measure the intended impact of a digital innovation, the adopting unit (e.g., the incumbent firm or the customer) and competitors play a major role and may act as benchmarks to measure the success of a digital innovation (Hauschildt and Salomo 2007; Rogers 2010). The literature on innovation management shows a dichotomy of incremental versus radical innovation discovery, development, and diffusion (Ettlie et al. 1984). Factors for differentiating incremental from radical innovations include the risk of adopting the (digital) innovation, the novelty of the (digital) innovation judged based on the adopting unit or the reference group of the organizations, or the amount of change needed within an organization to use the (digital) innovation (Duchesneau et al. 1979; Ettlie et al. 1984; Hage 1980). Incremental or "sustaining innovations" are described as minor improvements that assist in making current products, services, processes, or business models better from the viewpoint of incumbent firms' existing customers (Christensen 1997; Christensen et al. 2015). Dahlin and Behrens (2005) introduced three criteria that a radical digital innovation must fulfill: (1) it must be novel; (2) it must be unique, and dissimilar from prior innovations; and (3) it must be used, adopted, and influential for future innovations. While the first two can be claimed ex-ante, the third criterion is only claimed ex-post. The same criteria also apply for disruptive innovations, but, as an additional criterion, they need to create and scale completely new markets while disrupting other existing ones', highlighting the processual and contextual perspective (Christensen 1997; Christensen et al. 2015).

The scope in terms of the process or stages: Processes or stages for innovation management (including elicitation and implementation) have been discussed at length in research and show similar characteristics (e.g., Cooper 1990, 2014; Schon 1971; Schumpeter 1950; Thom 1992). This dissertation uses the four stages described by Fichman et al. (2014), as they focus explicitly on digital innovation. The four stages have an iterative nature, which may overlap: discovery, development, diffusion, and impact. While many process models have been introduced as rather linear and sequential phases, especially covering the first three stages (Ciriello et al. 2018), Fichman et al. (2014) considered the impact a separate

stage and thus emphasized the importance of making the benefits of an innovation transparent. This transparency is especially in line with Van de Ven (1986), as he emphasized the need for ideas to be perceived as useful to be called (digital) innovations. Unless explicitly stated otherwise, the following paragraphs describe Fichman et al.'s (2014) stages in depth.

The discovery stage entails the activities of invention and selection. Invention refers to a firms' own creation of innovations through creative idea generating processes ("internal view"). Selection implies finding and evaluating potential digital innovations outside the barriers of an organization ("external view"). Innovators focusing on the type of digital products and business models pursue and engage in both activities; digital process innovators mainly strive to engage in the activity of selection due to the huge rise of digital technologies (such as all-in-one solutions).

The development stage fulfills the activities of transforming an initial idea into a digital innovation. For digital product and business model innovations, the focus is on the implementation and refinement ("packaging") of digital technology. For digital process innovations, activities include deciding ("configuring"), "which technology features will be used, whether they will be used as is or with adaptations, how the technology will be integrated with other technologies the organization already has in place, how related organizational elements (e.g., structures, processes) will be changed, and how the organization will absorb and make use of the technology" (Fichman et al. 2014, p. 336).

The diffusion stage involves the distribution of an innovation across potential users. The central activity for digital product and business model innovations is deployment; and for digital process innovations, it is assimilation, which refers to the absorption of the innovation into organizational structures, processes, or workflows. Thus, in the organizational lens, diffusion may be internal (within an organization, focusing on employees) and/or external (outside a firm's barriers, focusing on current or potential new customers).

The impact stage measures the intended and unintended effects that digital innovations might have on individuals, organizations, markets, or even society. In terms of quantitative measures within organizations, digital innovations may influence the cost or revenue side (e.g., better efficiency leads to lower costs or higher revenues). The key activity for digital product and business model innovations is value appropriation, which involves the management of implicit and explicit knowledge to protect profits from competitors.

Innovators focusing on processes and value appropriation comprise the continuous transformation of used technologies and organizations to take and hold the advantages of new opportunities.

The application and execution of such a digital innovation process in the mentioned stages suggests that firms must have certain capabilities, especially since absorbing or integrating (digital) innovations seems to be a challenging task with high socio-technical complexities. Although research on so-called dynamic capabilities, with a particular focus on digital innovations, is already emerging in academia, firms lack the mechanisms needed to manage digital innovations. Following Fichman et al.'s (2014) calls to create new "IT innovation ensembles/systems" and "new mechanisms for promoting IT assimilation within organizations" (p. 347), this dissertation builds upon these calls and analyzes the phenomenon of DIUs in depth and their positioning within incumbent firms, which refers to such ensembles for promoting IT assimilations. Before delving into the foundations of organizational units that focus on digital innovations, this dissertation first explains the organizational structures to understand the potential options for embedding organizational units in firms.

2.2 Organizational Structures and Change for Innovation

Despite the variety of diverse organizational structures that exist in practice, their design can be understood as a (sociotechnical) system of interlocking roles (Jones 2013). Incumbent firms consist of four generic building blocks to differentiate their work tasks (depicted in Figure 2.1).

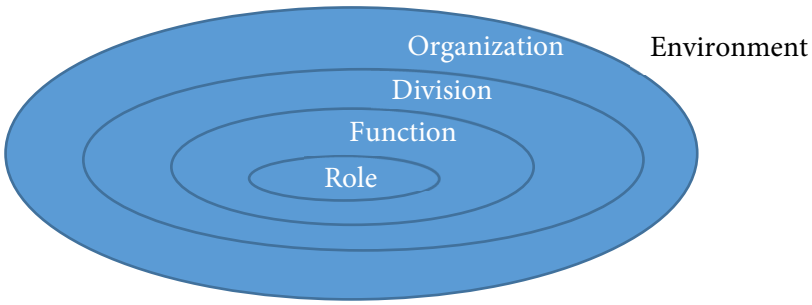


Figure 2.1: Organizational Building Blocks of Differentiation
Source: Own Representation (based on Jones 2013, p. 117)

An organizational role represents a set of task-related behaviors required of individuals by their positions in an organization. Organizational functions or departments are units composed of a group of people possessing similar capabilities to perform their jobs.

Organizational divisions are units that entail several functions or departments that share responsibility for a given task. People use an organization to coordinate actions to obtain something that they value (Jones 2013).

Creating value is highly affected by the continuously changing organizational environment (Jones 2013). Under pressure to avoid being put at a competitive disadvantage due to constant environmental changes, firms crave stronger (digital) innovation capabilities (Kohli and Melville 2019). These efforts to foster a higher (digital) innovation capability in incumbent firms are strongly intertwined with the implementation of various agility types, since "[a]gility is the ability to detect opportunities for innovation" (Sambamurthy et al. 2003a, p. 245). In this regard, incumbent firms strive for *doing agile* (1) by implementing agile methods (e.g., Scrum, Kanban, or Scrumban) and *being agile* (2) by changing their organizational designs, structures, and technology base for higher agility and fast integration of (digital) innovations (Horlach and Drechsler 2020; Lui and Piccoli 2006). Since agility originates from IT ("Manifesto for Agile Software Development" in 2001), the first considerations toward more agile organizational (IT) structures can be found in bimodal IT mechanisms, initially coined by Gartner (2021): "Bimodal is the practice of managing two separate but coherent styles of work: one focused on predictability; the other on exploration. Mode 1 is optimized for areas that are more predictable and well-understood. It focuses on exploiting what is known, while renovating the legacy environment into a state that is fit for a digital world. Mode 2 is exploratory, experimenting to solve new problems and optimized for areas of uncertainty".

Firms adopt multiple bimodal IT designs to increase agility, as depicted in Figure 2.2.

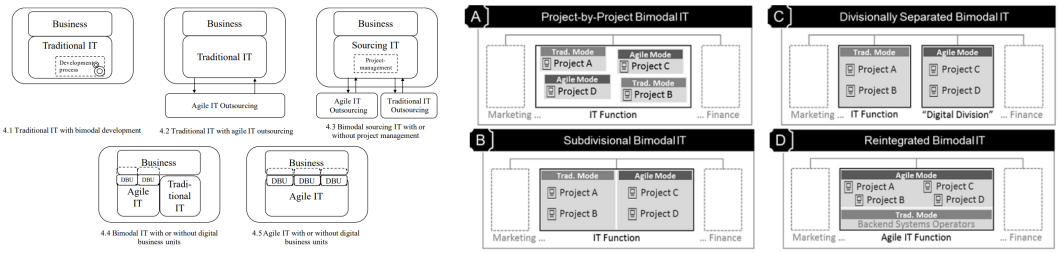


Figure 2.2: Bimodal IT Archetypes in Incumbent Firms
Source: (Haffke et al. 2017a, p. 105; Horlach et al. 2017, p. 5428)

The options range from simple structures—in which only bimodal development (project-by-project based) takes place—to complex, parallel functions and divisions for traditional and agile modes (agile IT with/without digital business units, divisionally separated). In this context, bimodal IT is not to be understood as a kind of end state, but rather as a path

or process to fully agile IT functions, as indicated by archetype D "Reintegrated Bimodal IT" (Haffke et al. 2017a).

In addition to bimodal IT, which focuses on the transformation of IT, another more mature research stream, originating from organizational science, presents a similar dichotomy that refers not only to IT but to the entire organization: organizational ambidexterity. Having its roots in organizational learning theory, ambidexterity entails modes of exploitation and exploration, whose balancing is crucial for incumbent firms to survive (March 1991). Like bimodal IT mode 1, exploitation stands for productivity and efficiency, while exploration motivates experimentation and innovation (March 1991), as in bimodal IT mode 2. As multifaceted changes caused by (digital) technologies, competitors, or other environmental factors are increasingly rising, faster incremental improvements ("exploitation") and more revolutionary radical changes ("exploration") are needed, thus highlighting a firm's need for ambidextrous organizational designs and structures (Tushman and O'Reilly 1996). The struggle lies in establishing a mode for exploration—since exploitation is well mastered in incumbent firms due to their striving for efficiency (March 1991)—and in connecting and balancing both modes. Thus, research on organizational ambidexterity introduces three classical approaches for addressing the struggle: (1) Structurally, by establishing dedicated exploration and exploitation modes (O'Reilly and Tushman 2013; Tushman and O'Reilly 1996); (2) sequentially, by shifting between exploitation and exploration over time (Duncan 1976; O'Reilly and Tushman 2013); and (3) contextually, by letting individuals decide how they allocate their available time between modes (Birkinshaw and Gibson 2004; O'Reilly and Tushman 2013). Despite giving firms guidelines on how to foster innovation, these approaches lack the part of balancing exploration and exploitation or connecting modes 1 and 2 of bimodal IT. Thus, integration—"the process of coordinating various tasks, functions, and divisions so that they work together and not at cross purposes" (Jones 2013, p. 121)—is crucial, which is partly described within a temporal ambidextrous setting in which structurally separated modes are balanced by a temporary transfer of individuals (Holotiuk and Beimborn 2019). Controversially, some scholars consider the latter a combination of the other three approaches (Göbeler et al. 2020) or as a hybrid type connecting contextual and structural ambidexterity (Jöhnk et al. 2020). Efforts to integrate diverse organizational tasks, structures, or modes for fostering agility and digital innovation are enhanced through different integration mechanisms that assist in maximizing effectiveness (Gassmann et al. 2012). Table 2.2 lists the different integration mechanisms described in prior research. This dissertation follows Jöhnk et al.'s (2020) interpretation that DIUs enable a hybrid mode of ambidexterity. In their paper, Jöhnk et

al. (2020) showed how different types of DIUs realized or enabled contextual and structural ambidexterity in firms. As part of this dissertation, the temporary transfer of individuals (Holotiuk and Beimborn 2019) is understood as a methodological integration mechanism ("liaison channeling").

Table 2.2: Integration Mechanisms within Organizations
Source: Own Representation

Integration Mechanism	Explanation	Article
Hierarchies of Authority	Specification of who reports to whom based on a ranking of employees.	Jones (2013)
Direct Contact	Coordination of tasks through direct communication.	
Liaison Role	Responsibility is given to an individual, a unit, or a function for connecting people of other units or functions and to overcome potential barriers.	
Task Force	Founding of a new temporary committee for cross-functional activity coordination.	
Team	Founding of a new permanent committee for cross-functional activity coordination.	
Integrating Role	Founding of a new role or unit to coordinate two or more functions or divisions.	
Integrating Department	Founding of a new department to coordinate two or more functions or even divisions.	
Focus on Methodological Integration	**Focus on Structural Integration**	
External Validating	Use of externals to proof sufficient technological or market-based know-how to business units of an incumbent firm. Validation by external parties may arouse desire and assist in the process of innovation transfer.	Gassmann et al. (2012)
Liaison Channeling	Use of personal ties to stakeholders within firms to spread innovations. Job rotation or employee shifting assists in connecting teams, units, or departments.	
Showcasing Innovation	Achieving acceptance through showcasing or making (digital) innovations tangible by translating tacit knowledge chunks or concepts into artefacts.	
Network Building	Building networks through exchange platforms comprising measures to form networks through direct exchange and communication with top management.	
Integrative Innovation Planning	Integration of Innovation through collaborative decision making. Collaboration between teams or units is triggered at an early stage; thus, a sense of ownership is imparted during the transfer.	

Jones (2013) summarized seven generic organizational integration mechanisms focusing on the structure of units and roles. Gassmann et al. (2012) identified mechanisms addressing radical innovation integration and transfer bridging the gap between units directing to exploration (Bimodal IT mode 2) and exploitation (Bimodal IT mode 1), which depicts a rather methodological integration approach for units to gain awareness within incumbent firms. These mechanisms lead to several options for embedding and positioning new units, such as DIUs. Figure 2.3 depicts a selection of suitable options, which includes Jones' (2013) stated integration mechanisms. However, these options are generic and may not be useful for embedding DIUs since these units have diverse objectives with disparate prerequisites to function, some of which may not nestle with efficiency-oriented processes, as they are mostly found in incumbents.

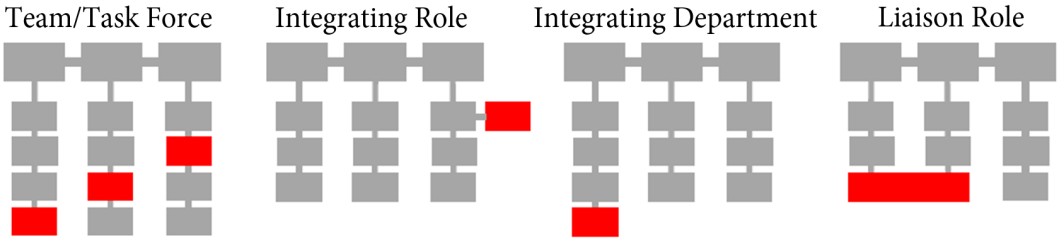


Figure 2.3: Options for Embedding New Units in Firms
Source: Own Representation (based on Kaiser and Stummer 2020, p. 31)

2.3 Dedicated Organizational Units for Digital Innovation

Terms such as Digital Innovation Lab, Digital Innovation Hub, Digital Unit, Digital Lab, Digital Transformation Initiative, and Experimental Lab ("X Lab") are used to describe units that strive to foster all kinds of digital innovation activities. At the start of the dissertation in 2019, no consistent terms for these units were available. For the sake of readability and clarity, this dissertation introduces the term digital innovation unit (DIU) for any kind of newly created, dedicated organizational unit focused on digital innovation.

As stated in the introduction, DIUs are dedicated organizational units that represent a potential vehicle or nexus for the ideation, development, and integration of digital innovation in organizations (Barthel et al. 2020a; Raabe et al. 2020a). They may coexist with several DIUs, additional digital divisions, or other bimodal IT modes (Raabe et al. 2020a). Despite the high emergence in practice so far, DIUs are only marginally mentioned in research (Meyer-Blankart 2020) and are peripherally addressed in adjacent IS research fields, such as organizational agility, or within fields focusing on the transformation of the IT function in firms (e.g., Horlach 2021). Still, there are some articles examining DIUs, as

listed in Table 2.3, showing prior publications of DIUs and their contribution highlighting the current nascent state of the phenomenon, with little to no prior literature synthesis or theory. The following paragraphs present papers on DIUs chronologically and describe their theoretical lenses.

In 2014, Blindenbach-Driessen and van den Ende analyzed the effects of separate innovation units on exploration and exploitation endeavors and showed strong evidence that such units foster a firm's innovation capacity. The focus on exploration was accentuated by Ciriello and Richter (2015), who theorized the main points of social networking in digital innovation as DIUs (so-called "idea hubs") and identified four initial DIU types, focusing on the discovery stage of digital innovations. The topic flourished in 2017 when Svahn et al. (2017) published their study presenting Volvo's journey with a DIU ("innovation hub") and demonstrated its success. Later that year, Rahrovani and Pinsonneault (2017) analyzed the ways in which knowledge is diffused within DIUs, building the steps for Hund et al.'s (2019) framework for managing knowledge in DIUs.

Table 2.3: Prior Research Publications Focusing on DIUs
Source: Own Representation

Article	DIU Contribution
Blindenbach-Driessen and van den Ende (2014)	Giving evidence on dedicated exploratory units having a positive effect on exploitation, exploration, and on balancing these two modes.
Ciriello and Richter (2015)	Identification of two offline and two online idea hub setups; Discussion of three influence factors for choosing one of the setups (material infrastructure, innovation process phase, and personal characteristics)
Svahn et al. (2017)	Describing Volvo's journey of embracing digital innovation through establishing an innovation hub as an integrating role for developing digital capabilities.
Rahrovani and Pinsonneault (2017)	Highlighting a DIU's expertise diversity in terms of knowledge integration and the high interactions with individuals within and outside a DIU.
Hund et al. (2019)	Addressing how DIUs facilitate knowledge management and recombination by analyzing how knowledge comes into a DIU, how it is applied, and how knowledge exchange between units take place.
Fuchs et al. (2019)	Characterizing DIUs by contributing a taxonomy of digital units.
Holotiuk and Beimborn (2019)	Introducing the enablement of a temporal ambidextrous setting achieved through the establishment of DIUs.

For the sake of clarity, Fuchs et al. (2019) designed an initial taxonomy of DIUs introducing the categories of "Objective & Scope," "Staffing & Collaboration," "Funding," "Governance & Structure," and "Origins" for separation (taxonomy depicted in Figure 2.4).

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 Implemen-tation	Innovation Commer-cialization
Staffing & Collabo-ration	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		

Figure 2.4: A Taxonomy of DIUs
Source: (Fuchs et al. 2019, p. 8)

Fuchs et al. (2019) highlighted the focus of DIUs as internal (addressing the main organization) or external (addressing current or new customers) and gave three main objectives of DIUs: (1) to foster digital innovation initiatives, (2) to trigger cultural change, and (3) to build up digital expertise. The dimensions given in the taxonomy provide a suitable first base for classifying DIUs. However, as the individual characteristics are hardly described, essential key issues about the objectives, archetypes, structures, or processes are not answered. Nevertheless, some white papers, mainly those from consulting firms, address the key issues, differentiate between different setups of DIUs, and emphasize the DIU connection to their incumbent firms. Examples include studies by Velten et al. (2016) and Sindemann and Buttlar (2018). Velten et al. (2016) distinguished between the types of innovation lab, company builder, accelerator, and incubator, while Sindemann and Buttlar (2018) defined only three but very similar setups: innovation lab, company builder, and accelerator. The main difference between these setups is their focus, being either internally or externally oriented. Company builders, incubators, and accelerators focus on offering digital innovations to the market(s) (Sindemann and Buttlar 2018; Velten et al. 2016).

While company builders strive to establish new startups with novel business models, incubators and accelerators aim to push firms (mostly start-ups) to develop and scale their business models further (Sindemann and Buttlar 2018). The difference between incubators and accelerators is the period in which these units participate. Incubators usually participate on a long-term basis (around 6 to 24 months), whereas accelerator programs last around 3 to 6 months (Velten et al. 2016). By contrast, innovation labs have an internal focus, striving to change existing business processes and integrate digital products into their main organization (Sindemann and Buttlar 2018; Velten et al. 2016).

Despite the contribution of these knowledge chunks, little is known about the structures of DIUs, their processes and challenges, their connection to the main organization, or their evolution or lifecycles. Thus, this dissertation utilizes prior publications and contributes to and refines further descriptive and prescriptive knowledge.

3 Research Design

This section explains the overall research design. Following Raabe et al. (2021b), this dissertation proposes and follows a research approach that integrates DSR and PDR. This dissertation provides a unified and holistic perspective of knowledge utilization and contribution over the course of a research process that starts with the initial observation of a novel phenomenon. A pure consideration of PDR did not fit into the context of this dissertation because PDR does not address or solve emerging challenges relating to novel phenomena. PDR focuses solely on explanation-oriented research (Krogh et al. 2012), whereas DSR requires a solid understanding of the phenomenon in the problem space and the key regularities associated with the phenomenon (Hevner et al. 2019; Raabe et al. 2021b). However, drawing on prior knowledge of the phenomenon of DIUs is difficult due to its novelty, which limits the possibilities of producing design knowledge. Therefore, this dissertation connects DSR and PDR, resulting in a phenomenon-driven DSR approach (Raabe et al. 2021b).

Section 3.1 describes PDR, DSR, and their integration. Building on this, Section 3.2 presents the research strategy, and Section 3.3 describes the research methods utilized.

3.1 Phenomenon-driven Research and Design Science Research

Since DIUs have recently emerged as a phenomenon in incumbent firms that initiate and trigger organizational change, this dissertation applies a unified approach that brings the phenomenon of DIUs to the center of attention (referring to the traditional scope of PDR) while creating descriptive and prescriptive (design) knowledge (referring to the extended scope of PDR and the general realm of DSR).

PDR is a research approach dedicated to contributing new knowledge about novel organizational and managerial phenomena (Schwarz and Stensaker 2016). PDR starts before a traditional theory-driven research path by differentiating a phenomenon from other facts and occurrences (Krogh et al. 2012). Its aim is to describe a phenomenon and conceptualize it so that appropriate theory building and knowledge synthesis can take place. PDR can provide a deeper understanding of a phenomenon. However, its extant focus on describing regularities does not address the need for solutions to the novel challenges associated with the novel phenomena. Further, the resulting knowledge might not be helpful to practitioners, as it does not guide them in *how* to deal with the

phenomenon. Such knowledge production falls traditionally into the realm of DSR, which is why this dissertation strives to connect and unify both approaches to gain novel knowledge for the phenomenon of DIUs.

The goal of DSR is to contribute prescriptive or Λ knowledge about solutions to real-world problems (e.g., design artefacts) and corresponding solution-related design knowledge (e.g., design principles or features) to the human knowledge base (Drechsler and Hevner 2018; Gregor and Hevner 2013; Hevner et al. 2004; vom Brocke et al. 2020). The solution design relies on the human knowledge base, including descriptive and explanatory knowledge (Ω knowledge) (Drechsler and Hevner 2018). Ω knowledge provides knowledge about (a) the problem space and (b) potential regularities that may comprise suitable means to bring forth the desired ends (= the objectives for the solution) (Raabe et al. 2021b), while Λ knowledge informs the solution design and provides evaluated means and artefacts. Extant Λ knowledge can be utilized for different contexts (but needs to be adapted or projected) (Baskerville and Pries-Heje 2019; vom Brocke et al. 2020). These knowledge chunks may be design theories (e.g., meta-requirements or design principles) or design entities (e.g., artefacts, systems, or processes designed for application within the problem solution space (Drechsler and Hevner 2018; Gregor and Hevner 2013; Hevner et al. 2019; Raabe et al. 2021b). A research project or journey (such as a dissertation) might have numerous knowledge chunks contributing to both the Ω and Λ knowledge bases. Within a DSR project, the interplay between both knowledge types is a crucial factor in designing a solution that is not only "fit-for-purpose" but also advances and generalizes both types of human knowledge (Drechsler and Hevner 2018; Raabe et al. 2021b; Seidel and Watson 2020; vom Brocke et al. 2020). Therefore, DSR builds upon a solid understanding of the phenomenon, which is why a profound knowledge base is needed to conduct proper DSR research (Hevner et al. 2019). This need of a profound knowledge base implies that DSR is not well-suited to use for phenomena, which is in a pre-theoretical stage. Thus, connecting DSR and PDR seems to be promising to describe nascent phenomena to gain a better understanding and to prescribe actions for, for example, overcoming the challenges novel phenomena face.

3.2 Research Strategy

This dissertation follows the phenomenon-driven DSR approach by Raabe et al. (2021b), which draws on the activities of PDR, as well as the realm of the DSR knowledge types, as depicted in Figure 3.1 (see Section 15 for an in-depth description of the research approach

and its activities; Figure 15.1 contains the research approach without the included publications). The figure contains the five enhanced activities of PDR; presents the included publications; emphasizes their utilization, contribution, and refinement of Ω and/or Λ knowledge; and shows their influence on answering the RQs. Some publications contribute to more than one activity and may contribute to earlier and later activities, thus highlighting the cyclical—and not necessarily in sequence—nature of the phenomenon-driven DSR approach pursued in this dissertation. These cycles are closely linked to the rigor and relevance cycles described by Hevner (2004) and assist in validating the refined or contributed knowledge chunks in terms of formative evaluation episodes (Sonnenberg and vom Brocke 2012; Venable et al. 2016), which strengthens the design knowledge fitness and confidence (vom Brocke et al. 2020). The following paragraphs describe the research efforts performed for each activity.

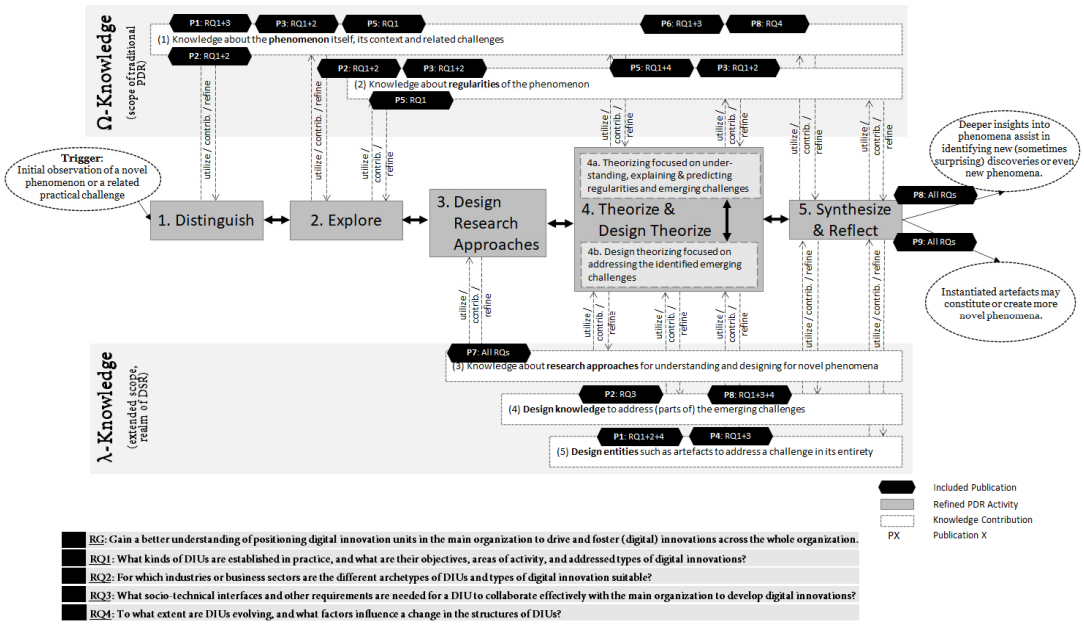


Figure 3.1: Phenomenon-driven DSR as Applied in this Dissertation
Source: Own Representation (based on Raabe et al. 2021b, p. 5)

The research entry point ("Trigger") is the appearance of the nascent phenomenon of DIUs within large incumbent firms. To distinguish a DIU's nature from other phenomena, publication P1 identifies various modes of bimodal IT, assigns two specific types of DIUs to a refined bimodal IT archetype, and thus demarcates DIUs from other IT units. Publication P2 identifies novel practical challenges that DIUs and their incumbent firms are confronted with, highlighting the need for DSR efforts to start by defining prescriptions as solutions. These two publications contribute to the Ω knowledge base by gaining

knowledge about the phenomenon, its context, and its multifaceted challenges (Knowledge Type 1). Consequently, the publications provide initial answers to RQ1, RQ2, and RQ3.

In-depth exploration takes place to intensify the process of understanding the phenomenon through the identification of regularities, principles, or patterns. Among the incumbent firm's digital innovation ecosystems, publications P3 and P5 shed light on the objectives and tasks of DIUs, which show the current regularities and patterns DIUs perform. These provided knowledge chunks contribute to Ω knowledge (Type 2) and assist in initiating a profound foundation of established DIUs in practice.

Experimenting with alternative research approaches may lead to novel understandings of the phenomenon of DIUs; thus, this dissertation combines several research methods to gain relevant data for analysis. These methods are described in Section 2.3. Despite the research methods, this dissertation performs and demonstrates a novel approach for conducting research on (IT) organizational and (IT) management phenomena. Since knowledge about research methodologies and paradigms contributes to the Λ knowledge base, publication P7 contributes to the Λ knowledge base and assists in indirectly answering the RQs. Publication P7 serves as the trigger and starting point for defining the research agenda for a promising phenomenon such as DIUs.

Theorize and Design Theorize utilizes, contributes, or refines Ω and Λ knowledge. The knowledge contributed from prior activities refines the regularities and context of DIUs. Publications P3, P5, and P6 refine the prerequisites for a successful DIU foundation, expand the knowledge about managing digital innovation (ecosystems), and connect DIUs with the adjacent research streams of bimodal IT and organizational ambidexterity. Furthermore, P8 introduces phases in which DIUs are strategically used, which might assist other firms in positioning DIUs in the long run (associated with 4a). Publications P2 and P8 contribute Λ knowledge, as they introduce crucial (meta-)requirements and design principles, thus addressing parts of the emerging challenges of DIUs in firms (Knowledge Type 4). Further, publications P1 and P4 contribute DIU good practices and a digital accelerator taxonomy as design entities for establishing DIUs (Knowledge Type 5). Although Gregor (2006) classified taxonomies as "type I" theory (descriptive knowledge), this dissertation follows Nickerson et al.'s (2013) taxonomy development approach, which entails, among descriptive "what" statements, prescriptive "how" elements referring to Drechsler and Hevner's (2018) interpretation of solution design entities. These knowledge chunks refer to the extended scope of PDR and the traditional realm of DSR, which is why they are associated with Activity 4b.

Synthesize & Reflect is the final activity of the approach. "The fifth activity still entails reconciling the newly generated knowledge with established wisdom, assessing the extent of the contribution, and identifying potential future research avenues, or future iterations on the same research questions" (Raabe et al. 2021b, p. 6). This dissertation contributes a synthesis of the partly isolated knowledge chunks and introduces a research agenda, including attributes that may assist researchers in conducting proper DIU research in the future (Publication P9). This synthesis utilizes the knowledge of all prior publications included in this dissertation, and it contributes a two-fold approach for DIUs (publication P3) into the Ω knowledge base, either focusing on (1) a problem-based selection of digital innovations or (2) a digital innovation-driven and triggered change of the firm as a whole (contributing to Knowledge Type 2). For Λ, pathways and guidance on establishing as well as positioning DIUs in incumbent firms are presented in publication P8, utilizing knowledge out of the previously included publications.

Design knowledge fitness was ascertained through qualitative–empirical expert interviews. The synthesized knowledge chunks are projectable on industry-independent large incumbent firms with legacy IT functions, and their confidence is assessed as medium, based on the number of interviews conducted and the understanding of the phenomenon, as no reapplication of the design knowledge in terms of establishing a DIU in a real scenario setting is performed.

Table 3.1 lists the publications and selected contributions to the knowledge base. The contributed knowledge chunks may be utilized by prior research on DIUs, may be a completely new contribution to one of the knowledge types, or may refine prior existing knowledge. Although these knowledge chunks already reveal several contributions of this dissertation, the theoretical and managerial/practical implications are further highlighted in Sections 5 and 6.

Table 3.1: Knowledge Contributions of the Included Publications

Source: Own Representation

#	Title	Ω Knowledge Contribution	Λ Knowledge Contribution
P1	Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups	*Phenomenon utilized & refined:* Definition of DIUs, demarcation to other (agile) units, assignment into a bimodal IT archetype	*Design entities contributed:* DIU good practices (C&S and CoE units) and their evolution
P2	'Forewarned Is Forearmed': Overcoming Multifaceted Challenges of Digital Innovation Units	*Phenomenon refined:* Challenges of DIUs, assignment into the PST-Model	*Design theory contributed:* Crucial actions to overcome the multifaceted challenges
P3	Towards an Intra-and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units	*Regularities refined:* Snapshot of DIU objectives and tasks, a two-fold approach to DIUs for managing digital innovations	N/A
P4	Realizing Organizational Ambidexterity: A Taxonomy of Digital Accelerators and Their Integration Mechanisms for Digital Innovation	*Phenomenon refined:* Definition of DIUs expanded to include digital accelerators and incubators, connecting DIU research with organizational ambidexterity research streams	*Design entity contributed:* A taxonomy for digital accelerators
P5	The Status Quo of Digital Innovation Units: "A Day Late and a Dollar Short"	*Regularities contributed:* Status quo of DIU types and addressed digital trends	N/A
P6	Towards a Foundational and Extensional Dynamic Capability Perspective on Digital Innovation Units	*Phenomenon refined:* Identification of dynamic capabilities realized or needed in DIUs	N/A
P7	Towards Phenomenon-driven Design Science Research	N/A	*Research Approach contributed:* Connecting phenomenon-driven approaches with DSR
P8	Meta-Requirements and Design Principles for Digital Innovation Units: A Longitudinal Investigation	*Phenomenon refined:* Introduction to phases in which DIUs are strategically used	*Design theory refined & contributed:* Meta-requirements and design principles for DIUs in the long term
P9	The Digital Innovation Unit: A Silver Bullet for Managing the Digital Transformation?	*Phenomenon utilized/refined*: Synthesis of the partly isolated knowledge chunks; definition of DIUs under a digital transformation lens	N/A

This dissertation evaluates the prescriptive Λ knowledge chunks (design theories and entities). Thus, this dissertation sketches three evaluation activities (Eval 1 to 3) incorporating the *design-evaluate-construct-evaluate* pattern for the realm of DSR developed by Sonnenberg and vom Brocke (2012). Using an evaluation approach suited for DSR is particularly eligible for this dissertation, since the produced phenomenon-related Λ knowledge chunks inform the human knowledge base of the traditional realm of DSR (Drechsler and Hevner 2018; Raabe et al. 2021b). This pattern suggests several ex-ante (formative) and ex-post (summative) episodes. Since no reapplication of the contributed design knowledge in the design of actual artefacts had taken place ("Use"), three evaluation episodes (two ex-ante and one ex-post evaluation activities) were conducted, as depicted in Figure 3.2. Following Prat's (2015) evaluation criteria, the evaluation gauges the utility, feasibility, generality (goal), completeness, simplicity, and understandability (structure), scalability, and adaptability (evolution) of the proposed good practices, taxonomy, meta-requirements, and design principles. The urge for DIU research is given due to the high emergence of DIUs in practice, little insights into what DIUs characterize and how they might be set up for fostering the innovation capacity of firms (Eval 1). Utilizing this descriptive knowledge of DIUs, the design entities (DIU good practices, digital accelerator taxonomy) and design theories (meta-requirements, design principles) were steadily evaluated through literature insights that matched the design theories and artefacts or through qualitative-empirical expert interviews, both ex-ante and ex-post (Eval 2 and Eval 3). The DIU good practices (Raabe et al. 2020a) and the digital accelerator taxonomy (Brauer et al. 2021) were both ex-post evaluated by three DIU experts who proofed the applicability of the design entities and suggested further improvements. The meta-requirements and design principles (Raabe et al. A.1) were ex-post evaluated by eight DIU experts. The final design theories and design entities are described and shown in Section 5.

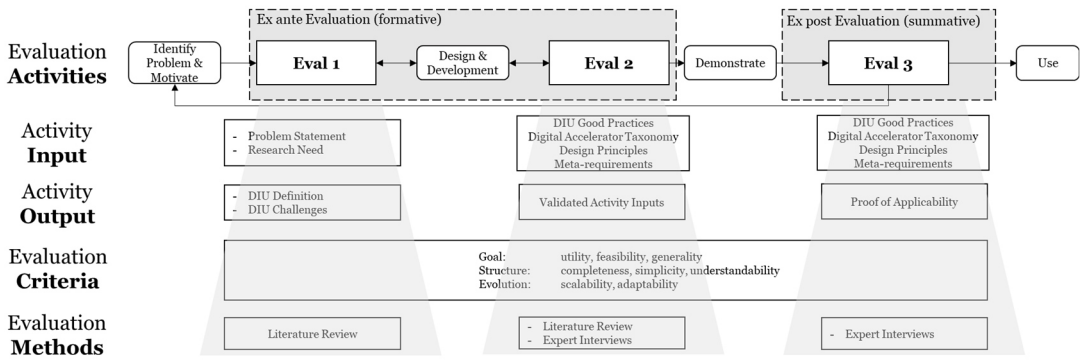


Figure 3.2: Evaluation Activities Performed in this Dissertation
Source: Own Representation (based on Sonnenberg and vom Brocke 2012)

3.3 Research Methods

Mingers (2001) argued that research results are more reliable if different research methods are utilized and combined, thus putting forward arguments in favor of a so-called pluralist approach. Following Mingers' (2001) call, this dissertation (a) connects different existing paradigms (PDR and DSR); (b) applies several research methods, including literature reviews and qualitative-empirical analyses; and (c) utilizes taxonomy development methodology and propositions for defining design principles. The following section describes each utilized research method in depth.

3.3.1 Literature Review

"The reviewing of existing literature relating to a topic is an essential first step and foundation when undertaking a research project" (Baker 2000, p. 219). A literature review is considered an essential feature for creating a foundation that promotes knowledge (Webster and Watson 2002). Knowledge synthesis and the utilization of prior literature is crucial and essential for a research field to be "scientific," particularly for novel emergent phenomena, where a profound theory is often lacking (Hunter et al. 1982; Paré et al. 2015). Therefore, Okoli (2015) differentiated between three general kinds of literature reviews: (1) theoretical background for giving theoretical foundations and insights into related research; (2) a literature review as a chapter within a thesis; and (3) a standalone literature review without the collection of any other data but the body of literature given. All three kinds are applied within the scope of this dissertation, either within the included publications or for utilizing knowledge to describe the theoretical foundations within the wrapper (see Section 2). The aim of the literature review is to gain a better understanding of the DIU phenomenon, emphasize the current research gaps, and assist in building design entities, such as the design principles or actions to overcome the multifaceted challenges DIUs are confronted with. Although all of the publications included herein entail a theoretical background section, Publications P3 (Raabe et al. 2021a), P5 (Holsten et al. 2021), P6 (Hellmich et al. 2021), and P9 (Raabe et al. A.2) perform a standalone literature review, with particular focuses on various information systems (IS) research outlets, such as articles within the "Senior Scholars' Basket of Journals" of the Association for Information Systems or other databases suggested by Knackstedt and Winkelmann (2006). The literature review process and inclusion and exclusion criteria are described in detail in the research methods sections of the articles. The first two general kinds of literature reviews are unstructured (Brink 2013) and conducted for the wrapper (especially Section

2) and the included publications (in their Related Research sections), whereas the standalone literature reviews follow a structured approach, complying with the guidelines and recommendations described by vom Brocke et al. (2009), Okoli (2015), and Paré et al. (2015). Further, literature reviews were continuously applied to validate the cycles of activities performed in the phenomenon-driven DSR approach to add and compare novel insights (Rowe 2014).

3.3.2 Data Collection and Data Analysis

Edmondson and McManus (2007) described three archetypes of methodological fit in field research: the nascent, the emerging, and the mature state of research. For a nascent state of prior theory and research, as for the phenomenon of DIUs, they emphasized open-ended inquiries about the phenomenon of interest and the collection of especially open-ended qualitative data through interviews, observations, and obtaining materials that are relevant to the phenomenon of interest (Edmondson and McManus 2007). Thus, following the recommendations by Helfferich (2014) and Gläser and Laudel (2010), several qualitative-empirical interviews (in total, 50; excluding the interviews for evaluation) were conducted via face-to-face meetings, remote video calls, and phone calls that all followed semi-structured questionnaires. The questionnaires were continuously updated based on the findings of the previous interviews, resulting in four questionnaire versions, which consisted of five blocks with further underlying questions: (1) Introduction, (2) Digital Innovation Management Processes: As-is and To-be, (3) IT-Organization and Handling of (Digital) Innovations, (4) Digital Innovation Ecosystem, and (5) Conclusion. The aim of these interviews was to sharpen the understanding of DIUs within the activities of distinguishing DIUs from other functions, exploring, (design) theorizing, and synthesizing. Thus, interviews were performed in the publications of Raabe et al. (2020a), Raabe et al. (2020b), Brauer et al. (2021), and Raabe et al. (A.1). All the interviews were audio-recorded and transcribed. For data analysis, the analysis is not limited to interview data as a source, as additional material in terms of a broad context analysis (Mayring 2014) may also be obtained. Habersang and Reihlen (2018) introduced a meta-analysis approach, reusing prior case studies described in the literature for data analysis. Raabe et al. (2021a) also performed this novel approach, which allows for the refinement or generation of new theory by identifying recurrent patterns from the reanalyzed cases (Habersang et al. 2019; Hoon 2013; Rauch et al. 2014).

Inspired by grounded theory research (Corbin and Strauss 1990), the qualitative data analysis encompasses inductive (data-driven codes derived from the data directly (Mayring 2014)) and deductive (codes derived from prior theory or concepts (Schreier 2014)) coding according to Mayring (2014), Schreier (2014), and Flick (2018). The interplay of deductive and inductive coding is particularly suitable for analyzing nascent phenomena since it assists in identifying problems or challenges or in deriving (meta-)requirements for phenomena where no prior theory exists. Qualitative content analysis is applied to develop design theories and design entities (Λ knowledge), such as good practices of DIUs (Publication P1), requirements for overcoming challenges (Publication P2), a taxonomy (Publication P4), and development of design principles (Publication P8).

3.3.3 Design Theory and Design Entity Development

In the realm of DSR, developing design theories or design entities are ways to contribute prescriptive Λ knowledge to the DSR knowledge base. "The first component of a design theory dealing with the product of design is a set of meta-requirements which describe the class of goals to which the theory applies" (Walls et al. 1992, p. 42). Meta-requirements (also known as design goal, design requirement, or boundaries) as a core component of an IS design theory apply generic and specify the purpose and scope (Jones and Gregor 2007) or boundaries (Dubin 1978). Besides generic meta-requirements, "[d]esign principles […] represent knowledge that is codified, explicit knowledge, readily accessible as prescriptive statements" (Chandra Kruse et al. 2016, p. 39). Design principles depict "not only innovative artifacts but also knowledge about creating other instances of artifacts that belong to the same class" (Sein et al. 2011, p. 39). Since "[d]esign principles must be understood in relation to the (often novel) contexts in which they are used" (Chandra Kruse et al. 2016, p. 39), this dissertation follows Chandra et al.'s (2015) proposition of design principles being acted upon to ensure consistency, clarity, and concision for prescribing DIUs and to give guidance on how to establish DIUs in incumbent firms (Publication P8). The separation of "generic" meta-requirements and "phase-dependent" design principles is particularly fruitful within this dissertation to cover the evolution or change of DIUs over time. While meta-requirements may be interpreted as defining generic principles for DIUs in the long run, design principles can assist in establishing the archetypes of DIUs, as described in publication P8.

Taxonomies are often used as a means to an end for developing design entities in IS research (e.g., Vogel 2021). Taxonomies provide a structure and organize knowledge,

which assists in classifying various concepts (Glass and Vessey 1995; Nickerson et al. 2013). These concepts (including taxonomies) represent conceptual DSR knowledge (Iivari 2007) that utilizes both Ω and Λ knowledge (Nickerson et al. 2013). Nickerson et al. (2013) initially proposed and demonstrated a method for developing taxonomies, which is used in Publication P4 for analyzing and deepening the understanding of digital accelerators, one specific archetype of DIUs focused on digital business models

4 Publications

This dissertation was written cumulatively and comprises nine publications that address the RG and the four stated RQs. Seven publications have been published in well-reputed IS conference proceedings; two are currently under review. This section introduces each publication in chronological order according to their publication dates and, for each publication, list the authors, (meta-)information about the conference (year and place of publication, the conference ranking based on WKWI[1], VHB-JOURQUAL3[2], and CORE2018[3], the type, and the track), the RQs addressed, the research methodology, the research contribution, and the coauthors' contributions. Table 4.1 presents an overview of the included publications.

Table 4.1: Included Publications
Source: Own Representation

No.	Publication	Section
1	Raabe, J.-P., Horlach, B., Drews, P., and Schirmer, I. 2020. **"Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups"** International Conference on Wirtschaftsinformatik (WI). Potsdam, Germany	9
2	Raabe, J.-P., Horlach, B., Schirmer, I., and Drews, P. 2020. **"'Forewarned Is Forearmed': Overcoming Multifaceted Challenges of Digital Innovation Units"** Americas Conference on Information Systems (AMCIS). A Virtual AIS Conference.	10
3	Raabe, J.-P., Drews, P., Horlach, B., and Schirmer, I. 2021. **"Towards an Intra- and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units"** Hawaii International Conference on System Sciences (HICSS). A Virtual Conference.	11

[1] http://gcc.upb.de/K-Pool/WKWI-Ranking

[2] https://vhbonline.org/fileadmin/user_upload/JQ3_WI.pdf

[3] http://portal.core.edu.au/conf-ranks/

4	Brauer, P., Raabe, J.-P., and Schirmer, I. 2021. **"Realizing Organizational Ambidexterity: A Taxonomy of Digital Accelerators and Their Integration Mechanisms for Digital Innovation"** Pacific Asia Conference on Information Systems (PACIS). A Virtual AIS Conference	12
5	Holsten, J., Raabe, J.-P., Gebken, L., and Schirmer, I. 2021. **"The Status Quo of Digital Innovation Units: "A Day Late and a Dollar Short""** Americas Conference on Information Systems (AMCIS). A Virtual AIS Conference.	13
6	Hellmich, J., Raabe, J.-P., and Schirmer, I. 2021. **"Towards a Foundational and Extensional Dynamic Capability Perspective on Digital Innovation Units"** Americas Conference on Information Systems (AMCIS). A Virtual AIS Conference.	14
7	Raabe, J.-P., Horlach, B., and Drechsler, A. 2021. **"Towards Phenomenon-Driven Design Science Research"** Australasian Conference on Information Systems (ACIS). A Virtual AIS Conference.	15
8	Raabe, J.-P., Horlach, B., and Schirmer, I. Under review. **"Meta-Requirements and Design Principles for Digital Innovation Units: A Longitudinal Investigation"** European Conference on Information Systems (ECIS). Timisoara, Romania.	A.1
9	Raabe, J.-P., Haskamp, T., Barthel, P., Schirmer, I., and Hess, T. Under review. **"The Digital Innovation Unit: A Silver Bullet for Managing the Digital Transformation?"** European Conference on Information Systems (ECIS). Timisoara, Romania.	A.2

Table 4.2: First Publication of the Cumulative Dissertation
Source: Own Representation

Citation	Raabe, J.-P., Horlach, B., Drews, P., and Schirmer, I. 2020a. "Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups," *International Conference on Wirtschaftsinformatik (WI)*.
Ranking	WKWI: A VBH-JOURQUAL3: C Core2018: C
Type	Completed Research Paper
Track	Digitale Innovationen & Entrepreneurship
Methodology	Qualitative–empirical cross-industry study
Research question	RQ1: How are DIUs set up? RQ2: How are DIUs linked with the main organization?
Research contribution	This paper develops design knowledge in terms of two design entities illustrating good practices of DIUs: a Coaching & Screening unit (C&S) and a Center of Excellence unit (CoE). This paper also describes integration mechanisms and initial evolution strategies that are usable for firms willing to establish DIUs. This paper contributes to the research on how innovation may take place in bimodal IT settings, as it argues that DIUs are one implementation option of an agile bimodal IT mode.
Co-authors' contribution	Bettina Horlach, Paul Drews, and Ingrid Schirmer co-authored this publication. Bettina Horlach assisted in contributing knowledge on bimodal IT. She revised the related research and discussion sections. Paul Drews and Ingrid Schirmer provided overall feedback and contributed to the discussion and conclusion sections.

Table 4.3: Second Publication of the Cumulative Dissertation
Source: Own Representation

Citation	Raabe, J.-P., Horlach, B., Schirmer, I., and Drews, P. 2020b. "'Forewarned Is Forearmed': Overcoming Multifaceted Challenges of Digital Innovation Units," *Americas Conference on Information Systems (AMCIS)*.
Ranking	WKWI: B VBH-JOURQUAL3: D CORE2018: A
Type	Completed Research Paper
Track	Strategic and Competitive Uses of IT
Methodology	Literature review Qualitative-empirical cross-industry study
Research question	RQ: Why do DIUs not meet their expectations and which set of actions can enterprises take to tackle the challenges?
Research contribution	This paper has three major contributions. First, it describes the multifaceted challenges DIUs face that may lead to their dissolution. Second, it connects DIUs with the organizational theories of ambidexterity, bimodal IT, and trimodal (multimodal) IT. Third, it contributes three crucial actions that DIUs and their incumbent firms must pursue to successfully establish and position DIUs. While researchers can gain a deeper understanding of a DIU's nature, practitioners may check whether their already established DIUs are at risk of ignoring the described multifaceted challenges. Practitioners might use these three crucial actions as a stencil for refining or even establishing DIUs.
Co-authors' contribution	Bettina Horlach, Ingrid Schirmer, and Paul Drews co-authored this publication. Bettina Horlach contributed to the introduction and advised on the research methodology. Ingrid Schirmer contributed to the discussion section and assisted in coining the three crucial actions to overcome the described challenges. Paul Drews provided overall feedback.

Table 4.4: Third Publication of the Cumulative Dissertation
Source: Own Representation

Citation	Raabe, J.-P., Drews, P., Horlach, B., and Schirmer, I. 2021a. "Towards an Intra-and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units," *Hawaii International Conference on System Sciences (HICSS)*, pp. 5902-5911.
Ranking	WKWI: B VBH-JOURQUAL3: C CORE2018: A
Type	Completed Research Paper
Track	Organizational Systems and Technology: Digital Innovation, Transformation, and Entrepreneurship
Methodology	Literature review Qualitative meta-analysis
Research question	RQ1: What are the objectives and areas of activity of DIUs? RQ2: How is the interorganizational perspective addressed in DIUs?
Research contribution	Drawing on multiple cases of DIUs described in the literature, this paper contributes and clarifies the objectives and areas of activity of DIUs. DIUs impose an intraorganizational cultural and overarching organizational design change. This paper also shows that DIUs convey an interorganizational perspective with customer-oriented digital expertise and innovation as well as the cultivation of digital innovation ecosystems.
Co-authors' contribution	Paul Drews, Bettina Horlach, and Ingrid Schirmer co-authored this publication. Paul Drews contributed to the research methodology. Bettina Horlach and Ingrid Schirmer advised on the conceptual design of the paper.

Table 4.5: Fourth Publication of the Cumulative Dissertation
Source: Own Representation

Citation	Brauer, P., Raabe, J.-P., and Schirmer, I. 2021. "Realizing Organizational Ambidexterity: A Taxonomy of Digital Accelerators and Their Integration Mechanisms for Digital Innovation," *Pacific Asia Conference on Information Systems (PACIS)*.
Ranking	WKWI: B VBH-JOURQUAL3: C CORE2018: A
Type	Completed Research Paper
Track	IT Strategy, Leadership and Governance
Methodology	Qualitative-empirical cross-industry study Taxonomy development
Research question	RQ1: What are the characteristics of digital accelerators? RQ2: What mechanisms for integrating digital innovations are used by digital accelerators?
Research contribution	This paper contributes a taxonomy of digital accelerators, which includes integration mechanisms as a crucial dimension. These mechanisms create fruitful support for enabling ambidextrous settings with digital accelerators or DIUs in general. Furthermore, this publication proposes digital accelerators acting as middleware for connecting incumbent firms with novel digital innovation ecosystems.
Co-authors' contribution	Patricia Brauer and Ingrid Schirmer co-authored this publication. Drawing on the results of Patricia Brauer's master's thesis, she assisted in refining the taxonomy, advised on the taxonomy dimensions, and contributed to the results section. Ingrid Schirmer provided overall feedback on the paper.

Table 4.6: Fifth Publication of the Cumulative Dissertation
Source: Own Representation

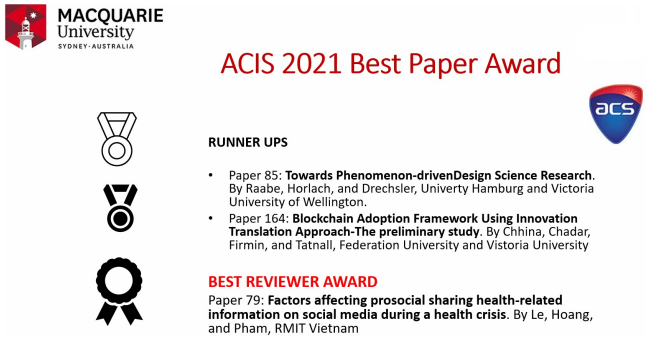
Citation	Holsten, J. M., Raabe, J.-P., Gebken, L., and Schirmer, I. 2021. "The Status Quo of Digital Innovation Units: "A Day Late and a Dollar Short"," *Americas Conference on Information Systems (AMCIS)*.
Ranking	WKWI: B VBH-JOURQUAL3: D CORE2018: A
Type	Completed Research Paper
Track	Digital Agility: Digital Innovation Units and Digital Agility
Methodology	Literature review
Research question	RQ1: Which DI types and digital trends are currently being addressed by DIUs? RQ2: To what extent do DI types and digital trends relate to DIU setups?
Research contribution	This paper shows the status quo of DIUs and describes current digital trends that are especially addressed by DAX30 DIUs. It identifies that DIUs focus on digital product and business model innovations related to artificial intelligence (AI), internet of things (IoT), and data analytics.
Co-authors' contribution	Johanna Marie Holsten, Larissa Gebken, and Ingrid Schirmer co-authored this publication. Drawing on Johanna Marie Holsten's bachelor's thesis, she contributed to the related research and results sections. Larissa Gebken supervised the bachelor's thesis. Ingrid Schirmer provided overall feedback on the paper.

Table 4.7: Sixth Publication of the Cumulative Dissertation
Source: Own Representation

Citation	Hellmich, J., Raabe, J.-P., and Schirmer, I. 2021. "Towards a Foundational and Extensional Dynamic Capability Perspective on Digital Innovation Units," *Americas Conference on Information Systems (AMCIS)*.
Ranking	WKWI: B VBH-JOURQUAL3: D CORE2018: A  Awarded "Best AMCIS 2021 Complete Top 25% Papers"[1]
Type	Completed Research Paper
Track	Digital Agility: Digital Innovation Units and Digital Agility
Methodology	Literature review
Research question	RQ1: Which dynamic capabilities are relevant in relation to agility and digital innovation? RQ2: How are the identified dynamic capabilities related to each other and connected with the stages of digital innovation and setups of DIUs?
Research contribution	This paper contributes a structured overview of dynamic capabilities realized or needed in terms of agile and digital innovation-friendly settings in incumbent firms. Connecting Dynamic Capability (DynCap) research with the nascent DIU research stream may assist in tackling multifaceted and competing concerns while establishing or positioning different DIU archetypes.
Co-authors' contribution	Jannis Hellmich and Ingrid Schirmer co-authored this publication. Drawing on Jannis Hellmich's bachelor's thesis, he contributed to the research methodology and results sections and advised on the discussion section. Ingrid Schirmer provided overall feedback.

[1] https://aisel.aisnet.org/amcis2021/awards.html

Table 4.8: Seventh Publication of the Cumulative Dissertation
Source: Own Representation

Citation	Raabe, J.-P., Horlach, B., and Drechsler, A. 2021b. "Towards Phenomenon-driven Design Science Research," *Australasian Conference on Information Systems (ACIS).*
Ranking	WKWI: C VBH-JOURQUAL3: / CORE2018: Australasian Awarded "ACIS2021 Best Paper Runner-up"[1]: 
Type	Completed Research Paper
Track	IS Philosophy and Research Methods
Research contribution	Drawing on PDR and DSR, this paper presents a novel hybrid research approach. The phenomenon-driven DSR approach develops both descriptive and prescriptive knowledge about novel phenomena, doing so in conjunction with and in a mutually reinforcing way. Researchers could use this approach to understand novel phenomena and to contribute knowledge relevant to practitioners who face serious challenges because of these novel phenomena.
Co-authors' contribution	Bettina Horlach and Andreas Drechsler co-authored this publication. Bettina Horlach contributed to example case 1. Andreas Drechsler assisted in contributing to the introduced research approach and theoretical framing and advised on the conceptual design of this paper.

[1] Announcement during ACIS2021's "Awards and Closing Ceremony" in 12/10/2021.

Table 4.9: Eighth Publication of the Cumulative Dissertation
Source: Own Representation

Citation	**Under Review**: Raabe, J.-P., Horlach, B., and Schirmer, I. 2022a. "Meta-Requirements and Design Principles for Digital Innovation Units: A Longitudinal Investigation," *European Conference on Information Systems (ECIS)*.
Ranking	WKWI: A VBH-JOURQUAL3: B CORE2018: A
Type	Completed Research Paper
Track	Rethinking IS Strategy and Governance in the Digital Age
Methodology	Design science research Qualitative–empirical single case study Meta-requirements and design principles development
Research question	RQ: What are meta-requirements and design principles for DIUs?
Research contribution	This publication contributes DIU meta-requirements and design principles and describes five distinct phases in which DIUs may be strategically used within incumbent firms. This paper also reveals an ambidextrous long-term trend concerning the oscillation of exploration and exploitation depending on the types of digital innovation: Digital business model innovations seem to be managed structurally separated; digital product and process innovations tend to be contextually integrated due to an overall innovation responsibility of all employees.
Co-authors' contribution	Bettina Horlach and Ingrid Schirmer co-authored this paper. Bettina Horlach assisted in conducting the interviews for the longitudinal single-case study. Ingrid Schirmer provided overall feedback and contributed to the discussion section.

Table 4.10: Ninth Publication of the Cumulative Dissertation
Source: Own Representation

Citation	**Under Review**: Raabe, J.-P., Haskamp, T., Barthel, P., Schirmer, I., and Hess, T. 2022b. "The Digital Innovation Unit: A Silver Bullet for Managing the Digital Transformation?," *European Conference on Information Systems (ECIS).*
Ranking	WKWI: A VBH-JOURQUAL3: B CORE2018: A
Type	Completed Research Paper
Track	Rethinking IS Strategy and Governance in the Digital Age
Methodology	Literature review
Research question	RQ: What is the current body of knowledge on digital innovation units and their role in digital transformation?
Research contribution	Drawing on extant DIU literature, this paper contributes a synthesis knowledge on DIUs and proposes a research agenda, which assists in classifying and structuring current knowledge on DIUs. This paper assists researchers in gaining a deeper understanding of the nascent phenomenon of DIUs and may guide them in conducting proper DIU research in the future. Practitioners can draw on this paper to understand a DIU's nature and role in managing a firm's digital transformation.
Co-authors' contribution	Thomas Haskamp, Philipp Barthel, Ingrid Schirmer, and Thomas Hess co-authored this publication. While Thomas Haskamp and Philipp Barthel contributed equally to each section of this publication, Ingrid Schirmer and Thomas Hess provided overall feedback for the publication.

5 Theoretical Contribution

This section comprises the main theoretical contributions of this dissertation and is divided into two subsections. The first section describes the contributions made within each activity of the phenomenon-driven DSR approach (Raabe et al. 2021b). The second section contains the overall theoretical contribution, which comprises three major contributions: (1) Demystification: "White-boxing" DIUs and their nature, (2) DIUs interaction with and integration within incumbent firms, and (3) DIUs and incumbent firms being in a constant flux. This section discusses the establishment and positioning of DIUs in the organization over time and makes further implications for digital innovation management in incumbent firms. The overall contributions serve to answer the RQs and the overlying RG.

5.1 Contributions within Each Activity of the Research Approach

Initially indicated within Section 3.2 ("Research Strategy"), the following subsections describe the contributed and/or refined knowledge chunks based on activities in the phenomenon-driven DSR approach (Raabe et al. 2021b). Figure 5.1 depicts the contributed/refined knowledge chunks within each activity of the phenomenon-driven DSR approach. The following activity-based subsections describe each produced knowledge chunk (bold marked), and these are later connected in the overall theoretical contribution section (Section 5.2).

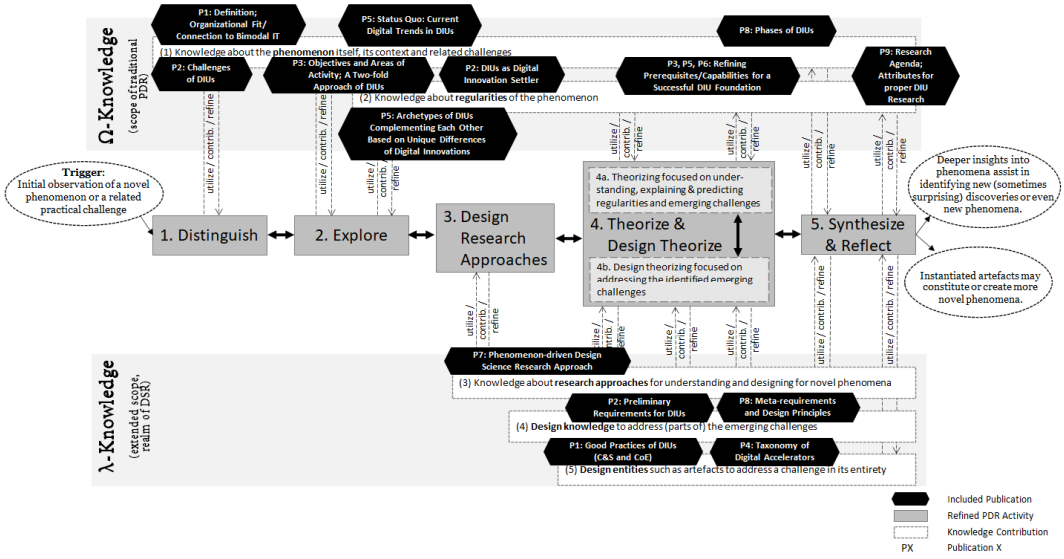


Figure 5.1: Contributed/Refined Knowledge Chunks within Each Activity
Source: Own Representation (based on Raabe et al. 2021b, p. 5)

Since P1–P8 produced partly isolated chunks, the main aim of P9 was to connect these chunks through synthesis, using Whetten's (1989) building blocks of theory. As a result, P9 (Raabe et al. A.2) presented a research agenda that might assist researchers in conducting proper DIU research, thus fulfilling the fifth activity ("Synthesize & Reflect") of the phenomenon-driven DSR approach.

5.1.1 Distinguish: Differentiating a DIU's Nature from Other Phenomena

Towards defining DIUs: DIUs appear in various names and characterizations (Barthel et al. 2020a; Fuchs et al. 2019; Holotiuk and Beimborn 2019; Velten et al. 2016) and may be demarcated based on whether their innovation activities occur within or outside of the main organization (Fuchs et al. 2019). In an initial attempt to define DIUs as dedicated organizational units, Raabe et al. (2020a) highlighted the primary internal focus of changing digital processes and products inside the main organization to which they belong, thus stating that DIUs do not focus on direct business model offerings to the markets (such as accelerators or incubators). This definition is later extended and refined, for example, by including externally oriented units and under the lens of digital transformation (Brauer et al. 2021; Raabe et al. A.2), leading to the following definition that is used in this dissertation: DIUs are dedicated organizational units that represent a potential vehicle or nexus for the ideation, development, and integration of digital innovation in organizations (Barthel et al. 2020a; Ciriello and Richter 2015; Raabe et al. 2020a).

DIUs and their connection to bimodal IT: By analyzing a DIUs organizational fit within the described bimodal IT setups (Gerster et al. 2019; Haffke et al. 2017a; Horlach et al. 2017; Jöhnk et al. 2017), Raabe et al. (2020a) substantiated DIUs as a specific implementation of an organizationally separated agile division (see Figure 5.2; Mode 2) that focuses on digital innovations involving (at least) radical product innovations. By showing evolutionary pathways for reaching a stronger agile mode in firms by establishing and transforming DIUs, Raabe et al. (2020a) introduced a dynamic view of bimodal IT explicitly for its specific type with separated divisions. Stating that DIUs fit a specific agile mode demarcates them from other traditional modes of a bimodal IT setup.

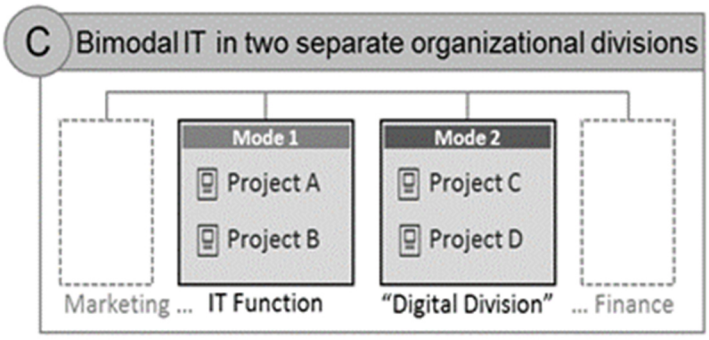


Figure 5.2: A Bimodal IT Setup with a Digital Division
Source: (Haffke et al. 2017b, p. 5464; cited in Raabe et al. 2020a, p. 3)

Challenges of DIUs: The first activity ("Distinguish") requires the identification of practical challenges related to DIUs (Raabe et al. 2021b). Thus, Raabe et al. (2020b) identified multifaceted challenges spanning the stages of digital innovation, organizational units, and hierarchical levels. Challenges arise within one, across several, or even in all stages of digital innovation (Fichman et al. 2014). As DIUs usually have strong ties to the main organization (Fuchs et al. 2019; Holotiuk and Beimborn 2019), they require sophisticated cooperation with the business units and IT departments of the main organization. Further, as the challenges are not confined solely to the level and role of executors, they require the high support of executives across diverse hierarchy levels (Raabe et al. 2020b). This results in seven challenges that have been identified through an extant literature review, as well as through qualitative-empirical interviews with DIU employees and external management staff who coordinate their work with DIUs. Figure 5.2 depicts the seven main challenges that are motivated by the rising number of negative press headlines addressing the failure of DIUs. These challenges affecting both DIUs and the main organization are candidates for subsequent validation and refinement into problems suitable for exploring the phenomenon and developing solutions.

Identified Challenges of DIUs	Affects[1]	Stage[2]				Literature Findings	Empirical Findings
		1	2	3	4		
C1: Not-Invented-Here Syndrome	DIU			x		Bärtle 2017; Catlin et al. 2017; Chiesa 2000; Ciriello and Richter 2015; Dearlove 2006; Diehl 2017; etventure 2018; Fecher et al. 2018; Islam et al. 2016; Narayanan 2017; Remfert and Stockhinger 2018; Svahn et al. 2017	ENT1–5, 8, 9
C1.1: Missing Collaboration in Discovery Stage	All	x				Kerr 2018; Novacek et al. 2017; Velten et al. 2016	/
C1.2: DIUs Attitude of Knowing Everything Better	BU, IT			x		/	ENT8
C1.3: Feeling of Getting Ideas Stolen	BU, IT	x				/	ENT1
C2: Unclear DIU Objectives	All	x				Catlin et al. 2017; Narayanan 2017; Turrin 2019	ENT11
C3: Missing Support from (Top) Management	DIU	x	x	x	x	Velten et al. 2016	ENT1–6, 8, 11
C4: Missing Skills	All	x		x		etventure 2018; Fecher et al. 2018; Haffke et al. 2017; Hyvönen 2018; Narayanan 2017; Novacek et al. 2017; Svahn et al. 2017; Velten et al. 2016; Wiesboeck 2018	ENT1–5, 8, 10
C5: CDO & CIO Conflicts	DIU			x		Pfirsching 2017; Velten et al. 2016	ENT10
C6: Financial Bottlenecks	DIU		x	x	x	Fecher et al. 2018; Hyvönen 2018; Sindemann and Buttlar 2018; Velten et al. 2016	ENT2, 4, 5, 8
C7: Part-Time Employees	DIU	x	x	x	x	Depiereux 2017	ENT4, 5, 7, 8, 11

[1] Challenge primary affects: BU = Business Units of Main Organization ; IT = IT Department(s) of Main Organization; DIU
[2] DI Management Stages (Fichman et al. 2014): 1 = discovery; 2 = delivery; 3 = diffusion; 4 = impact

Figure 5.3: Multifaceted Challenges Affecting DIUs, Business Units, and IT
Source: (Raabe et al. 2020b, p. 6)

5.1.2 Explore: Discover further Insights into the Phenomenon of DIU

DIUs' Objectives and Areas of Activity ("Status Quo"): Among the different challenges DIUs face (Raabe et al. 2020b), the identified challenge of unclear DIU objectives is a major issue that may have a massive impact on the success of a DIU. Therefore, Raabe et al. (2021a) and Holsten et al. (2021) further explored the prerequisites and reasons for establishing DIUs by shedding light on their objectives and tasks. The authors identified five objectives and seven accompanying areas of activity (tasks). Apart from the objectives discovered elsewhere, such as Digital Innovation, Cultural Change, and Digital Expertise (Fuchs et al. 2019), Raabe et al. (2021a) identified additional objectives: Organizational Design Change and Digital Innovation Ecosystem. Figure 5.4. shows the areas of activity and their connection to the five objectives: Digital Innovation (DI), Cultural Change (CC), Digital Expertise (DE), Organizational Design Change (ODC), and Digital Innovation Ecosystem (DIE). ODC and DIE have different impacts on the main organization. ODC enforces an intraorganizational change in the main organization, whereas DIE imposes an interorganizational perspective with customer-oriented digital expertise and innovation focus, shifting the locus of innovation toward networks of partners, customers, and even competitors (Raabe et al. 2021a).

No.	Areas of Activity	Objectives[1]				
		DI	CC	DE	ODC	DIE
#1	Explore new digital technology trends: evaluate their strategic fit with the business	x				x
#2	Discover, develop, implement, and diffuse digital solutions	x				(x)
#3	Foster a "Digital Culture"		x		(x)	
#4	Develop and leverage digital expertise (and agile methods)		(x)	x	(x)	(x)
#5	Participate and cooperate in existing digital innovation ecosystem(s):	(x)		(x)		x
#6	Build (complimentary) digital innovation ecosystem(s)	x		(x)		x
#7	Enable organizational designs/concepts (suitable for fast innovation integration)		(x)	(x)	x	

[1] DI = Digital Innovation; CC = Cultural Change; DE = Digital Expertise; ODC = Organizational Design Change; DIE = Digital Innovation Ecosystem

Figure 5.4: Objectives and Areas of Activity
Source: (Raabe et al. 2021a, p. 5905)

Two-fold approach of DIUs: The above-stated objectives and areas of activity lead to a two-fold approach to DIUs (Raabe et al. 2021a): (1) the business problem-based digital innovation selection and (2) the digital innovation-driven business change, which are rooted in the two perspectives of DIUs rather being internally or externally oriented (Fuchs et al. 2019). DIUs aspire to conduct either the first or second approach, but sometimes both. The first approach (business problem-based digital innovation selection) identifies the problems or challenges of the main organization, searches for suitable digital technology trends, and develops possible solutions to these problems or challenges with the help of these novel digital technologies. The second approach works oppositely by first exploring current digital technologies (in digital innovation ecosystems) and evaluating their potential of being disruptive, and then making recommendations if the main organization must react (e.g., adapting the current business model or integrating the new potential disruptive digital innovation) (Raabe et al. 2021a).

DIUs as settlers for integrating digital innovations: The two-fold approach (Raabe et al. 2021a) clarifies that DIUs are able to integrate new digital technologies into incumbent firms. While connecting DIUs with research on bimodal IT (Raabe et al. 2020a), Raabe et al. (2020b) showed that DIUs also enable a trimodal IT setting (Wardley 2015), in which the DIUs take the role of Pioneers and Settlers. Pioneers are responsible for creating novel prototypes or minimum viable products (MVP), and Settlers identify common patterns and strive to transfer a Pioneer's work into the Townplanner (an incumbent firm). Thus, a Settler aims to narrow the gap between the two large silos (Pioneer vs. Townplanner), which is often criticized within bimodal IT settings (Wardley 2015). To settle digital innovations into incumbent firms, a DIU uses several methodological integration mechanisms (Brauer et al. 2021; Raabe et al. 2020a), as discussed in Section 2.2.

Archetypes of DIUs: The two-fold approach, objectives, and areas of activity were also used to classify DIU cases and archetypes from the literature. Holsten et al. (2021) selected four archetypes that complement each other based on the unique differences of digital

innovations (Figure 5.5): Coaching & Screening (C&S) (Raabe et al. 2020a), Center of Excellence (CoE) (Raabe et al. 2020a), External Creator (ExC) (Barthel et al. 2020a), and Incubator (Inc) (Jöhnk et al. 2020). These archetypes are differentiated based on the digital innovation type (digital process, product, service, business model (Edwards-Schachter 2018; Fichman et al. 2014)), the degree of change (incremental or radical (Christensen 1997; Christensen et al. 2015; Dahlin and Behrens 2005)), or the stages of digital innovation covered (discovery, development, internal/external diffusion, impact (Fichman et al. 2014)). Holsten et al. (2021) claimed that DIUs not only have an internal focus but that they are also externally oriented. The authors showed that incumbent firms are implementing DIUs in particular that are classified as CoEs or Incs, primarily addressing digital products and digital business models related to AI, IoT/Smart X and Data Analytics (Holsten et al. 2021). Incs have only a few touchpoints to the main organization (Jöhnk et al. 2020).

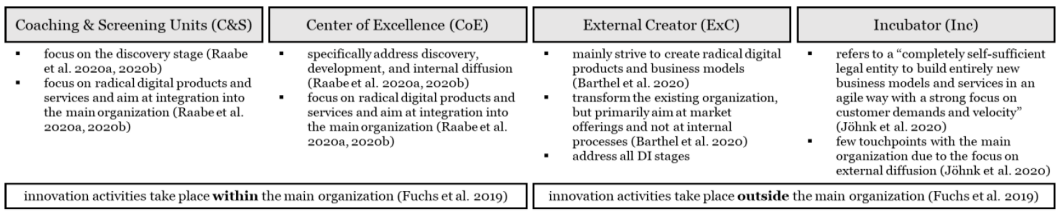


Figure 5.5: Four Archetypes of DIUs
Source: (Holsten et al. 2021, p. 3)

5.1.3 Design Research Approaches: Phenomenon-driven DSR

As well as contributing the **phenomenon-driven DSR approach** (Raabe et al. 2021b), this dissertation took several alternate research method approaches to understand the DIU phenomenon. These approaches include the research methods described in Section 3.3 as well as a standalone DSR research approach conducted in publication P8 (Raabe et al. A.1), which was used to define the meta-requirements and design principles for establishing DIUs in the long term. As stated in Section 3, a novel phenomenon-driven DSR approach was needed due to the embryonic phase in which DIUs are currently situated. Traditional PDR is aimed primarily at producing or refining descriptive or explanatory knowledge, whereas the realm of DSR assumes prior theoretical knowledge on which to build and contribute prescriptive knowledge. As DIU research is in a nascent state, there is little knowledge to build on for DSR. Thus, connecting these two paradigms in a mutually reinforcing way was fruitful to (1) gain a deeper understanding of DIUs and (2) obtain knowledge of how to face novel challenges resulting from DIUs.

5.1.4 Theorize & Design Theorize: Understanding DIUs and Addressing Emerging Challenges

Dynamic Capabilities: Based on a structured literature review on dynamic capabilities, agility, and digital innovation (units), Publication P6 (Hellmich et al. 2021) carved out the need for dynamic capabilities DIUs and introduced a differentiation between foundational and extensional perspectives of dynamic capabilities. Foundational perspectives are those initially described by Teece (2007) as sensing, seizing, and transforming. Extensional perspectives are extensions to foundational ones. The dynamic capabilities needed in a DIU setting vary depending on the stages in which DIUs perform. Following the four archetypes previously used and described by Holsten et al. (2021), Figure 5.6 shows the dynamic capabilities needed for DIUs and those dynamic capabilities that are enabled by DIUs.

DIUs enable firms to become ambidextrous by structurally dividing exploitation and exploration. DIUs realize an explorative mode insofar as dynamic capabilities for exploitation are not needed within a DIU (Raabe et al. 2020b). However, DIUs enable exploitation in incumbent firms indirectly due to being a counterpart of exploration (Raabe et al. 2020b). Connecting DIU archetypes, digital innovation, and agility with dynamic capability research is an initial try for theorizing (1) what dynamic capabilities are needed or expected in a successful DIU setup ("DIU's internal view") and (2) what dynamic capabilities are realized or enabled through establishing and positioning DIUs in firms (e.g., in terms of organizational structures such as ambidexterity) ("A DIU's enablement for the main organization").

Dynamic Capabilities	Capability dimensions	Stages*			
		1	2	3	4
Foundation: Dynamic Capabilities	Sensing	x	x		
	Seizing		x	x	
	Transforming			(x)	x
Extension: Absorptive Capacity	Potential Absorptive Capacity	x	(x)		
	Realized Absorptive Capacity		x	x	x
Extension: Adaptive Capability or Capacity	Forecasting Ability	x			
	Scanning Ability		x		
	Capturing Ability		x	x	
	Management Change Ability		x	x	x
Extension: (IT, Dynamic, and Operational) Ambidexterity	Exploration	x	x	x	x
	Exploitation	x	x	x	x
Extension: Digital Business Intensity	-	x	x	x	x
Extension: Digital Capabilities	Digital Proactiveness	x	(x)		
	Digital Responsiveness		x	x	x
Extension: Digital Options	-	x	x	x	x
Extension: Enterprise Architecture Capability	-	x	x	x	x

*Digital Innovation Stages: 1 = Discovery; 2 = Development; 3 = Internal/External Diffusion; 4 = Impact

C&S

CoE, ExC, Inc

Figure 5.6: Dynamic Capabilities Needed or Realized in DIUs

Source: (Hellmich et al. 2021, p. 7)

DIU good practices: The dynamic capabilities needed in different DIUs guide different archetypes. Despite a variety of DIUs being established in practice, prescriptive knowledge on how to establish and position DIUs with an internal focus remains scarce. Thus, Raabe

et al. (2020a) conducted a qualitative–empirical study with nine established DIUs in practice. From these, they derived two good practices of DIUs and determined how DIUs need to be positioned in their incumbent firms. While Coaching & Screening (C&S) units focus on digital trend screening and establishing digital and agile expertise (Raabe et al. 2020a; Raabe et al. 2021a), Center of Excellence (CoE) units are responsible for developing and integrating digital product innovations into their main organization (Raabe et al. 2020a). Figures 5.7 and 5.8 depict the good practices of the C&S and CoE units.

C&S units should be divided into the following three, or sometimes four, roles or functions: (1) external digital trend screening; (2) problem scouting, which analyzes and identifies the challenges its main or core organization (CE) is struggling with; (3) agile coaching; and sometimes (4) marketing, which strives to make digital innovation initiatives transparent within and outside a CE (Raabe et al. 2020a).

CoE units should have (1) a unit lead (usually the CDO of an incumbent firm); (2) problem scouts, who have specific digital innovation foci ("honey pots") for analyzing a digital innovation fit with a problem an incumbent is facing; and (3) agile development (Dev), for developing digital innovations and transferring them to the main organization (Raabe et al. 2020a). To overcome the problem of part-time employees (Raabe et al. 2020b), a CoE unit employs its own so-called problem scouts (former employees of the main organization) who transfer to the core team (see Figure 5.8) either as a product owner or developer, depending on the skills of the problem scout ("internal employee shifting").

These units pursue two integration mechanisms to tackle the aforementioned challenges of DIUs: employee shifting ("Liaison Channeling") and the diffusion of digital technologies into the main organization, as DIUs are not responsible for operating or maintaining these products in the long term (Raabe et al. 2020a). The transfer of digital innovation connects DIUs with its incumbent firm and assumes strong collaboration, leading to the integration mechanism of "Integrative Innovation Planning" (Gassmann et al. 2012).

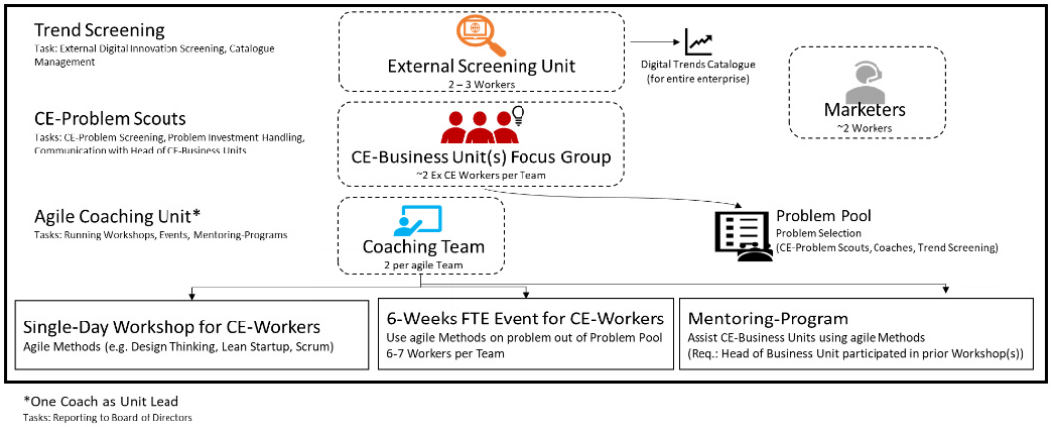


Figure 5.7: Coaching and Screening Unit
Source: (Raabe et al. 2020a, p. 8)

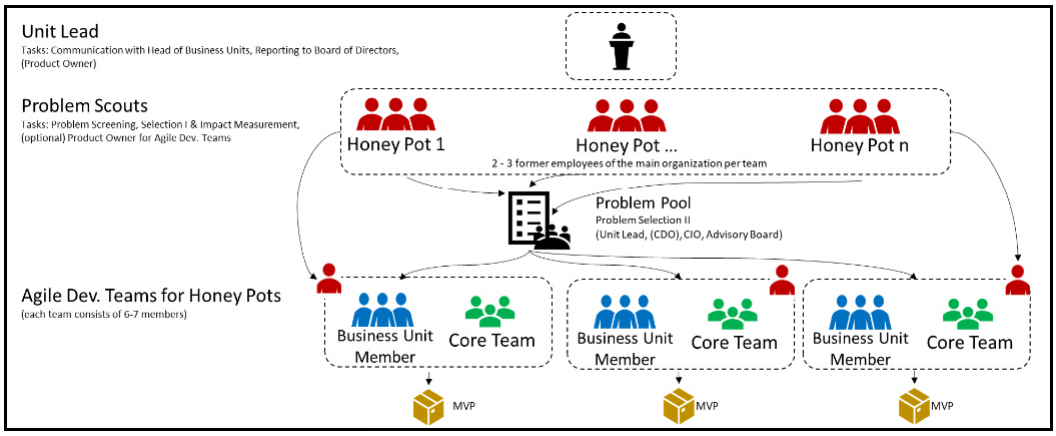


Figure 5.8: Center of Excellence Unit
Source: (Raabe et al. 2020a, p. 9)

Taxonomy of digital accelerators: Among internally oriented archetypes, externally oriented archetypes exist that strive to produce and scale digital business model innovations to address current or even new markets. Based on a qualitative-empirical study with ten accelerators and nine startups, Publication P4 (Brauer et al. 2021) carved out a taxonomy for digital accelerators, which entail and complement digital incubator units (Jöhnk et al. 2020) and external creator units (Barthel et al. 2020a) introduced in previous research. Figure 5.9 depicts the taxonomy of digital accelerators, which comprises three overarching meta-dimensions: (1) Goals and Organization, (2) Orientation (focused digital innovation stages and their involvement in different startups), and (3) Covered Areas of Activity. Brauer et al. (2021) addressed methodological integration mechanisms that are used not only in digital accelerators but also in DIUs in general. These units participate in ecosystems (referring to network building) and in external validation (Gassmann et al. 2012). Liaison channeling and showcasing innovation are also used; however, these mechanisms have not been applied as frequently as other mechanisms in digital

accelerators (Brauer et al. 2021). Aside from giving deeper insights into the design of digital accelerators, the taxonomy also provides prescriptive guidance on integrating externally oriented DIUs in incumbent firms.

	Dimensions	Characteristics					
Goals & Organization	Goals	Capital increase through the sale of shares	Technoloy know-how	Innovation impulses for companies	Indirect increase of revenue	Regional development	
	Organizational embeddedness	Independent organization		Business area of an organization		Offering of an association	
	Revenue model	Charged services	Coworking for program external startups	Activities in corporate innovation management	Funded by invested companies	Funded by parent company	Public funding
	Integration mechanism	External validation	Liaison channeling	Showcasing innovation		Ecosystem participation	
Orientation	Innovation process coverage	Development		Launch		Diffusion	
	Focus within start-ups	Industry		Region		Type of business model	
Design of the offering	Services	Shared office space	Consulting	Education	Provisioning contacts	Financial support	
	Program duration	Short-term		Mid-term		Long-term	
	Individuali-zation	Partly individualized with workshop program		Partly individualized with individual consulting		Complete individualization	
	Expert involvement	Internal experts			External experts		

Figure 5.9: Taxonomy of Digital Accelerators
Source: (Brauer et al. 2021, p. 8)

Meta-requirements and design principles of DIUs: The findings from the DIU archetypes developed in this dissertation, as well as those from other publications (Barthel et al. 2020a; Göbeler et al. 2020; Jöhnk et al. 2020), contributed to the development of DIU meta-requirements and design principles. These meta-requirements (MR) and design principles (DP) assist in positioning DIUs within incumbent firms in the long term. DIUs need to enable physical and mental space for ideation (MR1), ensure and assess the fit of currently available digital innovations in firms (MR2), foster intra- or/and interorganizational collaboration (MR3), and make digital innovation initiatives transparent (MR4) (Raabe et al. A.1). Meta-requirements have a close bond with the stages of digital innovation management (Fichman et al. 2014). MR1 is associated with discovery, MR2 with discovery and impact, MR3 with development and diffusion, and MR4 with impact. These generic meta-requirements contribute to the knowledge base by utilizing the previously produced knowledge chunks on the nature of DIUs (Raabe et al. 2020a), their objectives (Raabe et al. 2021a), and the challenges they need to overcome (Raabe et al. 2020b). Figure 5.10 depicts the design principles, their fulfillment of the overarching and generic meta-requirements, and potential DIU archetypes suitable for fulfilling the stated

design principles. The figure also connects the design principles being acted upon with the described DIU archetypes in research[1]. While the design principles specify how DIUs should be designed, they do not specify in detail how they should be implemented. Thus, the archetypes show exemplary designs of how to achieve and fulfill the design principles, as well as the overarching meta-requirements.

Meta-Requirements	DIU Design Principles (being acted upon)		DIU Archetypes
MR1, MR3, MR4	DP01	Provide an open forum or lab to employees who strive to participate in innovative endeavors	Inc, DigU, PasEna, C&S
MR4	DP02	Trigger communication of "digital" and "digitized" initiatives	IntFac, ExC, PasEna, C&S
MR2, MR3, MR4	DP03	Facilitate discourse with internal business units	ExtEnh, DigU, ActEna, PasEna, C&S, CoE
MR1, MR2, MR3	DP04	Provide collaboration touchpoints with external partners	Inc, PasEna, C&S, CoE
MR1, MR2,	DP05	Identify potential digital technology hypes suitable for current and new business models	C&S, CoE
MR2. MR3	DP06	Invest and participate in digital technologies or firms focusing on them	Inc, CoE
MR3, MR4	DP07	Guide in the context of agile	IntFac, PasEna, CulChaP, C&S
MR1, MR3	DP08	Represent a cultural mindset as a set of new rules	IntFac, PasEna, CulChaP, C&S
MR1	DP09	Enable employees to work with digital technologies	IntFac, PasEna, CulChaP, C&S
MR3, MR4	DP10	Test and produce digital artefacts	ExtEnh, DigU, ActEng, CoE
MR1, MR3, MR4	DP11	Organize and utilize acceleration programs	IntFac, PasEna, CulChaP, C&S

Figure 5.10: Meta-Requirements, Design Principles, and DIU Archetypes
Source: (Raabe et al. A.1, p. 10)

Connecting meta-requirements, design principles, and phases: Since DIUs may have different characteristics, as already indicated by the multitude of archetypes described in existing research, incumbent firms might implement diverse archetypes that may not fulfill all of the above-stated design principles. By conducting a single case study in a large incumbent online retailer ("RetailCo"), which established a multitude of DIUs in recent years, Raabe et al. (A.1) identified a bifurcation of ambidextrous modes. This bifurcation is differentiated by the digital innovation type of digital business models and products/processes and changes over time, which highlights a stronger decentralized digital innovation responsibility the longer DIUs are established. Raabe et al. (A.1) identified five phases in which DIUs are used strategically. Figure 5.11 depicts the ambidextrous bifurcation based on the digital innovation types and the phases. Although the stated bifurcation and phases may differ in other firms, these are seminal for others looking to adopt a DIU strategy.

[1] Inc = Incubator, DigU = Digital Unit, CulChaP = Cultural Change Program (Jöhnk et al. 2020)
ActEng = Active Engagement, PasEna = Passive Enablement (Göbeler et al. 2020)
IntFac = Internal Facilitator, ExEnh = External Enhancer, ExC = External Creator (Barthel et al. 2020a)
C&S = Coaching & Screening Unit, CoE = Center of Excellence Unit (Raabe et al. 2020a)

<table>
<tr><th colspan="2">RetailCo's Phases</th><th>(1) Business Model Beacon</th><th>(2) Digital Innovation Awareness</th><th>(3) DIU Appreciation</th><th>(4) Urge of Digital Innovation Activities</th><th>(5) Decentral Digital Innovation Responsibility</th></tr>
<tr><td colspan="7">Efforts for Achieving Organizational Ambidexterity</td></tr>
<tr><td colspan="7">Digital Business Model</td></tr>
<tr><td>Discovery</td><td rowspan="2">Structurally Separated</td><td>Structurally Separated & Contextual</td><td colspan="2" rowspan="2">Structurally Separated, Contextually Integrated & Temporal</td><td colspan="2" rowspan="2">Structurally Separated</td></tr>
<tr><td>Development, Diffusion, Impact</td><td>Structurally Separated</td></tr>
<tr><td colspan="7">Digital Product & Process</td></tr>
<tr><td>Discovery</td><td rowspan="2">Undefined Contextually Integrated</td><td rowspan="2">Contextually Integrated & Initially Structural</td><td colspan="2" rowspan="2">Structurally Separated, Contextually Integrated & Temporal</td><td colspan="2">Structurally Separated & Contextual</td></tr>
<tr><td>Development, Diffusion, Impact</td><td colspan="2">Contextually Integrated</td></tr>
</table>

Figure 5.11: The Ambidextrous Bifurcation based on the Digital Innovation Type
Source: (Raabe et al. A.1. p. 12)

5.1.5 Synthesize & Reflect: Introducing a Research Agenda

The cumulative design of this dissertation is particularly fruitful for "reconciling the newly generated knowledge with established wisdom, assessing the extent of the contribution, and identifying potential future research avenues, or future iterations on the same research questions" (Raabe et al. 2021b, p. 6), as it forces the publication of research articles that meet these requirements. In this respect, the generated knowledge chunks have already been communicated at highly reputable IS conferences and connected with diverse adjacent research streams, as described. However, Publication P9 (Raabe et al. A.2) conducted a final summative literature synthesis, leveraging Whetten's (1989) building blocks of theory to connect the partly isolated knowledge chunks in a coherent way. Among the contributed or refined knowledge chunks of this dissertation, further chunks of the literature on DIUs were taken into account in Publication P9 to fulfill the final activity of the phenomenon-driven DSR approach.

Owing to the nascent state in which no prior theory on DIUs exists, this dissertation represents one of the first building blocks to (design) theorize and synthesize knowledge on DIUs, which is synthesized in Publication P9 (Raabe et al. A.2). To follow the requisites of a theory, certain elements must be covered, which can be structured according to the question words "What," "How," "Why," "Who, "Where," and "When" (Whetten 1989). "Who," "Where," and "When" refer to boundary conditions that implicate limitations, and "Why" addresses the motivation and underlying foundations upon which the novel theory builds (Whetten 1989). "What" and "How" constitute the subject and relations (Whetten 1989), which are strongly addressed by the two knowledge types usually addressed in the

realm of DSR. Similar to Van de Ven's (1986) quotation—"New ideas that are not perceived as useful are not normally called innovations; they are usually called mistakes" (p. 592)—the importance of usefulness and novelty also applies in terms of contributing knowledge for (design) theorizing. Significant knowledge contributions need to show utility ("being useful") and originality ("being novel") (Ågerfalk 2014). Useful knowledge can be differentiated between two distinct types (Drechsler and Hevner 2018; Gregor and Hevner 2013): Descriptive knowledge (Ω) about a phenomenon and its regularities ("What") and prescriptive knowledge (Λ) on building design knowledge or design entities ("How"). To comply with originality ("Why"), "a theoretical contribution must be discussed in relation to existing theory in order to be established as a contribution" (Ågerfalk 2014, p. 594). Therefore, this dissertation produces both Ω and Λ knowledge chunks on DIUs by utilizing knowledge from prior DIU research and adjacent research streams, such as digital innovation, bimodal IT, or organizational ambidexterity. Utilizing adjacent streams has a further refining effect on them, through which these streams benefit from each other.

This is also in line with the final activity of the phenomenon-driven DSR approach. As synthesizing and reflecting entail reconciling knowledge with established wisdom (e.g., the adjacent streams) and assessing the impact of the contribution, it may lower the risk of knowledge being scattered, leading to isolated contributions to the knowledge base (Raabe et al. 2021b). Thus, Figure 5.12 utilizes the synthesized knowledge chunks and may act as a stencil for future DIU research. The mentioned areas of activity are further clustered based on Raabe et al.'s (2021a) five objectives as well as seven areas of activities. By structuring the synthesized DIU knowledge chunks based on Whetten's (1989) building blocks of theory, the nine core finding points (within the figure) that this study contributed implicate attributes or moderating factors that may guide researchers to either describe DIU settings within future DIU research or to further conduct proper DIU research. The right column shows future research opportunities and further research gaps in the context of DIUs.

Type	Core Findings	Research Gaps/Future Research
What? (Foundations)	1. **Definition**: DIUs are dedicated organizational units whose role is to drive and support digital transformation by promoting diverse facets of digital innovation. 2. **Areas of Activity**: DIUs might occur concurrently, are used industry-independent within large incumbents, and address at least one of the following tasks: ○ Participation in all kinds of activities around novel digital technologies ○ Triggering a cultural change ○ Fostering digital capabilities ○ Enabling ambidexterity ○ Participation in ecosystems 3. **Archetypes**: DIUs come in various archetypes that differ especially in terms of their internal vs. external focus, their aimed digital innovation type, or their target group(s).	• **Dimensions of Classification**: We highlighted the internal vs. external classification of DIUs. However, researchers introduced a variety of other dimensions which may be promising in future research: *Integration vs. Exchange; Active vs. Passive; Explore vs. Exploit; Innovate vs. Transform* • **Biased Data**: Researchers primarily conducted qualitative-empirical studies with DIU employees. Other stakeholders (CIOs, external partners) should be considered for a thorough data base. • **"Silver Bullets"**: Are DIUs a suitable vehicle for all kind of firms? What kind of value can DIUs generate in specific settings? • **Design Knowledge**: Within a design science lens, current knowledge is primary descriptive and misses further prescriptive design theories and design entities of DIUs that might assist in establishing and positioning DIUs in the long run. • **DIU Lifecycles**: In terms of longevity (programs vs. dedicated units), it is not clear, if and how DIUs (co-)evolve, as their main organizations might be in a constant flux as well.
How? (Relationship)	4. **Relationship to the Main Organization:** DIUs play a role in building dynamic capabilities, specifically contribute to building different forms of organizational ambidexterity. 5. **Knowledge**: DIUs facilitate knowledge recombination. 6. **IT Function**: DIUs may refine an agile mode of a bimodal IT setup. 7. **Strategic Partner**: DIUs might support business model exploration by being connected to a firm's business development or innovation management unit.	• **The Main Organization:** "How do DIU's create value for the main organization?" as a future research question is deeply intertwined with processes and workflows to embed DIUs into the main organization for e.g., absorbing digital innovations. However, described or even prescribed processes or workflows are scare and need further attention. • **Dynamic Capabilities**: Since DIUs might appear in diverse archetypes with a variety of tasks, different design parameters and configurations of DIUs are needed that might influence the development of dynamic capabilities, e.g., for realizing/enabling organizational ambidexterity. • **DIUs in Ecosystems:** Due to a DIU's participation in innovation networks, other stakeholders are crucial as well. Thus, it is not clear what roles a DIU might have within the orchestration of digital innovation ecosystems and how they are enabling collaborations with external stakeholders.
Why? (Motivations)	8. **DIU Motivation**: DIUs might enable firms to master at least one of the following multifaceted challenges of digital transformation and innovation stated: ○ Breaking-up silos ○ Building-up new capabilities ○ Developing deviant digital innovation ○ Anchoring digital business ○ Anchoring digital transformation strategy	• **Measuring Success**: Currently, there is a high level of turmoil about whether DIUs actually solve these challenges. The debate is about whether DIUs even contribute to fostering silos in the form of a "two-tier society". Thus, this raises the question of how DIUs track and measure the fulfillment and, more broadly, their success. • **Isomorphism**: Many DIUs have been established in recent years. We are ambivalent about whether the reasons for this were strictly rational, as it could be that many units were founded only because decision-makers felt a certain pressure to adapt, to imitate their competitors in setting up DIUs. Thus, are the reasons for DIU's existence entirely rational or might it be also explained with institutional isomorphism?
Where? **Who?** **When?** (Context)	9. **Context:** DIUs are especially founded in Europe by large pre-digital incumbent firms in times of economic success	• **"Innovative Europe?"**: Obviously, it raises the question, if or why DIUs are a European phenomenon. As most research analyzed DIUs within large incumbents, we like to know why born-digital firms are also utilizing DIUs. We struggle to understand if DIUs founded at the beginning of digital transformation differ from DIUs founded in mature stages.

Figure 5.12: Synthesis of the Knowledge Chunks, Research Gaps, and Future Avenues
Source: (Raabe et al. A.2, p. 10)

5.2 Overall Theoretical Contribution

Within the prior sections, this dissertation contributed partly isolated knowledge chunks (Sections 5.1.1–5.1.4), which have been connected via syntheses (Section 5.1.4). Drawing on these connected knowledge chunks, this dissertation makes three major contributions

to reaching the RG of gaining a better understanding of positioning DIUs in the main organization to drive and foster (digital) innovations across the whole organization. First, this dissertation contributes (design) knowledge of demystifying DIUs by exploring and distinguishing the phenomenon from other adjacent research streams and concepts. Second, it sheds light on a DIU's interaction with and integration within incumbent firms. Lastly, this study analyzes how DIUs coevolve and may change their integration mechanisms over time. The major contributions are the answers to RQ1 to RQ4. Figure 5.13 depicts the three major contributions of the dissertation and shows how these three streams assist in answering the RQs. A solid line represents a direct link and a dashed line an indirect link, highlighting the interdependencies between each major contribution, which addresses more or less all RQs.

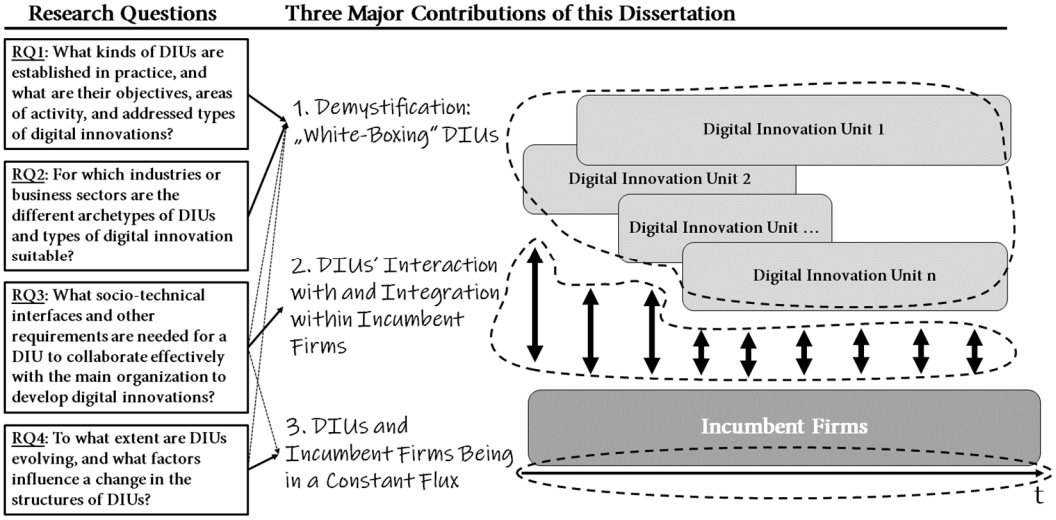


Figure 5.13: Depicting the Three Overall Theoretical Contributions
Source: Own Representation

The three major contributions address diverse multi-layered levels: within a DIU, at the level of the core organization (integration through new digital products and processes; internal diffusion), to current and new markets (external diffusion through new business models), and over time. Although not depicted in the figure, incumbent firms and their DIUs are surrounded by various digital innovation ecosystems, emphasizing strong interactions with different customers, suppliers, competitors, etc. These multi-layered levels evince the high socio-technical complexity of this dissertation. On the one hand, these levels evince the difficulty of establishing and positioning DIUs within incumbent firms over time. On the other hand, the contributions within these layers help to manage, reduce, and even avoid these high complexities. These contributions to DIU research are considered and perceived as useful since they motivate scholars conducting IS research to

deepen the emerging phenomenon of DIUs and adjacent research streams. As one of the first peer-reviewed articles addressing DIU archetypes, their integration mechanisms, and their lifecycles (Raabe et al. 2020a), a new community of DIU research has been framed, which is steadily growing. Furthermore, this article spurred IS research by introducing the concept of DIUs as a nexus or vehicle for conducting digital innovation management within firms.

Apart from the three major contributions, by introducing a hybrid PDR and DSR approach that brings the phenomenon to the center of attention, this dissertation produces a novel research approach for IS research. As traditional PDR strives to produce explanatory knowledge, the phenomenon-driven DSR approach aims to develop not only Ω knowledge about phenomena but also prescriptive Λ knowledge about how to face corresponding novel challenges in a mutually reinforcing way (Raabe et al. 2021b). This dissertation contributes to the Ω and Λ knowledge base by producing knowledge about the phenomenon, its regularities, new research approaches, design knowledge, and design entities.

5.2.1 Demystification: "White-Boxing" DIUs and Their Nature

This dissertation framed and coined DIU terminology in research. It is one of the first studies to give a broad definition of DIUs and white-boxing their nature. Since the initial framing of the DIU terminology at the "International Conference on Wirtschaftsinformatik" in March 2020 (Raabe et al. 2020a), research on DIUs has risen linearly, as shown in Figure 5.14. DIU Core Papers are articles that directly investigate the DIU phenomenon, whereas DIU Periphery Papers only entail DIUs indirectly as part of, for example, an incumbent firm's digital transformation journey. By introducing the phenomenon of DIUs into research, it has become a popular subject within IS research. In 2021, the Americas Conference on Information Systems started a specific mini-track named "Digital Innovation Units and Digital Agility," calling for high-quality DIU papers analyzing innovation management practices in DIUs, the interlink between digital agility and digital innovation, and the skills and capabilities of DIUs. The rising number of publications and the call for DIU papers highlight the need for and importance of future DIU research.

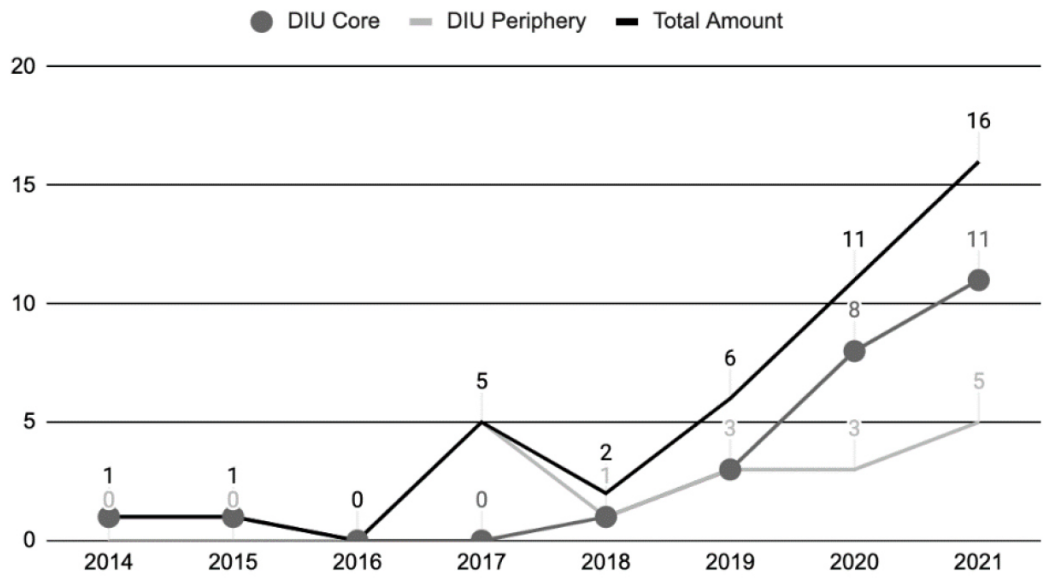


Figure 5.14: DIU Publications from 2014 to 2021
Source: (Raabe et al. A.2, p. 4)

This dissertation makes several contributions toward answering the RQs (particularly RQ1 and RQ2) in the Ω knowledge space by obtaining a deeper understanding of DIUs, describing objectives and tasks, and compiling realized or needed dynamic capabilities. As part of this dissertation, DIUs are introduced as intended "speedboats" to support the "tanker" (an incumbent firm) in the identification, implementation, and integration of digital innovations (Raabe et al. 2020a). Further, this dissertation contributes to the Ω knowledge base by presenting a two-fold approach in which DIUs perform (1) business problem-based digital innovation selection, highlighting the need to find solutions for incumbent firms; and (2) digital innovation-driven business change, emphasizing the crucial digital innovation ecosystems by analyzing and evaluating current digital technologies unrelated and independent from the main organization (Raabe et al. 2021a). Initially, a purely internal focus was assumed (Raabe et al. 2020b; Raabe et al. 2020a). Since it became apparent that—among digital products and processes—digital business models are also within the scope of common DIU tasks, the definition was expanded in this dissertation to include internally and externally oriented archetypes of DIUs (Brauer et al. 2021).

Moreover, this dissertation builds on previously mentioned DIUs that differ mainly in their internal or external focus and the type of digital innovation they address (Fuchs et al. 2019) leading to the prescribing archetypes of a coaching & screening, a center of excellence, and a digital accelerator unit (Brauer et al. 2021; Raabe et al. 2020a), contributing to the Λ

knowledge base. These archetypes are accompanied by challenges that prior research has failed to address. These challenges are multifaceted and affect not only the DIU but also the IT and business units of incumbent firms. Highlighting, in particular, the challenges of diffusing, absorbing, or integrating digital products from DIUs into the main organization (Raabe et al. 2020b), diverse foci of DIUs arise, thus refining the objectives in the areas of developing digital innovations, enabling a cultural change, building up digital expertise, triggering an organizational design change, and addressing the new locus of innovation toward a stronger interorganizational ecosystem perspective (Raabe et al. 2021a). By contributing multifaceted challenges that DIUs are confronted with to the descriptive knowledge base, three crucial actions were elaborated upon. These three crucial actions of enabling (1) strong collaboration mechanisms, (2) top management support, and (3) digital awareness are considered prerequisites for tackling the challenges (Raabe et al. 2020b), prescribing future designs of DIUs, and thus contributing to the Λ knowledge base.

Of these crucial actions, four generic meta-requirements and eleven design principles being acted upon for DIUs have been derived that assist in choosing a suitable DIU archetype for firms (Raabe et al. A.1), contributing to the Λ knowledge base. These generic meta-requirements call for enabling physical and mental space for ideation (MR1), ensuring and assessing the fit of currently available digital innovations in firms (MR2), fostering intra- or/and interorganizational collaboration (MR3), and making digital innovation initiatives transparent (MR4) to prescribe a needed setting for DIUs to work properly.

To connect the meta-requirements and design principles, this dissertation identified the DIU archetypes out of 28 mentioned cases and differentiated between 10 best practices in the literature (Raabe et al. 2021a) based on their digital innovation type, the degree of change, their market focus (whether it is a current or new business model), and their importance to external and internal ties to the main organization. Figure 5.15 depicts the 10 good practices of DIUs that were identified. The intertwinement of generic meta-requirements, design principles, and possible archetypes of DIUs helps obtain a deeper understanding of DIUs, thus assisting in demystifying the nascent phenomenon of DIUs.

		Characteristics				
Authors	**Archetypes**	**Digital Innovation Type**	**Degree of Change**	**Market Focus**	**Imp. of External Partners**	**Imp. of Internal Ties**
(Barthel et al., 2020)	Internal Facilitator (IntFac)	Processes	Not defined	C-BM	None to Low	High
	External Enhancer (ExEnh)	Business Models	Radical	C-BM	Not defined	Mid to High
	External Creator (ExC)	Business Models, Products	Radical	N-BM	Not defined	Low to Mid
(Göbeler et al., 2020)	Active Engagement (ActEng)	Processes, Products	Radical	Both	Not defined	High
	Passive Enablement (PasEna)	Not defined	Incremental	Both	High	High
(Jöhnk et al., 2020)	Digital Unit (DigU)	Business Models, Products	Radical	Both	Not defined	Mid to High
	Digital Incubator (Inc)	Business Models	Radical	N-BM	High	None
	Cultural Change Program (CulChaP)	Not defined	Not defined	Not defined	High	High
(Raabe et al., 2020a)	Coaching & Screening (C&S)	Products	Radical	Both	Mid to High	High
	Center of Excellence (CoE)	Business Model, Products	Radical	Both	High	High

Figure 5.15. Synthesized DIU Archetypes and Their Characteristics
Source: (Raabe et al. A.1, p. 3)

5.2.2 DIUs' Interaction with and Integration within Incumbent Firms

Today, an incumbent firm's ability to innovate is a decisive factor that can lead to competitive advantages. Numerous historically grown, "non-digital-native" firms are faced with the problem of being incapable of digitizing their process and structures and integrating their digital innovations quickly enough. Therefore, this dissertation contributes a taxonomy that identifies usable integration mechanisms connecting DIUs with their incumbent firm. This taxonomy also presents how these mechanisms can be used to enable DIUs to act as middleware between the frontend and backend of innovation activities (Brauer et al. 2021), connecting DIUs with incumbent firms. This connection is also explored within DIUs, where the dynamic capability jungle for agility and digital innovation is used to describe the dynamic capabilities needed within each digital innovation stage in which DIUs operate (Hellmich et al. 2021). Further, two DIU archetypes contribute to the Λ knowledge base as good practices (Coaching & Screening and Center of Excellence units) and serve as a blueprint to couple a DIU with two integration mechanisms for an incumbent firm: liaison channeling and integrative innovation planning (Raabe et al. 2020a).

Further, by conducting in-depth DIU research, this dissertation extends and refines several adjacent research streams, such as digital innovation, IT-function (bimodal/trimodal IT), and organizational ambidexterity research that strongly affects digital innovation

management within incumbent firms, highlighting the interaction between DIUs and incumbents. By doing so, these adjacent research streams draw attention to and motivate incumbent firms to pursue specific digital innovation initiatives, such as establishing DIUs.

Digital Innovation: Although innovations are not new phenomena, as firms have always been permeated with them, digital innovations are specific due to their high speed with which they are transforming entire firms (Fichman et al. 2014; Turrin 2019). Dedicated units that deal with nondigital innovations are also not a novelty. Many firms have established research and development departments (R&D) to optimize existing products and services from the corporate portfolio. Besides the obvious difference that DIUs explicitly deal with digital innovations and their facets, the degree of change perceived by an adopting unit is an important differentiator. While R&D primarily drives incremental innovations, DIUs strive to trigger radical changes by using agile methods (Raabe et al. 2020a). The highly salient characteristics of digital innovation further shift the locus of innovation toward a stronger customer orientation, thus highlighting the need for specific initiatives that co-create solutions with customers, partners, or even broader digital innovation ecosystem participants (Raabe et al. 2021a). This dissertation distinguishes digital innovations from non-digital innovations based on the above criteria and highlights the need for novel initiatives, such as DIUs, that address digital innovations for incumbent firms (Raabe et al. 2020a; Raabe et al. 2021a).

This dissertation also shows two starting points or perspectives that underly and highly motivate DIUs: bimodal IT in terms of initiatives triggered by the IT function and organizational ambidexterity in terms of a holistic, non-IT-specific innovation initiative (Raabe et al. A.2). Both perspectives are relevant research topics within the IS community and highlight a stronger alignment between business and IT.

Bimodal IT: By extending the knowledge of how to pursue innovation activities in a bimodal IT setup, this dissertation contributes to bimodal IT research by differentiating agile IT setups for digital innovations and their dimensions. Further, by justifying DIUs as one implementation of an organizationally separated agile division focusing on digital innovations, the human knowledge base on bimodal IT and possible implementation options is refined (Raabe et al. 2020a). The knowledge base on trimodal or n-modal IT research is also refined because DIUs enable transition modes and act as middleware, fostering collaboration between IT and business units (Brauer et al. 2021; Raabe et al. 2020b).

Organizational Ambidexterity: Recent research differs between several options on how to enable ambidextrous settings in firms and emphasizes the high complexity of managing the tensions between the modes of exploration and exploitation (Park et al. 2020): contextually, sequentially, structurally, and temporally (Holotiuk and Beimborn 2019; O'Reilly and Tushman 2013). By interpreting the temporary transfer of individuals as a contextual activity for individuals, temporal ambidexterity intimates a combination of structural and contextual modes. Thus, as part of this dissertation, DIUs are seen as dedicated exploratory units that combine ambidextrous modes (as described by Jöhnk et al. 2020). Owing to the highly salient characteristics of digital innovations (such as the speed they transform the world), DIUs need to have dynamic capabilities to enable and realize ambidextrous modes (Raabe et al. A.1; Hellmich et al. 2021). Further, by substantiating DIUs as one implementation of an exploratory mode, the human knowledge base on organizational ambidexterity and its possible implementation options is refined (Raabe et al. A.1; Brauer et al. 2021; Hellmich et al. 2021).

Because of these facets, it has become apparent that DIUs may be embedded into an organization *just* as an extension of a bimodal IT archetype (Raabe et al. 2020a) or may even be a strategic partner that significantly shapes the digital innovation management of an organization (Raabe et al. 2021a). Either way, they enable and realize an ambidextrous setting by being exploratory (Hellmich et al. 2021).

5.2.3 DIUs and Incumbent Firms Being in a Constant Flux

Current DIU research and consulting firm contributions are rather static, neglecting the fact that both DIUs and incumbent firms may be in a constant flux and (co-)evolve. Thus, this dissertation introduces five phases from a single-case study of a large online retail firm (pseudonymized under the name "RetailCo"), which has strategically positioned and used DIUs (Raabe et al. A.1). RetailCo's DIU journey could be generalized to other firms and may be utilized to drive a DIU strategy, highlighting the constant flux of DIUs and their incumbent firms. Figure 5.16 depicts RetailCo's use of different DIU archetypes (Figure 5.15) and shows five phases that may provide one (not exclusive) stencil for establishing and positioning DIUs within incumbent firms in the long term (Raabe et al. A.1):

Phase 1: "Business Model Beacon" refers to an initial setup of DIUs, primarily established to foster digital business model innovations without connections to the incumbent firm; thus, DIUs are completely independent.

Phase 2: "Digital Innovation Awareness" highlights the business problem-based approach (Raabe et al. 2021a), starting to connect DIUs with incumbent firms, and therefore making digital innovation endeavors transparent for the main organization.

Phase 3: "DIU Appreciation" emphasizes a firm's need to further DIU activities by, for example, establishing DIUs with a particular focus on digital innovation trend screening and prioritization.

Phase 4: "Urge of Digital Innovation Activities" refers to a general need to foster digital innovation activities, which are not solely refined to address business models but digital processes and products as well as their integration into incumbent firms.

Phase 5: "Decentral Digital Innovation Responsibility" highlights the general need of all employees to foster digital innovations to withstand potential disruption.

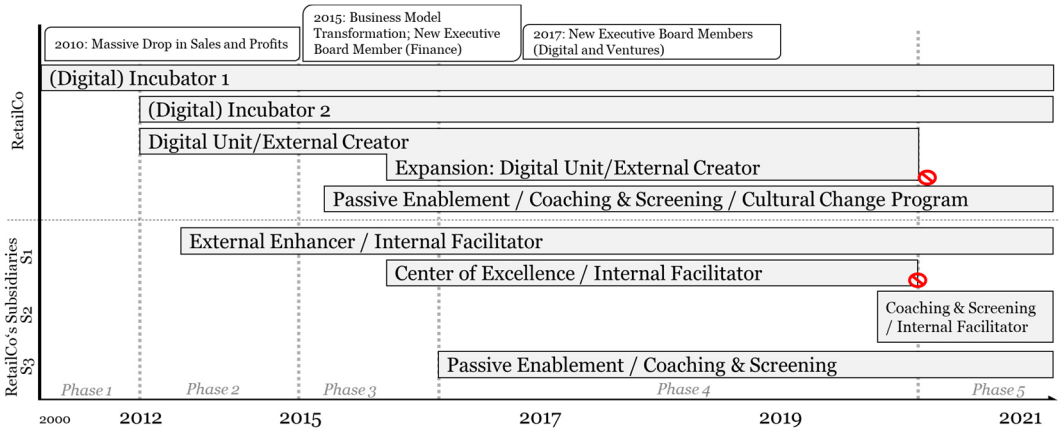


Figure 5.16: Five Phases in which DIUs Are Strategically Positioned
Source: (Raabe et al. A.1, p. 6)

The expansion of the Digital Unit/External Creator suggests an evolution of DIUs, which has been further described in Raabe et al. (2020a), defining four options for how DIUs (in this context, the archetypes C&S and CoE) might be embedded into firms (Figure 5.17). Option 1 ("Transformer") highlights the transformation of a C&S into a CoE unit. Option 2 ("Pure C&S") describes a pure C&S setting without the intention of transforming it into another archetype. Option 3 ("Big Bang") stands for direct CoE implementation, while Option 4 ("Concurrent") highlights multiple concurrent initiatives that may be implemented within firms. RetailCo used a mix of these options to position its DIUs strategically to foster its digital innovation capacity. These options for implementing and transforming DIUs during the five phases might also be suitable for other firms.

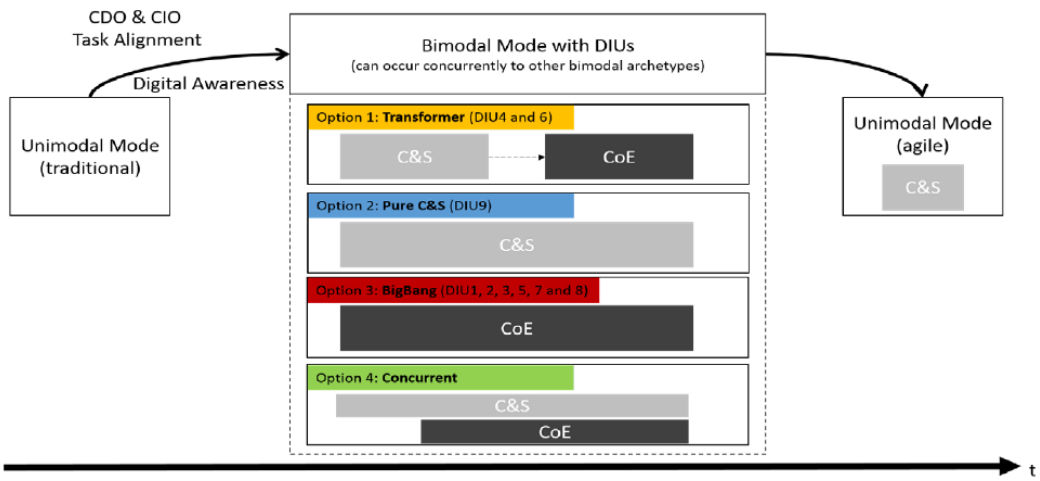


Figure 5.17: Options for Embedding DIUs in Incumbent Firms
Source: (Raabe et al. 2020a, p. 11)

Embedding DIUs depends on a firm's general agile or traditional orientation in terms of bimodal IT, as depicted in Figure 5.18. These four options foreshadow evolutionary pathways, indicating the specific dynamics of DIUs. Incumbent firms operating in a strong traditional mode are encouraged to pursue option 1 or 2, while option 3 is suitable for firms with strong established agile modes. Option 4 can operate in both modes (Raabe et al. 2020a).

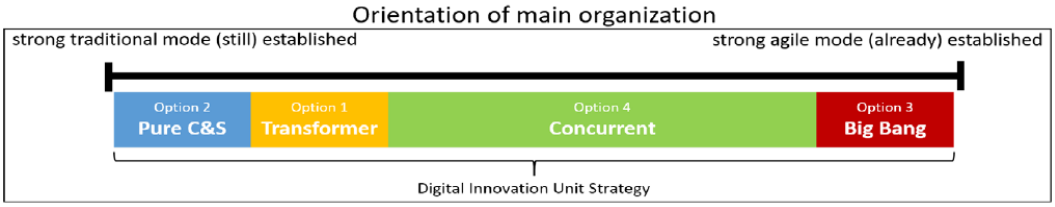


Figure 5.18: Implementation of DIUs in Incumbent Firms
Source: (Raabe et al. 2020a, p. 12)

6 Practical Contribution

This dissertation focused on the nascent phenomenon of DIUs and their embedding within incumbent firms. It highlights DIU structures and potential integration mechanisms in firms, and addresses the shift from an intraorganizational toward an interorganizational ecosystem perspective. As a result, this research project has several managerial implications that may guide practitioners in (1) establishing and positioning DIUs in firms and (2) refining currently established DIUs, referring to a greenfield and brownfield approach. These approaches—names inspired by Hopkins and Jenkins (2008) and made famous by SAP—assist firms in deriving a DIU strategy to drive digital innovation.

6.1 Greenfield Approach: Establishing Digital Innovation Units

The three major contributions are not solely helpful for researchers since practitioners might draw on the contributed knowledge on DIUs. This knowledge implies a managerial guide for establishing and positioning DIUs in firms in the long run. Thus, this dissertation introduces the following six-step greenfield approach:

1. Motivation
2. Organizational Readiness
3. Objectives and Tasks
4. Integration
5. DIU Options
6. DIU Evolution

1. Motivation for Establishing DIUs: Incumbent firms need to be aware of the situation that digital innovations must be emphasized to withstand potential disruption. Since organizational change is a complex task with employees having high aversions, DIUs need a strong raison d'être to be accepted. This is especially true for DIUs that have an internal focus and strive to foster business-driven change through digital technologies (Raabe et al. 2021a). For externally oriented DIUs, which explore new digital technologies for new opportunities in new markets independently from current business models, the connection to the main organization might not be as important as internally oriented DIUs. However, both their internal and external orientations (Fuchs et al. 2019) have further implications for structural integration.

2. An Incumbent Firm's Organizational Readiness for Embedding a DIU: Highlighting the described challenges of DIUs, Raabe et al. (2020b) prescribed the need for high top

management support. Since measuring DIU performance is a complex and difficult task, DIUs need strong ties with high support from top management who believe in a DIU's mission of accomplishing and enabling firms for faster innovation. In general, digital awareness in all hierarchical layers needs to be present, as it is crucial in preventing potential aversions to digital innovations, which may hinder the successful integration of digital innovations (Raabe et al. 2020b).

3. Objectives and Tasks for DIUs: Rooted by motivation, the objectives and tasks need to be clearly defined for DIUs. Since several DIUs have failed due to the unclear objectives of DIUs (Raabe et al. 2020a), the objectives and tasks should be precisely defined and communicated within the entire firm. DIUs may be used to discover, develop, or diffuse digital innovations; lever digital expertise and cultural change; emphasize organizational design change; or strive to participate in digital innovation ecosystems (Raabe et al. 2021a). These objectives lay the foundation for a DIU strategy and provide a rough guide to which DIU archetypes are suitable as options to implement for later steps.

4. Integration of DIUs in Incumbent Firms: As depicted in Figure 2.3, DIUs may be embedded as a team/task force, an integrating role or department, a liaison role, or an own legal entity. Whereas legal entities are particularly suitable for externally oriented DIUs focusing on business model innovations targeting new customers who do not need strong ties to the main organization, other integration options may be suitable for serious needs for strong collaboration with the main organization. While task forces tend to perform DIU activities part-time in addition to their own duties and will therefore have a relatively low impact (Raabe et al. 2020b), dedicated departments or divisions have significantly more opportunities for impact (Kaiser and Stummer 2020). Methodological integration may be achieved through external validation, liaison channeling, showcasing innovation, network building, and/or integrative innovation planning (Gassmann et al. 2012).

5. Finding suitable DIU implementation options: Complying with the four generic meta-requirements and referring to the objectives that need to be fulfilled, the design principles assist in designing diverse DIU options that lead to several potential DIU archetypes (Raabe et al. A.1). These archetypes represent suitable options to choose from for implementation. They are not mutually exclusive and may be implemented concurrently in diverse phases, referring to the final step of planning evolutionary pathways for DIUs.

6. Planning Evolutionary DIU Pathways: DIU transformations or lifecycles are currently understudied in research. However, the identified phases of RetailCo (Raabe et al. A.1) and

its use of DIUs assist in establishing, positioning, and dissolving multiple DIUs in the long run. RetailCo's use of DIUs emphasizes a fully structurally separated unit with little to no touchpoints with the main organization for digital business model innovations in the long run, whereas digital product and process innovations may be fostered contextually (see Figure 5.11).

Among positioning several and adding further DIU archetypes within the phases, DIUs might transform and extend their tasks based on refined objectives of the DIU, an incumbent firm's enablement of handling digital innovation, or a radical change within the digital innovation ecosystem. Thus, DIUs may change over time. Figure 5.17 depicts exemplary strategies for positioning C&S and CoE units. C&S units may transform into a CoE unit (Option 1: Transformer), may be pure without a CoE unit (Option 2: Pure C&S), or may occur concurrently with CoE units (Option 4: Concurrent). There might also be cases of single CoE units being implemented without prior C&S units being established (Option 3: Big Bang).

6.2 Brownfield Approach: Refining Digital Innovation Units

The three major contributions of this dissertation might assist practitioners in refining or repositioning already established DIU(s). Thus, like the greenfield approach, this dissertation suggests the following two steps for the brownfield approach:

1. Comparison of Established DIU(s) with Prescriptive DIU Designs
2. Context Analyses

Comparison of Established DIU(s) with DIU Designs: Comparing established DIU(s) with the stated meta-requirements, design principles, and archetype(s) may assist in classifying DIUs and highlighting potential meta-requirement or design principle gaps that need to be addressed for proper DIU operation. The comparison further helps in determining a DIU's lifecycle and thus may indicate the phase in which the DIUs participate, pointing to, for example, a stronger contextual or structural ambidextrous setting.

Context Analyses: Context analyses involve analyzing the integration mechanisms used (structural and methodological) and identifying and comparing diverse challenges. Whereas further methodological integration mechanisms might be used for stronger impact within the main organization, the described multifaceted challenges in literature

(Raabe et al. 2020b) and their prescribed mechanisms for tackling them might also assist in solving the issues within the already established DIU(s).

7 Limitations

Although the included publications cover diverse knowledge on DIUs and their positioning within organizations, this dissertation faces some limitations rooted in the research design, the conducted phenomenon-driven DSR approach, and its evaluation, which reduces the rigor and relevance of the results.

Because this dissertation makes strong use of qualitative-empirical analyses, comprising both inductive and deductive coding for analysis, it is subject to personal biases (Galdas 2017; Thirsk and Clark 2017). Therefore, the interpretation of data might be derived based on personal preferences and the researcher's opinions, which constrain objectivity. To reduce the risk of personal biases, the coauthors of the included publications assisted in analyzing the data and, where appropriate, challenged the results within internal review cycles. To counteract this subjectivity even further, data were used from diverse data sources to gain a better understanding of the phenomenon. For example, a multitude of qualitative-empirical interviews were used to gather data, and to validate and evaluate the results. These interviews were conducted with DIU employees, individuals who collaborate with DIUs, strategic management consultants, and members of top management. However, this group of interview partners foreshadows further boundaries, referring to Whetten's (1989) "Who," "Where," and "When" factors. This research addresses DIUs in the context of incumbent firms to foster digital innovation capacity. Therefore, DIUs associated with incumbent firms meeting specific criteria were analyzed. These incumbents were required to be nondigital natives, established for at least a decade, and employ at least 1,000 workers. With these criteria, we assume high complexities with "legacy IT" systems and non-agile processes within the organization, drawing a clear line compared to DIUs. As no industry-dependent factors for establishing specific archetypes of DIUs have been identified (Holsten et al. 2021), a relation to domains, regions, or locations cannot be determined. However, as this dissertation conducted interviews with experts throughout Europe (predominantly Germany), the question arises as to whether DIUs are also established in other continents. DIUs might be *only* a European phenomenon that is not applicable to other regions or locations.

The multitude of different names for DIUs raises another limitation, especially during the structured review of the extant literature. Despite including a wide range of DIU terms in the search queries (such as digital innovation lab, digital lab, digilab, X-Lab, digital

transformation unit, digital unit, and idea labs), many more terms have been used in the research literature that would have further refined the results.

The applied phenomenon-driven DSR methodology, as introduced within the included publications in Section 15, encompasses further limitations. Despite the many opportunities to conduct research using this completely novel approach, some limitations already described in the DSR also apply to this research approach. Research is usually triggered based on diverse starting points that focus, for example, on a specific problem or project, which makes it context-specific (Drechsler and Hevner 2018; Peffers et al. 2007). Thus, positioning utilized, contributed, or refined knowledge chunks in project-specific problems and solution spaces and transferring them toward the generic design knowledge base is challenging and levers the dimensions of (1) projectability within single projects, (2) fitness within the generic design knowledge base, and (3) confidence in terms of validity (Drechsler and Hevner 2018; vom Brocke et al. 2020). Although this dissertation strived to maximize projectability and fitness by conducting several formative and summative evaluation episodes with experts from the respective studies as well as outside for applicability proof (Sonnenberg and vom Brocke 2012), the knowledge chunks on DIUs that have been contributed and refined and their positioning in incumbent firms lack a proper real-world application, which reduces the level of confidence.

A further limitation involves measuring the usefulness of DIUs. This dissertation investigated DIU objectives, archetypes, processes, prerequisites for successful implementations, and connections to the main organization over time. Although research highlights and introduces indicators for measuring a DIU's effectiveness (Haskamp et al. 2021), it has been deliberately omitted due to the difficulty of measuring the performance of innovations in general since "performance assessments are based on subjective measures obtained in retrospect from single respondents" (Blindenbach-Driessen et al. 2010, p. 572). The assumption was made that digital innovation is essential for the survival of firms and that doing nothing offers greater risks of disruption than establishing concrete organizational units as centers of excellence for digital innovation. In this respect, measuring success was considered secondary, and the factors that make DIUs successful or unsuccessful were analyzed.

8 Implications for Further Research

Following these limitations, this dissertation builds the foundation for multiple future research avenues regarding DIUs. At the beginning of the dissertation project, the extent to which the topic would be accepted and manifested in the research was unclear, as it was, and still is, a nascent phenomenon. Several promising and impactful research avenues could be identified that focus on diverse facets of DIUs.

As stated in Publication P9 (Raabe et al. A.2), many DIUs have been established within the last few years. However, it is unclear whether the reasons are strictly rational. It is possible that DIUs were established because of some pressure felt by management to imitate or copy competitors in establishing DIUs. Future research should therefore focus on whether the reasons for establishing DIUs are fully rational or whether they are a case of institutional isomorphism.

Future research could examine the collaboration of multiple concurrent DIUs ("inter-DIU collaboration") and further collaborations with new founded ventures since participation within several digital innovation ecosystems results in diverse collaborations, especially with digital startups. However, their short- and long-term collaborations or partnerships have been understudied. Recently, so-called "Venture Client" models have been rising, implicating fruitful potentials for future studies.

Further, since Holsten et al. (2021) identified a strong data-driven topic focus of DIUs, a comparison or demarcation between DIUs and business intelligence units might be necessary to better understand their objectives and potential points of interaction or overlap.

The connection between DIU research and the adjacent research streams is cutting edge and motivates further investigations. Further research on shaping the IT function beyond bimodal or trimodal IT constructs, such as agile unimodal or multispeed approaches, and analyzing the role of DIUs within such settings could be promising.

Another emergent phenomenon is named shadow IT, "which is hardware, software, or services built, introduced, and/or used for the job without explicit approval or even knowledge of the organization" (Haag and Eckhardt 2017, p. 469). Haag and Eckhardt (2017) motivated the need for further governance approaches in managing shadow IT by

creating separate digital IT units. Thus, analyzing the connection with DIUs might also be fruitful in future research.

Future research should also analyze the temporal and contextual factors of DIUs, which include whether DIUs are a worldwide phenomenon or just a European phenomenon that is not applicable to other regions. Further, it should be questioned whether DIUs represent just a short-term hype that will deflate in the next few years or a long-term trend exponentially that will rise in the next decade. As only non-digital-native incumbent firms with high employee numbers have been analyzed, it would be worthwhile to analyze DIUs within small- and medium-sized enterprises and/or determining how digital-native firms foster radical digital innovations.

Furthermore, as no application of the knowledge chunks—in terms of an action design research project—has taken place in a real scenario setting, it would be fruitful to demonstrate and validate the phenomenon-driven DSR methodology, DIU good practices, digital accelerator taxonomy, and/or the contributed meta-requirements and design principles.

Taking up the acronym from the introduction, VUCA still applies to the world and entails great complexity, which is constantly increasing. However, establishing and using DIUs as a nexus for digital innovation management may at least make this specific complexity manageable, enable firms to become ambidextrous, and assist firms in becoming digital and digitized.

9 Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups

Raabe, J.-P., Horlach, B., Drews, P., and Schirmer, I. 2020a. "Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups," *International Conference on Wirtschaftsinformatik (WI)*.

Abstract. Due to rapidly changing customer needs, enterprises seek to innovate continuously. This includes the capability of discovering and developing digital innovations. As a nascent phenomenon, companies increasingly use digital innovation units (DIU) as fast and flexible accelerators. Although DIUs are established in practice, research on them and their role in bimodal IT setups is still sparse. Based on a qualitative cross-industry study in nine organizations, we identified two types of DIUs: Coaching & Screening (C&S) units and Center of Excellence (CoE) units. Furthermore, we describe two linking mechanisms between the DIUs and the main organization for ensuring impact and continuous innovation. Finally, we present four DIU evolution strategies, which can be employed by companies seeking to establish a DIU. Our study contributes to research on bimodal IT by developing a foundational understanding of how digital innovation activities are organized in DIUs to create impact on the main organization.

Keywords: Digital Innovation Units, Digital Innovation Labs, Bimodal IT, Digital Innovation Management.

9.1 Introduction

Digital technologies have become increasingly crucial for enterprises, as they have highly salient characteristics with important implications for innovations (Fichman et al. 2014). After transforming physical processes, content or objects into digital entities ('digitalization'), these entities are highly malleable and provide large new areas of potential functionality (Yoo et al. 2010). Further, the range of what is technically and economically feasible to accomplish with IT is rapidly extending. This fosters the role of IT as a strong

enabler for innovation (Fichman et al. 2014). Beyond the increasing potential of IT, digital innovations are also heavily influenced by network effects as they become more valuable for an individual adopter as the number of adopters in a network grows (Fichman et al. 2014). This effect allows enterprises with huge networks to decrease costs or increase functionalities of IT innovations and thus increases the potential value creation in a growing adopter network (Shapiro and Varian 1999). We refer to this type of innovation which is enabled by digital technologies (and their highly salient characteristics) as a digital innovation (DI) (Holotiuk and Beimborn 2018). Digital technologies are often also employed for supporting the "*process of innovating*" (Nambisan et al. 2017).

Despite their high importance for enterprises, the rise of DI deeply challenges corporate reality. Especially the reduced entry barriers for new competitors, the resulting volatility of markets based on a potential multitude of new offers at any time and the increasing number of opportunities available to customers (Dixon 2017) call for enterprises' ability to respond to those threats in the business environment in a timely manner. Thus, companies need to be able to improve their capabilities and resources by exploring and exploiting new (digital) business opportunities to stay one-step ahead of their competitors and to fulfill and surpass (changing) customer needs (Dixon 2017). While this may involve the development of improved or new offerings in current markets for securing the current position, DIs may also result in stepping into new markets based on changing customer needs (Dixon 2017). Many organizations try to balance the exploration of new and exploitation of existing resources and practices with an ambidextrous organizational approach (Lee et al. 2015).

First approaches for fostering DIs arose in recent times. For instance, bimodal IT was proposed as an organizational concept to transform enterprises (especially IT functions) into an ambidextrous setup with two different modes (Haffke et al. 2017b). While the first mode ("slow IT") focuses on exploiting what is known, the second mode ("fast IT") is optimized for areas of uncertainty by exploring and experimenting to solve new problems (Gartner 2021; Haffke et al. 2017b; Horlach et al. 2016). As the fast IT mode is often seen as the key provider of DIs (Gartner 2021), a structural separation in organizational divisions is favored in many organizations (Dixon et al. 2017; Haffke et al. 2017b; Vial 2019). The basic idea of such a digital division is to create a fast lane for digitalization topics alongside the traditional IT development and business organization (Urbach 2017). For instance, Volvo Cars decided to create a digital division ('app development group') focusing on the implementation of an integrated (digital) infotainment platform (Svahn et al. 2017). This was seen as a completely new and radical approach for fostering DIs (Svahn et al.

2017). As DIs can span various contexts (from disruptive for entering new markets to incremental for existing products), different focuses may exist within digital divisions. We refer to one kind as digital innovation units (DIUs), which focus on developing new products or services for existing markets (Velten et al. 2016). As those involve permanent staff as well as temporal internal staff from the main organization and external people, they work across enterprise boundaries and are intended to serve as an enabler for the integration of DIs into the main organization (etventure 2018b; Velten et al. 2016). Thus, they ought to co-exist with other digital divisions and other bimodal IT modes, e.g. on a project-by-project basis (Haffke et al. 2017b). However, knowledge about their internal organization and their interaction with the main organization is yet scarce.

Due to the nascent state of prior theory on DIUs and sparse research and practical findings (Fuchs et al. 2019; Holotiuk and Beimborn 2018; Hund et al. 2019), we aim to outline their nature based on experiences of experts from established DIUs in practice. With an exploratory study comprising nine existing DIUs, we focus on analyzing the DIU setup and their link to the main organization for developing DIs. Therefore, we strive to answer the following research questions:

RQ1: How are DIUs set up?
RQ2: How are DIUs linked with the main organization?

The remainder of the paper is structured as follows. In section 9.2, we briefly describe DIs, DIUs and bimodal IT. Afterwards, we outline our research methodology. In section 9.4, we present our main results, the two types of DIUs, linking mechanisms and evolution strategies for embedding DIUs in the organizational context. Finally, we discuss our findings and conclude with future research opportunities.

9.2 Related Research

9.2.1 Bimodal IT as an Enabler for Digital Innovation (DI)

DIs may be characterized based on different dimensions, which are not mutually exclusive. While some emphasize their type (Fichman et al. 2014; Yoo et al. 2010), others focus on the intended impact (Binetti 2018; Christensen 1997; Dahlin and Behrens 2005) or the unit of adoption for which a DI is perceived as new (Rogers 2010). DI types can be a digital product, service, business model or process (Yoo et al. 2010). While process innovations are still valid for optimizing internal business operations [24], product and business model innovations are increasing in popularity, as they enhance the company's position in the

market (Yoo et al. 2012). For all types, the intended impact of DIs can be of incremental, radical or disruptive nature (Binetti 2018; Christensen 1997; Dahlin and Behrens 2005). Incremental DIs refer to continuous improvement of existing opportunities (Christensen 1997), while radical DIs create novel and unique opportunities instead of exploiting existing ones (Dahlin and Behrens 2005). However, they still need to fit within the main organization's business (Binetti 2018). In contrast, disruptive DIs are technologically a non-linear break, which create completely new markets while 'disrupting' others (Binetti 2018; Christensen 1997). Units of adoptions for which a DI is perceived as new may be the main organization, its customers or competitors (Hauschildt and Salomo 2007; Rogers 2010). Despite the different dimensions of DIs, several stages for innovation elicitation and implementation have to be undertaken (e.g., Cooper 1990; Rogers 2010). Especially for DIs, four stages, which are of an iterative nature and may overlap, are perceived as crucial (Fichman et al. 2014). The discovery stage identifies new ideas that could potentially represent a DI type. Core tasks within this stage are invention and selection. In the development stage, an idea is transformed into a DI. The focus is on developing, updating the core technology and refining it with complementary products and services. In the diffusion stage, a DI diffuses into a group of potential users. This includes setting up necessary resources to convince potential users or companies and to enable the adoption. The impact stage focuses on both, the intended and unintended effect of DIs after internal and external diffusion on individuals, organizations, markets or society.

Although DIs are seen as crucial for corporate success, knowledge about how to create organizational structures to facilitate DI is yet scarce. Although approaches like bimodal IT (Gartner; Gartner 2021) are recommended and applied to facilitate DI (Horlach et al. 2016; Horlach et al. 2017), e.g. via dedicated digital divisions (Haffke et al. 2017b; Horlach et al. 2017) (see Figure 9.1), they mainly focus on agility and incremental customer-focused innovation. Others (Gerster et al. 2019; Jöhnk et al. 2017) define some implementation

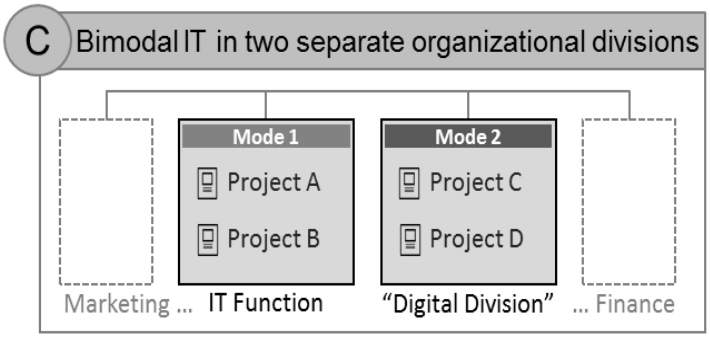


Figure 9.1: Bimodal IT with a Separate Agile Digital Division
Source: (Haffke et al. 2017b, p. 5464)

options of digital divisions as fully agile IT setups. While this may involve DIs, the literature does not yet provide insights into how they organize in order to develop and implement radical and disruptive DIs.

9.2.2 Digital Innovation Units (DIUs) and other Characterizations

Neither innovations nor innovation units/labs are new phenomena (Turrin 2019), since innovation has always been essential for business success (Chiesa 2000). However, *"what is different and noteworthy within the past 25 years of digital history […] is the speed with which innovation is transforming our world. […] If [DI] labs do one thing, they give innovation a home within your company, which allows it to […] improve your chances of survival in the Darwinian process of digital evolution"* (Turrin 2019, p. 10). Various names and characterizations for DIUs exist, e.g. (digital) innovation labs, company builders or accelerators (Sindemann and Buttlar 2018). Others refer to them as digital labs, which contain innovation labs, company builders, incubators and digital units (etventure 2018b; Velten et al. 2016). Despite their names, the main differences between these forms are whether the innovation activities occur within or outside of the main organization (Fuchs et al. 2019). Company builders, incubators and accelerators offer DIs directly to the market(s). Company builders also focus on implementing new ideas, but they seek to turn them into a startup (etventure 2018b; Sindemann and Buttlar 2018; Velten et al. 2016). These startups represent subsidiaries, established for the purpose of using internal and external resources to develop digital business models throughout the entire lifecycle (etventure 2018b; Sindemann and Buttlar 2018; Velten et al. 2016). Incubators and accelerators are programs for identifying and selecting external startups or firms to further develop and scale their business ideas (Sindemann and Buttlar 2018). Incubators participate in existing startups on a long-term basis and make their expertise and working environment available in exchange for company shares (etventure 2018b; Velten et al. 2016). While incubators usually assume a period of cooperation of 6 to 24 months, accelerators provide programs that are designed for a shorter time, approximately 3 to 6 months (Velten et al. 2016). In contrast, DIUs have a primary internal focus to change existing processes and products inside the main organization. Therefore, DIUs are not company builders, incubators or accelerators. Even though recent papers address DIUs' organizational design options (Fuchs et al. 2019) and show how DIUs facilitate ambidexterity (Hund et al. 2019) or knowledge management (Hund et al. 2019), the structures and processes of DIUs as well as their linking mechanisms to the main organization and their role in bimodal IT settings are not yet explored.

9.3 Research Methodology

Though many enterprises established DIUs during the last years, research on them is still sparse and in a nascent state. As DIUs may be an accelerator for digital endeavors, we seek to develop initial models of DIU setups and to understand their link to the main organization. Recommended by Edmondson and McManus (2007) for a nascent state of prior research, we conducted an explorative qualitative-empirical study with nine organizations from October to December 2018 to analyze established DIUs in practice. The field study spanned multiple industries, as we aimed to gain insights on a variety of units. The participants were selected based on the following criteria: First, the main organization involves at least 1000 employees. With this size, we assume high complexities with 'legacy IT' systems and non-agile processes within the organization, which draws a clear line compared to a DIU and its tasks. Second, the organization is a non-digital-native and established at least for 30 years or more. We assume, that older enterprises have a historically grown IT, where parts of a bimodal IT mode 1 are still present. Third, the participants hold a position with in-depth insights regarding the DIU and have general knowledge about the whole organization. Therefore, we mainly contacted Chief Digital Officers (CDOs), DIU Leads or DI Managers. Table 9.1 gives an overview of all interviewed DIUs. We used semi-structured interviews, preferably in face-to-face meetings, for detailed discussions and a comprehensive exploration of participants' views and experiences. We asked each participant to thoroughly describe the organizational setup of the DIUs, their position and integration in the main organization and the applied workflows, processes and methods as differentiated by the DI stages discovery, development, diffusion and impact (Fichman et al. 2014). The interview sessions took 45–90 minutes, were audio-recorded and transcribed. For our analysis, the first author conducted a deductive qualitative content analysis according to Mayring (2015) in the tool MAXQDA. As categories for coding, we utilized the thematic elements from the semi-structured interview guideline. Therefore, three main code areas were used for the analysis: (1) the DIU in its structure, processes, methods & resources, (2) the main organization with focus on its structures and its responsibilities in relation to DI management and (3) the overlap via bimodal IT as well as specific integration and positioning of the DIU. In total, 337 encodings emerged, which compose of 238 codes assigned to DIUs (1), 33 to the main organization (2) and 66 to the overlap (3). A segment matrix was utilized to support the analytical process. Based on the three main code areas, the codes of each interview were consolidated by their

commonalities, first by DIUs objectives, their structural setup and tasks within each DI stage, and then based on their position within the main organization.

Table 9.1: Overview of Analyzed DIUs

Source: Own Representation

ID	Size[1]	Legal Entity	Main Org. Size[2]	Main Org. Industry	Interviewee Position	Reporting Level
DIU1	Large	No	Upper Large	e-commerce	DIU Lead	to advisory council
DIU2	Medium	No	Lower Large	real estate	CDO (DIU Lead)	to CEO
DIU3	Medium	Yes	Upper Large	e-commerce	DIU Lead	to advisory council
DIU4	Medium	Yes	Upper Large	banking	DI Manager	to DIU Lead
DIU5	Small	No	Large	public transport	DIU Lead	to board of directors
DIU6	Medium	Yes	Lower Large	energy	DI Manager	to CEO
DIU7	Small	No	Upper Large	healthcare	DIU Lead	to board of directors
DIU8	Medium	No	Large	parcel delivery	DIU Lead	to CDO
DIU9	Small	No	Lower Large	public transport	DI Manager	to CDO

[1]DIU size (number of full time equivalent [FTE]): Small = < 6; Medium = 6 – 15; Large > 15

[2]Size: Lower Large = < 5k FTE & revenue < 1B€; Large = 5k–20k FTE & revenue 1–5B€; Upper Large = > 20k FTE & revenue > 5B€

9.4 Results

Based on our empirical data, we developed three key findings. First, we identified two different ways of how organizations set up and anchor DIUs. Second, we found two linking mechanisms between DIUs and the main organization. Third, we derived four evolution strategies of DIUs from the data.

9.4.1 Setting Up and Anchoring DIUs in the Main Organization

The DIUs of our dataset can be divided into two basic types, the Coaching & Screening (C&S) type and the Center of Excellence (CoE) type. The division of the two types mainly results from the different focus and modus operandi of the units, but it is also in line with the DI stages by Fichman et al. (2014). A C&S unit solely concentrates on the first stage of innovation discovery, while a CoE unit also includes development, diffusion in the main organization and impact measuring. However, the two unit types cannot be separated according to the type of DI, as all interviewees stated that their DIUs concentrate on digital

product and service innovations. The intended impact should at least be radical, as incremental innovations are the responsibility of the business units or of product-oriented agile development teams in the main organization. All interviewees stated that DIUs are not averse to discover and integrate disruptive innovations. However, little attention is given to them, as these types are not simply transferable into the main organization. Except DIU8, all DIUs are referencing their main organization as unit of adoption for which a DI is perceived as new. DIU8 additionally focuses on the customers of a main organization's business unit, for which a digital product or service innovation is implemented. Almost all DIUs are located separately, but in the immediate vicinity of the main organization. Only DIU1 is located within its main organization. All DIU offices are creatively furnished, as the environment is expected to positively influence the DI activities. Surprisingly, we found no differences between DIUs, which are established as legal entities or as divisions in terms of objectives or tasks. However, a clear line of DIUs from accelerators, incubators or company builders cannot be drawn in every case (see Table 9.2). An 'x' refers to their main characteristics, whereas brackets show partial overlaps to other types. DIU1 and DIU3 stated that although the focus clearly matches the tasks of a CoE, some good ideas could also be implemented within a startup (company builder). This also applies to DIU6, which is currently transforming into a CoE. As DIU6 and 7 currently transform from a C&S to a CoE, we assigned them to the type which captures their dominant character. DIU3 and DIU7 indicated that they are not averse to also supporting potential partners in the form of an incubator.

Table 9.2: DIU Types with Overlaps
Source: Own Representation

		DIU1	DIU2	DIU3	DIU4	DIU5	DIU6	DIU7	DIU8	DIU9
DIU Type	C&S				x		x	(x)		x
	CoE	x	x	x		x	(x)	x	x	
Company Builder		(x)		(x)			(x)			
Incubator				(x)				(x)		
Accelerator										

In the next two subsections, we describe the DIU types C&S and CoE in detail.

9.4.1.1 Supportive Coaching & Screening (C&S) type

As stated, C&S units mainly address innovation discovery. This implies promotion of an agile mindset in the main organization and the development of new digital skills. DIUs conduct a trend screening, which includes the analysis of concrete digital search fields and

their relevance for the main organization. DIU4 and DIU9 explicitly screen for radical, innovative solutions to problems. DIU6 further identifies potential disruptive innovations, which can also be spun off as separate companies if required. This indicates that DIU6 also has some characteristics of a company builder. *"We're just working up to a [minimum viable product] now. After that, the project is no longer with us and a handover takes place. Once you've found something good [a DI], the goal is actually to make resources available. It may be usable within the main organization or perhaps also externally towards the direction of a spin-off"* (DIU6).

However, both discovery and enabling the main organization to think about new products or services in a new way are key. Thus, screening DI trends, coaching and the use of agile methods to enable the creation and processing of minimum viable products (MVPs) are essential. According to our data, C&S units have dedicated coaches who offer special training courses and programs for digital expertise, sometimes in cooperation with external partners as specialists in new methods or technologies. The teams in these units are interdisciplinary, composed of former employees of the main organization and external employees, who usually have several years of experience in a startup environment. C&S units tend to be smaller than CoE units (small to medium DIU size). In general, we identified three forms in DIU4, 6, 7 and 9:

1. In one to three day workshops, groups from the main organization are trained in agile working methods such as Design Thinking, Lean Startup, Personas, Customer Journey or Scrum. The workshops are voluntary and intended for all employees throughout the whole organization.
2. In six-week events, five to seven employees from the main organization who applied for this event are assembled in an interdisciplinary team and work on a problem using agile methods. The coaches support the teams. Problems or issues are sponsored from divisions of the main organization, selected and prioritized by employees of the C&S and assigned to an agile team. The aim is, from a training perspective, to develop a problem solution, possibly by creating a prototype, which provides a value for the sponsor of the problem.
3. Mentoring includes the support of traditional departments within the main organization to change existing structures or processes so that agile methods can be applied. This requires a fundamental openness within a department or in the teams to approach topics in a different way. The prior participation in the other formats would be advantageous.

In addition to the coaching tasks, partner management and marketing are established in all units of this type. In particular, marketing includes the promotion of the unit within the main organization. DIU9 conducts early acceptance tests for its six-week events by doing social media surveys and asking potential users for feedback.

Based on these insights, we are able to describe a good practice (see Figure 9.2). The unit is divided into three core areas. Trend Screening, Problem Scouts and Agile Coaching. Trend Screening, consisting of two to three employees, analyzes current external trends and produces a Digital Trends Catalogue available to the main organization at regular intervals. Employees use internet sources and conferences for this purpose and exchange information on trends with partners. The Problem Scouts specialize in digital focus topics and have the task to identify problems inside the main organization for which a solution can possibly be developed within a six-week full time equivalent (FTE) event using agile methods. Approximately two people, ideally former employees of the main organization, work on a digital focus topic. The problem scouts should be well connected within the organization. In addition to the independent search for problems, the problem scouts are also responsible for providing a channel on which, for example, business unit leads can invest their own problems. The potential problems are collected centrally within a problem pool and evaluated together with Trend Screening and the coaches. Agile coaches are responsible for all mentioned formats. The teams work full-time on prototypes with the focus on learning new agile methods and should be exempted from daily business tasks. In order to maintain a continuous flow of applications for these formats, marketers can optionally provide social marketing campaigns that carry the offered formats into the main organization and invite other people to participate as well.

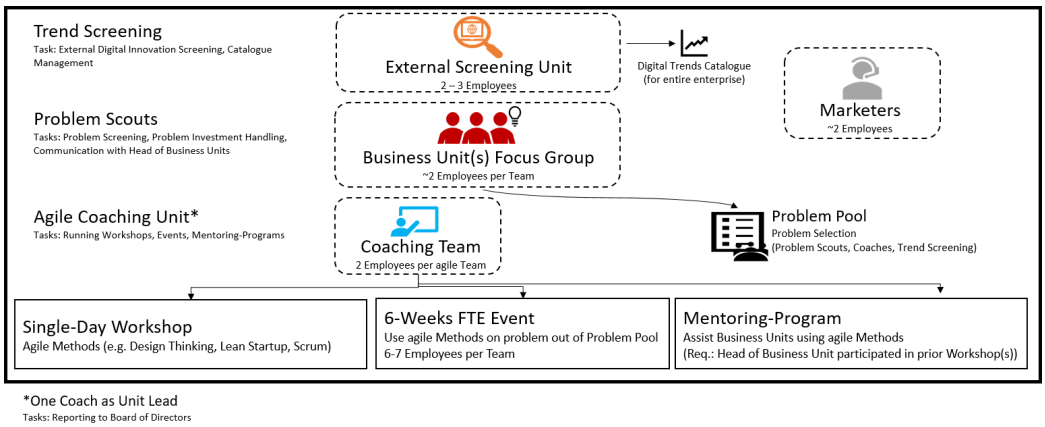


Figure 9.2: Coaching & Screening Unit Setting

Source: Own Representation

9.4.1.2 Center of Excellence (CoE) type

Contrary to C&S units, a CoE is responsible for the entire implementation of radical innovations, especially digital products and services, for integrating these innovations into the business units of the main organization and for measuring their impact. A CoE passes through all DI stages, with the particular focus on implementation and integration into the main organization.

All CoEs emphasized the need of autonomous budgets in order to fulfill and implement DIs within a short time period. “So I have a budget and I don’t have to get permission to take individual actions. […] We don’t do this with a business case approach. We believe that we spent the money anyway. My job is to make sure that we invest it in the right and best topics” (DIU8). This ensures fast decision-making processes and avoids lengthy discussions about individual investments (e.g. for an approval by the board of directors). With the exception of DIU1, all DIUs have a self-managed budget. As with the C&S, we have developed a good practice model based on the identified units (see Figure 9.3). CoE units are also split into three core areas and are usually slightly larger than a C&S unit. All interviewed CoE units had the explicit role of a unit lead. The CDO of the main organization takes the role or someone who reports directly to him (as seen in DIU2, 3 and 8). His or her task is to communicate with the collaborating business units, report to the board or advisory board and, if necessary, work as a product owner for one or more DIs. DIU8 has a separation between the Problem Scouts and the Agile Development Teams. Like the Unit Lead, Problem Scouts must possess strong communication skills and, as former employees of the main organization, must continue to be well connected within it. Problem Scouts have to be familiar with agile working methods and are responsible for the initial selection of identified problems that may be solved through DIs. The problem scouts are subdivided according to concrete digital focus topics, here called ‘Honey Pots’. We call them ‘Honey Pots’ because they contain potential highly relevant innovations (‘honey’) which need to get extracted. The division into ‘Honey Pot’ topics allows scaling and represents the reason for the slightly larger size compared to a C&S. The preselected problems end up in one Problem Pool that forms the basis of the final selection. In addition to the identification and selection of problems for the digital focus area, impact measurement is also part of the problem scouts task area, as provided for in DIU2. User data is collected at fixed intervals, e.g. through surveys, which are returned to the entire CoE unit as feedback. Every ‘Honey Pot’ has two to three employees and one of them takes

the Product Owner role. These employees must already have experience in agile settings and master the usual methods such as design thinking, lean startup or scrum.

The final selection of the topics within the Problem Pool is carried out in consultation with the Unit Lead (CDO), the CIO, and the management or advisory board. The CIO takes part to ensure that the required IT infrastructure is provided on time. The Agile Development Teams is interdisciplinary based on the different topic areas. The core team, which has expertise in the implementation of the digital focus topic, works together with employees of the business units who will use the solution in the future. The core team also has the task of identifying new potential partners and maintaining relationships with existing partners. The employees from the main organization who temporarily work in the Agile Development Teams provide domain-specific input, which continuously introduce the customer perspective into the project right from the beginning (based on DIU2), and support the implementation or can work as product owners depending on their skill set. These employees also work full-time in the unit until an MVP is implemented. They also serve as positive communicators in their business unit. After developing the digital product or service, the team is dissolved.

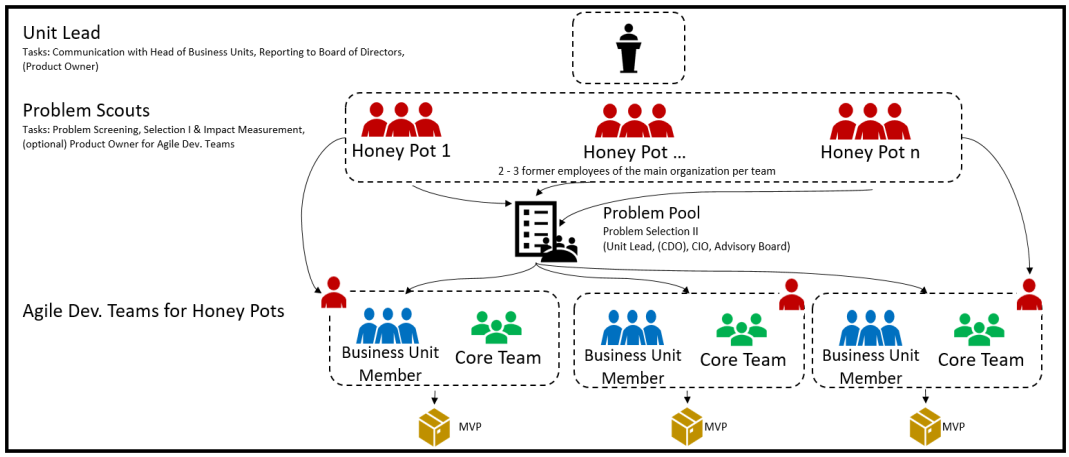


Figure 9.3: Center of Excellence Unit Setting
Source: Own Representation

9.4.2 Linking Mechanisms between DIUs and the Main Organization

We identified two basic prerequisites of DIUs. First, employee shifting enables collaboration between a DIU and the main organization. Second, as mentioned in 4.1, we found that DIUs are not responsible for operating and maintaining DIs for a longer period and therefore are interested in integrating DIs into the main organization.

Although each DIU has permanent staff, the units are very variable and cooperate closely with the main organization and external partners. In general, all interviewed DIUs compel

themselves to collaborate with the main organization. In order to make this possible, employees of the main organization are temporarily sent to the DIUs either to learn (C&S) or to support (CoE) them with digital expertise. *"This team is built up of employees from the main organization. This means that they also return to their business units. They are just in the DIU for a certain time. Anyone, honestly anyone, can join. Students, managers, our CEO…"* (DIU9). This shifting requires tolerance of the managers and special employee's skills to work in this agile working environment. This way of working leads to a strong collaboration. We believe that this strong collaboration, along a self-managed budget, enables high degrees of freedom, which reduces the risk for silo mentalities or a dog-eat-dog society. The closure of DIU5 a few months after the interview shows the significance of an employee shifting mechanism. Although there was a shifting mechanism established, these employees also had to take care of day-to-day business in their actual business unit in addition to the tasks in the DIU. *"If employees are only allowed to spend 50% of their working time in the DIU, this can be very difficult […]"* (DIU5).

The need of a strong collaboration between DIU and the main organization is also realized by bringing the DI and the employees back into their business units of the main organization. DIUs are not responsible for maintaining the implemented product as the business units of the main organization are in charge maintaining and innovating these DIs. Through the joint development of DIs with members of the business units and the concomitant transfer back, potential aversions to DIs can be opposed.

9.4.3 DIU Evolution Strategies within a Bimodal IT Setting

We derived four evolution strategies to classify the surveyed units (see Figure 9.4). Considering the life cycle of DIUs, we assume that the following options are transition stages, which leads to an approved digital alignment throughout the whole organization.

Option 1: 'Transformer'. The main organization starts with establishing a C&S unit to bring agility and new working methods into the organization. As soon as digital expertise is built up inside the main organization, the tasks of a C&S are systematically expanded. Transformation refers to an expansion of tasks, which are common in a CoE, in order to address all DI stages. The collaboration with employees of the main organization within a CoE enables all units to implement DIs on their own. As a result, a separate CoE is no longer necessary in the long run. Therefore, the tasks can be reduced to a regular C&S unit again. C&S unit DIU4 and 6 both note that they are transforming into a CoE unit. They are already handling the development of MVPs, but they still do not perform change

management or the integration of MVPs into the main organization at the time the interviews were conducted.

Option 2: 'Pure C&S'. Option 2 focuses on establishing digital awareness and an agile mindset in the whole organization. By means of the programs and events offered in a C&S, the DIs shall be fostered interdisciplinary without a CoE. The main organization of DIU9 pursues a cross-sectional strategy. DIU9 is not to be transformed into a CoE, in which the digitization is dealt with centrally. Its main organization wants digitization to be disseminated and embedded: *"It's not about building a lab with high potentials or any experts for agile work [like a CoE unit], but [we] want [...] this to be spread within the company"*. DIU9 tries to coach all employees with the aim to manifest digital expertise and especially agile methods holistically.

Option 3: 'Big Bang'. Big Bang refers to establishing a DIU as CoE without having a C&S beforehand. All other interviewed DIUs can be classified in our option 3, without a C&S set initially. Big Bang is mostly chosen or led by a CDO with the goal for radical changes in the main organization within a very short time period.

Option 4: 'Concurrent'. Although this derived option is more expensive than the others, operating a C&S and CoE in parallel with a run-up time for C&S units is key to continuously strengthen the digital expertise and agile working capability. This option fits in particular, if the main organization has a traditional IT and is still in its infancies in terms of agile methods and digitalization. Like option 1 or 2, a C&S unit starts establishing digital awareness throughout the main organization. The cooperation of C&S and CoE enables employee shifting and integrating new digital products or services in the business units of the main organization. Similar to option 1, a separate CoE is no longer necessary in the long run. Therefore, the termination represents the reduction of tasks included in discovery stage (without development, diffusion and impact).

The succeeding unimodal agile mode can, however, still be organizationally separated. Therefore, C&S units may always be set up in order to identify digital trends at an early stage and not to have a competitive disadvantage over competitors.

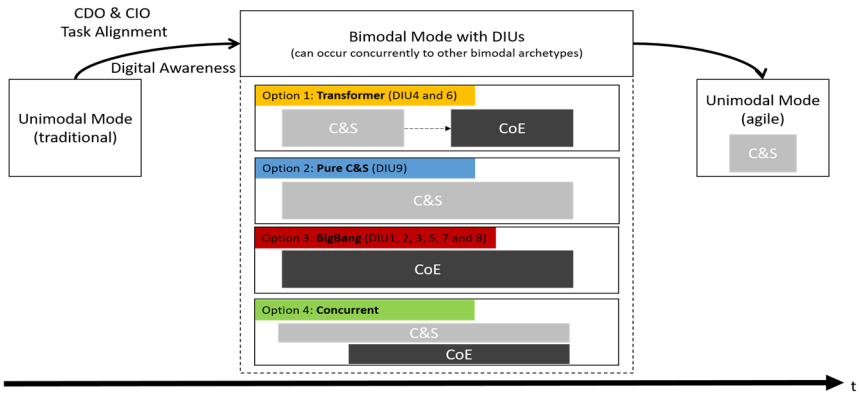


Figure 9.4: DIU Evolution Strategies
Source: Own Representation

Depending on the actual situation and the agile maturity of the main organization, different implementation options can be employed. As mentioned above, other archetypes of bimodal IT modes can be established in the organization in addition to our focused agile mode with DIUs. We derived implementation options, which depend on the mode of the main organization, whether it is more traditional or agile-oriented. These recommendations are illustrated in Figure 9.5. For a very traditionally oriented main organization, a pure C&S (option 2) tends to be a good option to start maturing into an agile mode. Supporting already established smaller agile structures, e.g. on an agile project basis, a transformer strategy (option 1) is suitable, as it first rises the agile mode and then transforms into an executing CoE. Big Bang (option 3) can be applied, if the main organization has reached a high level of agile maturity and no agile trainings are needed. The concurrent option 4 is a secure and robust option, suitable for both, traditionally or agile mature main organizations as it combines the advantages of both types.

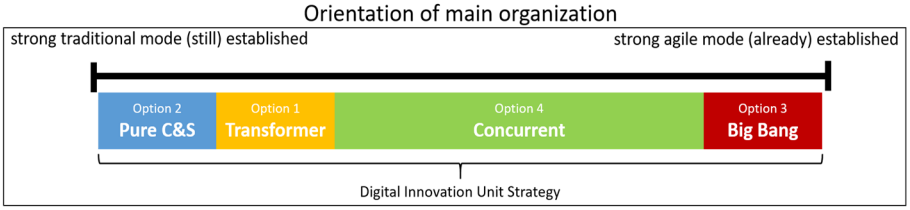


Figure 9.5: DIU Implementation Options
Source: Own Representation

9.5 Discussion and Conclusion

As one of the first studies on the nascent phenomenon of DIUs for realizing DIs, we provide an integrated view on their organizational setup, linking mechanisms to the main organization and evolution strategies. We identified two types of DIUs: Coaching & Screening (C&S) units and Center of Excellence (CoE) units. While the C&S unit is responsible for DI discovery, the CoE type focuses on DI implementation and integration. Both DIU types have strong partnerships with external partners and work across enterprise boundaries, which does not necessarily apply to non-digital innovation labs or traditional R&D units (Chiesa 2000). DIUs focus on screening emergent digital trends on the market, which may be integrated into the main organization.

Our identified types and the suggestive good practice models fit Fuchs et al.'s (2019) taxonomy of digital units, but we enrich their general categories by e.g. concretizing the dimension of the DIs and by describing workflows for the DIU types.

We further extend the knowledge on how to innovate in a bimodal IT setup (Haffke et al. 2017b; Horlach et al. 2016; Horlach et al. 2017) with our findings by differentiating the agile IT setup (Gerster et al. 2019; Jöhnk et al. 2017) for DIs and their dimensions by substantiating DIUs as one implementation of an organizationally separated agile division focusing on DIs. Other agile units or digital divisions may also focus on DIs in general (as described by Haffke et al. (2017b)), but their goals may be different to the goals of a DIU. Other digital divisions may have a focus on other dimensions of DIs, e.g. incremental product and process innovations. DIUs are specific as we identified that they concentrate on (at least) radical product and service innovations (and not incremental or process innovations). This implies that DIUs may coexist with other digital divisions or agile IT units, which focus on other DI dimensions. With the resulting different types of DIUs and their alternative evolution stages, we introduce a dynamic view of bimodal IT explicitly for its specific type with separated divisions (Haffke et al. 2017b; Horlach et al. 2017). This is in line with Dixon et al.'s (2017) notion of (IT-)ambidexterity being in a constant flux, as the contexts for DIs are ever-changing. In line with literature, we assumed that the options for positioning DIUs are transitional stages (Gerster et al. 2019; Haffke et al. 2017b), which may result in an *"[…] unimodal design after it has adopted the learnings from the governance principles, working methods, and cultural aspects developed in Mode 2 throughout the IT function"* (Haffke et al. 2017b, p. 5468). Depending on the current situation of the main organization, our options can assist explorative endeavors and

consequently help enterprises to promote DIs. As Horlach et al. (2016, p. 1425) point out, *"[…] bimodal IT is being criticized as a temporary and intermediate state […]"*, we take a more optimistic view on this and see bimodal IT structures as a necessary step for organizations in order to enable digital expertise and to digitally align the current processes for assisting enterprises to become ambidextrous.

Our identified linking mechanisms are further in line with Hund et al.'s (2019) findings on how knowledge enters a DIU and how it is exchanged between units. In accordance with their insight that people rotation acts as one crucial step to ensure that new knowledge enters a DIU (Hund et al. 2019), we see this way of working as essential for ensuring close collaboration between DIUs and the main organization. It does not necessarily apply only to DIUs, as (non-digital) innovation labs may have similar working methods established (Turrin 2019). Yet, this way of working is crucial for DIUs, as it resolves possible challenges like silo mentalities or 'digital aversions'.

The results of this paper are not without limitations. First, as they are solely grounded on empirical data based on nine organizations, the results are limited in terms of generalizability. We tried to solve this challenge by interviewing very knowledgeable experts in this field, as they both know their individual unit very well and are usually well-connected with units in other organizations. However, as we just interviewed leading positions within DIUs, the results might be biased because these people have a strong incentive to let their DIU 'shine'. Therefore, we recommend to extent our results with further cross-industry and in-depth case studies including additional interviews with people in non-leading positions and with people from the main organization. While we focused on DIUs in the first step, further insights on how the main organization acts in relation to DIs are necessary to understand DIs within the organization in its whole. Thus, our next phase will include an in-depth analysis of the link between DIUs and the main organization in order to identify design principles for facilitating the whole lifecycle of DIs. Furthermore, we will analyze overlaps between different forms of digital labs like company builders, incubators, accelerators and in-house consulting within one company to gain a deeper understanding on their interplay.

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10 'Forewarned Is Forearmed': Overcoming Multifaceted Challenges of Digital Innovation Units

Raabe, J.-P., Horlach, B., Schirmer, I., and Drews, P. 2020b. "'Forewarned Is Forearmed': Overcoming Multifaceted Challenges of Digital Innovation Units," *Americas Conference on Information Systems (AMCIS)*.

Abstract. Due to rapidly changing customer needs, enterprises seek to innovate continuously. Incumbent firms need to improve their capabilities to develop, evaluate, and implement digital innovations. Recently, many enterprises established digital innovation units (DIUs) for accelerating their digital innovation endeavors. Although numerous units exist in practice, the number of negative press headlines that address failure or dissolution of DIUs is increasing. Based on a literature review and a qualitative cross-industry study with eleven enterprises, we discuss the relation of DIUs to organizational concepts like ambidexterity, bimodal, and trimodal IT. Furthermore, we substantiated seven multifaceted challenges of DIUs, which span across stages of innovation development, organizational units, and hierarchical levels. Based on these findings, we developed three recommendations for responses to these challenges: (1) DIU-Business-IT collaboration across stages, (2) network of executive responsibilities, and (3) general digital awareness of the organization as a whole.

Keywords: Digital Innovation Units, Digital Innovation Labs, Challenges, Failure.

10.1 Introduction

The rise of digital technologies imposes new opportunities and challenges for incumbent firms. As 'digital' reduces entry barriers for new competitors and leads to a greater variety of offers to choose from, the power shifts towards the customer (Denning 2010). Thus, enterprises feel forced to rapidly and continuously develop particularly digital innovations (DI) for the market(s). For non-digital enterprises, this often implies becoming ambidextrous with simultaneously exploiting the existing day-to-day business and exploring radical or disruptive innovations for new business opportunities with new digital technologies (Dixon 2017; Kathuria and Konsynski 2012; O'Reilly and Tushman 2008).

To respond to this need, enterprises seek new ways of enabling DI. One approach to speed up digital endeavors is to set up a separate 'fast lane' for DIs (Fuchs et al. 2019). This 'fast lane' can have different forms of specifications, e.g. by being realized as separate (digital) units, and vary whether the innovation activities happen within or outside of the main organization (Fuchs et al. 2019). For instance, company builders, accelerators, or incubators directly offer innovations to market(s), which leads to outside innovation activities (Hausberg and Korreck 2018; Raabe et al. 2020a). However, we focus on units with inside innovation activities, which deliver DIs for the main organization. We call them digital innovation units (DIUs). Despite being one specific kind of a 'fast lane' implementation, DIUs are not mutually exclusive to other units, as they can co-exist with company builders, incubators and accelerators, or other initiatives (Jöhnk et al. 2020; Raabe et al. 2020a).

Although numerous DIUs do exist in practice (Barthel et al. 2020a; Raabe et al. 2020a), research on DIUs and how they foster DIs for the main organization is still scarce. Yet, research is especially crucial, as negative press headlines on DIU failure or dissolution and challenges with the approach are rising (Depiereux 2017; Kleske et al. 2016; Römer et al. 2017; Unger 2018). Although some issues are stated in the articles, the challenges are neither described nor solutions are given. We seek to fill the gap by analyzing the following research questions: *Why do DIUs not meet their expectations* and *which set of actions can enterprises take to tackle the challenges?*

This paper is structured as follows: In the next section, we describe DIUs and DI management as conceptual foundations. Afterward, we outline our research methodology and present our main results. Finally, we discuss our findings and conclude with future research opportunities.

10.2 Related Research

As 'digital' becomes a key factor for success, the use of digital technologies challenges enterprises during the whole process of innovating (Nambisan et al. 2017). In general, 'digital' refers to all innovations that are enabled by or embodied in IT (Fichman et al. 2014). DIs can be conceptualized as "the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology. […] [I]n digital innovation, digital technologies […] form an innate part of the new idea and/or its development, diffusion, or assimilation" (Nambisan et al. 2017, p. 224). Thus, DIs can

be distinguished along three dimensions: DI type, the intended impact, and the unit of adoption. Types of DIs refer to digital product, service, business model, or process innovations (Fichman et al. 2014). The intended impact of DIs can be incremental, radical, or disruptive. While incremental innovations refer to continuously exploiting existing types (Christensen 1997), radical DIs need to be completely different and adaptable to influence future DIs (Dahlin and Behrens 2005). Disruptive DIs are technologically a non-linear break, create new markets, and eventually bring existing ones to a standstill (Christensen 1997). "[D]isruption refers more to a market/business phenomenon rather than a major technical breakthrough" (Edwards-Schachter 2018, p. 72). The unit of adoption refers to by whom the novelty of innovations is measured. Units of adoption can be the business units of the main organization, customers, or competitors (Rogers 2010).

The complex task of managing DIs includes appropriate practices, processes, and principles to orchestrate them effectively (Nambisan et al. 2017). Most important is digital awareness, which "[…] should allow the firm to discern when it is time to be patient with a developing technology, and when it is more important to abandon the technology and search for a better solution" (Dixon 2017, p. 27). Awareness shall be secured by allocating DIs to the role of Chief Information Officers (CIOs) and Chief Digital Officers (CDOs) (Drechsler et al. 2018; Haffke et al. 2016; Tumbas et al. 2018). Further, stage models exist to advance digital endeavors, e.g. the 'stage-gate systems' (Cooper 1990) or the 'new product process' (Crawford and Di Benedetto 2011). As these focus on tangible products, Fichman et al. (2014) define a stage model that explicitly addresses DIs. It consists of four stages. After discovering and selecting potential ideas that could lead to a DI, the ideas are implemented and diffused externally to the market or internally into the main organization. Finally, the intended and unintended impacts of DIs are measured based on the predefined unit of adoption. A final practice for success is embedding DIs in a broader management of innovation. To react to rapidly changing customer needs, bimodal IT appeared to be a promising concept to respond to the duopoly of speed (Horlach et al. 2016). The first traditional mode addresses more predictable areas to exploit what is known; the second agile mode focusses on uncertain areas by being exploratory (Horlach et al. 2016), which highlights the parallels to ambidexterity, connecting the traditional mode to exploitation and the agile IT mode to exploration (Jöhnk et al. 2017; Kathuria and Konsynski 2012; Lee et al. 2015).

Initial approaches on how to implement bimodal IT setups exist, e.g. on a project-by-project base or with separate organizational units for DI discovery and delivery (Haffke et

al. 2017a; Raabe et al. 2020a). However, challenges and downsides of bimodal IT are rising (Cohen 2016; Jöhnk et al. 2019), e.g. the problem of a two-class silo system creating conflicts (Boulton 2016; McCarthy et al. 2016). Consequently, some enterprises move beyond and implement multimodal or trimodal concepts (Jöhnk et al. 2019). This may result in a structural division to foster innovations by transitioning between so-called pioneers, settlers and town planners (Wardley 2015): While pioneers create entirely novel and new prototypes or minimum viable products (MVPs), settlers identify common patterns and productize them, so they are documented, manufacturable and stable. Town planners then "build the core, volume operations based, good enough, ultimately (long term) low margin but highly industrialized services & commodity components [...] [by] [using] the portfolio of the settlers" (Wardley 2015). Besides, they encourage pioneers and settlers to continuously cannibalize the as-is state of the business (Wardley 2015).

The trimodal concept is supposed to narrow the gap between the two bimodal modes, but research on this concept and the realization via 'fast lane' units is yet in its infancy. While some place 'fast lane' units within the explorative mode of ambidexterity (Fuchs et al. 2019; Jöhnk et al. 2020), other see DIUs as one implementation of an organizationally separated agile division within a bimodal IT context (Haffke et al. 2017a; Holotiuk 2020; Raabe et al. 2020a). While the main organization usually contains large parts of the exploitative traditional mode, DIUs are fully explorative and agile. However, the embedding of these units into the trimodal concept is not delineated. Although the connection between pioneers as explorative/agile and town planners as exploitative/traditional mode is already described (Wardley 2014), it is unclear if DIUs enable enterprises to realize trimodal IT with its transition mode of settlers as a middle component. This may depend on the characteristics of DIUs and 'fast lane' units in general. Based on the research gaps outlined above, we outline DIUs, which primary objective is to develop and diffuse DIs into its main organization, and analyze occurring challenges in-depth.

10.3 Research Methodology

Since little is known about DIUs and their challenges, we conducted a literature review (vom Brocke et al. 2009) and a qualitative cross-industry study via expert interviews to gain rigorous insights on existing DIUs and their challenges. For reviewing the literature, we searched for the combination of 'Digital Innovation*' and 'Digital Unit*', 'Digital Innovation Unit*' or 'Innovation Lab*' in the title, keywords or abstract in the IS databases ACM Digital Library, ProQuest AbiInform, Science Direct, IEEE Xplore, AIS eLibrary,

EBSCOhost Business Source Complete, and SpringerLink. As we suspected that little prior scientific literature on DIUs and their challenges exists, we also analyzed the first 50 entries in Google for white papers and relevant websites. Our initial pool contained 739(+50) articles. We excluded articles that had no challenges or concerns mentioned within the title, abstract, or keywords. Our final pool consisted of 27 relevant articles addressing DIUs and their explicit challenges or concerns in the full text.

To gain first-hand insights on DIUs challenges in practice, we further interviewed experts from eleven organizations in 2018 and 2019. For insights on a variety of DIUs, we selected organizations from multiple industries. Interview partners were selected based on three criteria. First, the main organization applies a bimodal IT type with a separate organizational division (Haffke et al. 2017a) and employs at least 1000 people. We assume that due to higher complexities with legacy IT systems and non-agile processes, these enterprises face different challenges than startups. Second, the main organization is not a digital-native and established for more than 30 years. Since DIUs are closely linked to the digital transformation of enterprises, we assume that older enterprises have historically grown IT systems, where parts of a traditional IT are still present. Finally, the participants need to have in-depth insights into the overall organization, especially regarding the DIU and all its tasks within the DI stages. Thus, we contacted Chief Executive Officers (CEOs), Chief Digital Officers (CDOs), Chief Information Officers (CIOs), DIU Leads, and Innovation Managers (Inno. Mngr.).

Nine interviews were conducted with DIU leaders or their innovation managers and two with top managers, who work with them (ENT10 and 11). We used semi-structured interviews which mostly were conducted by phone. In the interview, we asked each participant to describe the DIUs objectives, the general setup and tasks, DI focus, and challenges.

Table 10.1 gives an overview of the participating enterprises. The interviews lasted 45–90 minutes, were audio-recorded and transcribed. For deriving the challenges of DIUs, we conducted a qualitative content analysis. The dimensions of DIs served as deductive codes, whereas we assigned inductive codes for specific identified challenges (Mayring 2015). To attain the final results, we clustered the challenges out of our data, until the final challenges emerged.

Table 10.1: Overview of Analyzed Enterprises
Source: Own Representation

	ID	DIU Size[1]	Main Org. Size[2]	Industry	Interviewee Role	Est. / Status of DIU
DIU Employees	ENT1	Large	Upper Large	E-Commerce	DIU Lead	2012 / active
	ENT2	Medium	Lower Large	Real Estate	CDO/DIU Lead	2018 / active
	ENT3	Medium	Upper Large	E-Commerce	DIU Lead	2016 / active
	ENT4	Medium	Upper Large	Banking	Inno. Mngr.	2017 / active
	ENT5	Small	Large	Transport	DIU Lead	2015 / closed in 2019
	ENT6	Medium	Lower Large	Energy	Inno. Mngr.	2017 / active
	ENT7	Small	Upper Large	Healthcare	DIU Lead	2017 / active
	ENT8	Medium	Large	Parcel Delivery	DIU Lead	2016 / closed in 2019
	ENT9	Small	Lower Large	Transport	Inno. Mngr.	2017 / active
	ENT10	/	Upper Large	Aviation	Former CIO	/
	ENT11	/	Lower Large	IT Consulting	CEO	/

[1] DIU size (number of full time equivalent [FTE]): Small = < 6; Medium = 6 – 15; Large > 15
[2] Size: Lower Large = < 5k FTE & revenue < 1B €; Large = 5k–20k FTE & revenue 1–5B €; Upper Large = > 20k FTE & revenue > 5B €

10.4 Results

Based on our data, we developed three key findings. First, we outline and embed DIUs into the organizational concepts and identified the dimensions of DIs. Second, we identified seven challenges, which can lead to DIU failure. Third, we derived three actions, which assist overcoming them.

10.4.1 Nature and Shape of Digital Innovation Units

Based on Raabe et al. (2020a) we define DIUs as newly founded organizational units dedicated to develop DIs. They consist of interdisciplinary teams of permanent employees, employees from the main organization, and external partners who design and develop DIs for its main organization. As a separate legal entity or department, they work across enterprise boundaries, have high degrees of freedom, are involved in all DI management stages, and serve as enabler for the integration of DIs into the main organization. Some authors (Barthel et al. 2020a; Jöhnk et al. 2017; Raabe et al. 2020a) suggest ideal types or good practices with very similar characteristics. Referring to DIUs as specialization-based

global R&D structures, Chiesa (2000) divides between support and center of excellence structures. While a support structure is responsible for generating innovation stimuli and providing support for the centers of excellence, the latter is responsible for DI development and transfer (Chiesa 2000). This division fits within the DI management stages since support structures have tasks in discovery and center of excellence structures in the remaining stages. Raabe et al. (2020a) describe two types of DIUs, which fit these stages. Their 'Coaching & Screening' units focus on discovery and 'Center of Excellence' units specialize in the other stages (Raabe et al. 2020a). As we see the term 'support structure' ambiguous, we refer to it as discovery structure. This dichotomy is in line with the empirical data, as we could identify three DIUs mainly as discovery structures (ENT4, 6, 9) and six combined DIUs, that include both structures in separate teams (ENT1–3, 5, 7–9). We identified that DIUs focus on digital product and service innovations since these require the least effort of integration (Memon et al. 2018; Svahn et al. 2017). All interviewed DIUs state, that digital business model and process innovations are not focused (ENT1–9). The intended impact for these DIs is radical (ENT1–9). While incremental innovations are in the responsibility of the main organization, radical innovations should primarily not address completely new customers, as disruptive ones are usually supposed to do, but new target groups inside the industries of the main organization (Sindemann and Buttlar 2018). Disruptive DIs have minor attention, as they can hardly be integrated into existing processes of the main organization. All interviewees stated the main organization as the unit of adoption, except DIU of ENT8, which also includes customers of the main organization. In addition to the DI dimensions, Table 10.2 lists the embedding of DIUs in the previously described organizational concepts. Due to the identified division of two DIU structures, DIUs can enable enterprises to realize trimodal IT. Pioneers can be assigned to the discovery structure (stage 1), settlers to the center of excellence structure (stages 2–4), which refer to the transition stage due to its task of enabling the integration into the main organization, and town planners to the main organization.

Table 10.2: Categorization of DI Dimensions and Organizational Concepts

Source: Own Representation

		DIU		Main Organization
		Stage 1* (discovery)	Stages 2–4* (center of excellence)	
DI Dimensions	Type of Innovation	Digital Products and Services		All
	Intended Impact	Radical		Incremental
	Unit of Adoption	Main Organization		Customer
Organizational Concepts	Ambidexterity	Exploration		Exploitation
	Bimodal Mode	Fully Agile		Traditional and Partly Agile
	Trimodal Mode	Pioneers	Settlers	Town Planners

* DI Management Stages (Fichman et al. 2014): 1 = discovery; 2 = delivery; 3 = diffusion; 4 = impact

10.4.2 Identified Challenges in DIU Settings

We identified seven challenges in total, which could lead to DIU failure. The results in the literature and the empirical data are homogeneous, despite minor differences (see Table 10.3). We categorized the challenges according to the DI management stages and their affect. In the following, we describe each challenge.

Both in literature and the empirical data, the NIH syndrome (C1) is addressed very often. It is defined as "the rejection of an innovation developed elsewhere during the transfer and introduction of that innovation […]" (Chiesa 2000, p. 353). It manifests itself in managerial (non-)actions, including lack of appreciation, lobbying, rejection, delay, or other justifications, which can be linked to ethnocentrism or resistance to change (Fecher et al. 2018). Ethnocentrism in particular is specified as mutual ignorance or as corporate clash of cultures (Islam et al. 2016). We identified three underlying challenges, which enhances the NIH syndrome. As the main organization is partly dissatisfied with the innovations realized (Kerr 2018), wrong potential DIs are selected, which indicates a missing collaboration within discovery stage (C1.1). "This may explain why many firms are disappointed with the returns […] – if the right conditions aren't set, the output tends to be isolated" (Kerr 2018, p. 63). Therefore, the selection of DIs based on the main organization is of great importance (Novacek et al. 2017; Velten et al. 2016). "In many companies, corporate IT does not have the reputation of being an innovator. However, it is nonsense to believe that a DIU can be successfully built up in the medium and long term without 'IT' [...]." (Velten et al. 2016, p. 27; translated). We further identified a DIUs attitude of knowing everything better (C1.2) (ENT8). This challenge implies that DIU employees may feel superior. This could be perceived as arrogance and therefore harms the diffusion due to the interactions between DIU and the main organization. ENT1 describes a further challenge that possible ideas do

not remain with the owner of ideas and 'are stolen' by DIUs (C1.3). This may lead to reluctance finding solutions and therefore influences discovery. Out of empirical and literature findings, we elaborated the challenge of unclear DIU objectives (C2). This challenge affects the DIU and the main organization. DIUs are often founded out of fear not to miss current digital trends and consequently not to lose current competitive advantages. Although the used agile methods are usually defined in detail, a clear definition of objectives, focus topics, or achievements, is missing and the used methods become an end in themselves (Narayanan 2017, ENT11). Due to that, business units and the IT department of the main organization may brand them under the term of 'innovation theater' (Turrin 2019), which enhances the NIH syndrome. Since it hinders the collaboration from the beginning, it affects especially the discovery. We identified missing support of the top management as a third challenge (C3), primarily within the empirical data. Low support or commitment may lead to rejected decisions for implementing or integrating DIs (Velten et al. 2016, ENT1–6, ENT8, ENT11). DIU of ENT5 and ENT8 were closed because their leads left the unit. Without the unit leads, top management lost its trust in the DIUs. C3 refers to all DI management stages, as top management could influence and abort all endeavors. Further, we identified the challenge of missing skills (C4) in the literature and empirical data, which affects the whole enterprise. Among technical skills, DIU employees may lack of strong communication and cooperation skills to maintain contact with the employees of the main organization (etventure 2018a; Velten et al. 2016). As agile working methods may have been hardly adapted in the main organization, the results of DIUs might not be transferred. For the main organization, the results (MVPs or prototypes) may seem to be in an immature state of development (Fecher et al. 2018; Narayanan 2017). Missing skills affect especially the discovery for DIUs and the diffusion stage for the main organization. The conflict between CDOs and CIOs is another crucial challenge (C5) described by ENT10. Many enterprises have established the role of a CDO in recent years. Although this role should foster digital endeavors, it could lead to problems with the CIO, as their tasks could overlap and fortify conflicts (Pfirsching 2017; Velten et al. 2016). Interviewee from ENT10 (the former CIO) left the enterprise due to their different views on digital leadership. "I personally don't like this CDO role at all [...] especially if it is approached in a way that someone comes in with a traditional hierarchical thinking and then wants to build his empire. [...] That made the traditional business nervous because they felt attacked" (ENT10). This challenge has serious effects on the diffusion stage, as the conflicts between CDO and CIO may hinder suitable DI integration plans. Financial bottlenecks (C6) were often mentioned in literature and the empirical data.

As digital endeavors are costly, it should be transparent that digital endeavors are always associated with high costs to get enough budget, otherwise, DIUs will be prematurely condemned as failed (ENT8). As implementing, diffusing, and evaluating DIs are costly, this problem affects especially DI management stages 2–4. Part-time employees (C7) represent our last identified challenge, which occurred often in the empirical data. Employees should not be distracted by additional tasks, e.g. day-to-day operations, as it could be labeled as a frivolous project without serious intentions for change (Depiereux 2017) and might result in an 'innovation theater' (Turrin 2019) as well. This affects all DI management stages.

Table 10.3: Identified Multifaceted Challenges of DIUs

Source: Own Representation

Identified Challenges of DIUs	Affects[1]	Stage[2]				Literature Findings	Empirical Findings
		1	2	3	4		
C1: Not-Invented-Here Syndrome	DIU			x		Bärtle 2017; Catlin et al. 2017; Chiesa 2000; Ciriello and Richter 2015; Dearlove 2006; Diehl 2017; etventure 2018a; Fecher et al. 2018; Islam et al. 2016; Narayanan 2017; Remfert and Stockhinger 2018; Svahn et al. 2017	ENT1–5, 8, 9
C1.1: Missing Collaboration in Discovery Stage	All	x				Kerr 2018; Novacek et al. 2017; Velten et al. 2016	/
C1.2: DIUs Attitude of Knowing Everything Better	BU, IT			x		/	ENT8
C1.3: Feeling of Getting Ideas Stolen	BU, IT	x				/	ENT1
C2: Unclear DIU Objectives	All	x				Catlin et al. 2017; Narayanan 2017; Turrin 2019	ENT11
C3: Missing Support from (Top) Management	DIU	x	x	x	x	Velten et al. 2016	ENT1–6, 8, 11
C4: Missing Skills	All	x		x		etventure 2018a; Fecher et al. 2018; Haffke et al. 2017a; Hyvönen 2018; Narayanan 2017; Novacek et al. 2017; Svahn et al. 2017; Velten et al. 2016; Wiesboeck 2018	ENT1–5, 8, 10
C5: CDO & CIO Conflicts	DIU			x		Pfirsching 2017; Velten et al. 2016	ENT10
C6: Financial Bottlenecks	DIU		x	x	x	Fecher et al. 2018; Hyvönen 2018; Sindemann and Buttlar 2018; Velten et al. 2016	ENT2, 4, 5, 8
C7: Part-Time Employees	DIU	x	x	x	x	Depiereux 2017	ENT4, 5, 7, 8, 11

[1] Challenge primary affects: BU = Business Units of Main Organization ; IT = IT Department(s) of Main Organization; DIU

[2] DI Management Stages (Fichman et al. 2014): 1 = discovery; 2 = delivery; 3 = diffusion; 4 = impact

10.5 Three Crucial Actions to Overcome the Multifaceted Challenges

The previously described DIU challenges are multifaceted and occur on various layers. (1) The challenges arise within one, across several, or even in all DI management stages. Since several DIs may be processed in parallel within DIUs, these DIs may be at different DI

management stages and therefore have different needs. As they are not only dealt with in DIUs, they require sophisticated cooperation with business units and IT departments of the main organization, which needs to be understood and handled. (2) Further, the identified challenges are not solely confined to the level and role of executors across tasks in DI management stages; they also require the support of executives across various hierarchy levels, as clearly stated in the interviews. Here, a network of responsibilities and decision rights regarding DIs and the fostering of collaboration across units has to be determined and established. (3) Furthermore, some of the challenges point to an overall mindset and openness towards DIs, which we subsume under a general digital awareness of the organization as a whole. In the following, we identify, propose, and elaborate possible actions according to the identified three layers and their actors.

DIU-Business-IT Collaboration across Stages. The individual actors must converge and foster strong collaboration mechanisms between DIUs, business units, and IT within and across stages and all hierarchy levels to overcome all of the mentioned multifaceted challenges. As this collaboration includes the missing collaboration within the discovery stage (C1.1), it also assists to overcome the feeling of getting ideas stolen (C1.3). The continuous integration of business stakeholders leads to the impression that ideas remain with their providers. Collaboration lowers the boundaries between DIUs, business units and IT and involves enabling employees not to work as usual in business units of the main organization, but to identify concrete challenges and to solve those using new IT technologies in interdisciplinary expert teams within DIUs. The proximity to the business units overcome a DIUs attitude of knowing everything better (C1.3) and further solves the challenge of an NIH syndrome (C1) in general. As the discovery, development, diffusion, and the desired benefit of DIs are in close consultation with the business units for which a DI is developed, it also fosters the definition of clear objectives and therefore addresses the challenge of unclear or even missing DIU objectives (C2). *Executives Actions:* To foster collaboration, executives have the responsibility of fostering job rotation or exchange programs where employees of the main organization can work together with DIU employees. They need to create incentives for employees to share their expertise with DIUs. This exchange should be a common practice as it enables all employees to learn from each other, e.g. new technical skills, agile working methods, or handling prototypes. *Executors Actions:* Executors within the business units and IT of the main organization need to build up the necessary skills (e.g. to work with agile methods, handle MVPs and prototypes). Building up these digital skills requires a strong motivation of the executors to compel

themselves continuously to learn (Fecher et al. 2018; Novacek et al. 2017; Svahn et al. 2017). This should assist in overcoming missing skills in the diffusion stage (C4). *DIUs Actions:* DIUs should focus on proactively maintaining and keeping in contact with the business units and IT of the main organization. They should motivate digital endeavors throughout the organization through motivational events, trainings, or publishing digital trends within an in-house newsletter (ENT3, 6). DIU discovery structures could assist in getting in contact with the main organization and center of excellence structures can further assist in the remaining stages.

Network of Executive Responsibilities. Especially support from top management is crucial, as ENT5 and ENT8 were closed due to missing support (C3). Therefore, a network of responsibilities and decision rights regarding DIs is of great importance. As first digital initiatives are usually implemented project-based (Haffke et al. 2017a) and led top-down by IT executives within IT departments (Novacek et al. 2017), IT executives should co-decide who is suitable for the role of a digital leader. As working together is crucial, these roles should have the same view of digital leadership (ENT10). The digital leader is a key player in digital initiatives, usually responsible for DIUs, and is reliant on full support of all executives. The tasks should be clearly distinguished from those of a CIO with whom close collaboration within and across all DI management stages is crucial (ENT10), as this assists overcoming CDO & CIO conflicts (C5). *Executives Actions:* Executives or (top) management need to provide appropriate conditions and need to understand and communicate the relevance of digital endeavors top-down. They must provide DIUs with financial independence (adequate resources) to avoid lengthy decision-making processes. DIUs should have their budget for the long term, managed by the unit lead (Velten et al. 2016). This refers to overcoming the challenge of financial bottlenecks (C6) and part-time employees (C7). As ensuring high degrees of freedom and fast feedback mechanisms are crucial for DIUs, the location should be detached, but close to the main organization. *DIUs Actions:* DIUs must continuously communicate their value and results transparently throughout the entire enterprise to receive long-term support from top management. Therefore, good communication channels should be established. This supports overcoming missing support of the top management (C3).

Digital Awareness in General. Digital awareness (Dixon 2017) should be spread early on. It acts as motivation for all digital endeavors in the entire organization. The necessity of promoting digital endeavors and agile working methods should be presented transparently and the value communicated (Velten et al. 2016), which assists to conceive the objectives

of DIUs (C2). The whole organization needs to understand, why digital and agile working methods are so important, as major (digital) changes in organizations are always tough and unpleasant (ENT11). Digital awareness acts as an enabler for collaboration mechanisms, which assists in tackling the NIH syndrome (C1). *Executives Actions:* Executives should enable DIU employees to work in fulltime without having other tasks (C7) to strengthen DIUs serious intentions for change (Depiereux 2017). *DIUs Actions:* DIUs should motivate digital endeavors by e.g. publishing digital trends within an in-house magazine or newsletter (ENT3, 6).

10.6 Discussion

Prior research dealt with the identification of bimodal IT types, agile setups in general, and 'fast lane' units like DIUs. Jöhnk et al. (2019) initially describe general challenges for various types of the bimodal IT concept and therefore derive potential governance mechanisms based on the organizational concept to tackle them. We follow a similar approach but proceed vice versa. We focus on DIUs, which enable enterprises to realize the organizational concepts (ambidexterity, bimodal IT with separate organizational units, and the trimodal concept). As we outlined DIUs and their preferred DI dimensions, our research contributes to the increasing number of DIUs that have been (successfully) established in recent years. As we identified a DIU dichotomy between a discovery ('Pioneers') and a center of excellence structure ('Settlers') (Chiesa 2000; Drechsler et al. 2018; Keuky and Rilhac 2012; Raabe et al. 2020a), it enables enterprises to realize the trimodal concept, which introduces a transition mode that fosters closer collaboration. However, enabling the trimodal concept with a DIU dichotomy is not a guarantee to work. DIUs face challenges in day-to-day operations that have so far only been addressed in press articles and not in the academic discourse. We extend the current body of knowledge and initially demonstrate critical aspects of a setting with DIUs by explicating challenges that could lead to failure. Due to the multifaceted nature of the challenges, they appear in all DI management stages, affect the whole enterprise, and are not solely confined to one hierarchical level. This is why we introduce responsibilities and a set of actions to overcome the challenges. Our practical implications for DIUs, executors, and executives assist among general actions to establish or improve current DIUs in practice. However, as we identified the general need for stronger collaboration based on the data, it should be critically scrutinized whether DIUs, as promoters of radical DIs, create value and have an impact within the whole enterprise. On the one hand, the necessary degrees of freedom must be

granted to motivate creative ideas. On the other hand, close holistic collaboration of DIUs and the main organization must be established so that DIUs can pursue their objectives. The need for collaboration is already discussed in prior research, e.g. by Svahn et al. (2017), and not necessarily a new finding, but it seems that DIUs primarily insist on their degrees of freedom and forget about the importance of collaboration. Hence, the right balance between degrees of freedom and collaboration is crucial for DIUs to work.

10.7 Conclusion

We outlined DIUs, identified their multifaceted challenges initially in research, and give a set of actions to tackle them, according to the aphorism 'forewarned is forearmed'. Complying with them can enable a successful setup of DIUs. We provide stimuli especially for digital leaders to benchmark their setting of DIUs and its ability to foster digital endeavors. However, this paper does not come without limitations. Although the results of this paper are based on recent literature and empirical data, we cannot guarantee that we cover all challenges of DIUs. Further research can be built based on our paper. As the dichotomy of DIUs is barely discussed, we recommend extending the study with in-depth case studies to gain a better understanding of DIUs and the trimodal concept. Since we limit ourselves only to DIUs, an analysis of other 'fast lane' units would also be promising. Another avenue for research may be a longitudinal study about DIUs and their transformation within incumbent firms. Although concepts with DIUs have received much criticism, we are optimistic and see them as an enabler to boost digital endeavors.

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11 Towards an Intra- and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units

Raabe, J.-P., Drews, P., Horlach, B., and Schirmer, I. 2021a. "Towards an Intra-and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units," *Hawaii International Conference on System Sciences (HICSS)*, pp. 5902-5911.

Abstract. Incumbent firms increasingly strive to embrace digital innovation, often via implementing dedicated digital innovation units (DIUs). As seizing the rapid and various digital innovation-related market movements may be overwhelming for an individual DIU, collaborations within ecosystems are perceived as crucial for continuously recognizing business opportunities and threats. Although this is a growing field of interest in recent research, insights into the objectives of DIUs and the consequent activities for effectively handling digital innovation are yet scarce. We address this issue by synthesizing 28 cases on DIUs through a qualitative meta-analysis. The analysis revealed that while DIUs enforce an intraorganizational cultural and overarching organizational design change, they also impose an interorganizational perspective with customer-oriented digital expertise and innovation, as well as cultivation of digital innovation ecosystems. Thus, we contribute to the existing DIU research by clarifying these objectives and extending them to achieve a conscious interorganizational perspective with accompanying activities.

Keywords: Digital Innovation, Digital Innovation Ecosystem, Digital Innovation Units.

11.1 Introduction

With the advent of the digital age, in which digital technologies often shift the core of businesses (Bharadwaj et al. 2013; Nissen and Rennenkampff 2017), firms understand the need to drive their own digital transformation (Ross et al. 2019). Digital technologies have very prominent characteristics with important implications for firms' innovation management procedures (Fichman et al. 2014). "Digital innovation has radically changed the nature and structure of new products and services, spawned novel value creation and

value appropriation pathways, enabled innovation collectives that involve dynamic sets of actors with diverse goals and capabilities, […] and, more broadly, transformed entire industries in its wake" (Nambisan 2013, p. 223). In the past, incumbent firms successfully sensed and responded to potential (digital) disruptions by (1) adapting their business models, (2) extending or updating to current digital technologies, or (3) sometimes cooperating with disruptors (Beltagui et al. 2020). However, absorbing or integrating (digital) innovations still seems to be a challenging task for incumbent firms. To tackle these challenges, many incumbents have recently attempted to implement digital innovation units (DIUs). DIUs are described as dedicated organizational units that work with a high degree of freedom across firm boundaries and serve as enablers for embedding digital technologies into incumbent firms (Raabe et al. 2020a). Their intent is to accelerate and trigger digital transformation (Fuchs et al. 2019; Raabe et al. 2020a).

Prior research on DIUs has intraorganizationally focused on their design, distinct types, links to the main organization (Barthel et al. 2020a; Fuchs et al. 2019; Raabe et al. 2020a), and challenges that occur (e.g. due to missing objectives) (Raabe et al. 2020b). Among these missing objectives, interorganizational aspects rarely seem to be addressed in the DIU literature, although the strong need for external collaboration is emphasized in digital innovation research (Svahn et al. 2017). As digital innovation causes a shift, especially in the locus of innovation, toward an intensified open and collaborative setting involving various partners (Nambisan 2013), a digital innovation ecosystem perspective emphasizes a stronger focus on an incumbent firm's partners and its network. This specific ecosystem is defined as "a dynamic collective of interdependent actors and the resources they draw on to innovate with digital technology" (Wang 2019, p. 5).

By undertaking a focused study of DIU settings in practice, we strive to (1) obtain a deeper understanding of their objectives and areas of activity and (2) identify potential connections between DIUs and digital innovation ecosystems. By conducting a qualitative meta-analysis of previously published single and multiple case studies on DIUs, we strive to answer the following research questions:

RQ1: What are the objectives and areas of activity of Digital Innovation Units?
RQ2: How is the interorganizational perspective addressed in Digital Innovation Units?

We answer these research questions by synthesizing five general objectives and seven areas of activity for DIUs. In this regard, we propose an extension of the DIU objectives stated by Fuchs et al. (2019), in which the digital innovation ecosystem perspective is insufficiently

addressed. The analysis of the cases reveals that the digital innovation ecosystem is very often addressed in DIUs. However, the interorganizational perspective is not sufficiently emphasized in DIU research and only superficially mentioned. With this paper, we seek to explore the DIU perspective and propose implications for management.

The remainder of this paper is structured as follows: Section 11.2 provides an overview of related research on DIUs and their connection to digital innovation ecosystems. Section 11.3 describes our research methodology. In Section 11.4, we introduce the synthesized DIU objectives and areas of activity. We discuss the results of our research in Section 11.5. Finally, we conclude with a summary, a discussion of limitations, and outlook in Section 11.6.

11.2 Related Research on DIUs

Innovation and its management in firms are not new phenomena, as they have always been crucial for firms (Chiesa 2000). However, digital innovation differs significantly from prior non-digital innovation (Yoo et al. 2010), which motivates firms to establish DIUs to accelerate their digital innovation endeavors (Raabe et al. 2020b). In information systems research, authors have previously analyzed DIUs within the context of enabling (IT-)ambidexterity (Holotiuk and Beimborn 2019; Jöhnk et al. 2020), loose-tight-coupling (Barthel et al. 2020a) or bimodal IT (Raabe et al. 2020a), and established initial descriptive models about their characteristics and value contributions within firms. DIUs are seen as significant and fast accelerators for digital endeavors (Fuchs et al. 2019; Göbeler et al. 2020; Jöhnk et al. 2020; Raabe et al. 2020a). They are intended to "serve as [an] enabler for the integration of [digital innovation] into the main organization" (Raabe et al. 2020b, p. 4). Fuchs et al. (2019) developed a taxonomy that addresses the objectives of DIUs by differentiating between "digital innovation", "cultural change", and "development of digital expertise". DIUs should foster an innovative culture, strengthen the digital expertise within the main organization, and/or implement digital solutions together with one or more business units (Fuchs et al. 2019). By doing so, DIUs have to ensure that no current digital trends are missed, which could potentially be disruptive to the entire firm and harm day-to-day business. Differences exist between two (Göbeler et al. 2020; Raabe et al. 2020a) or three DIU types (Barthel et al. 2020a; Jöhnk et al. 2020). These types are not mutually exclusive and may coexist within incumbent firms (Jöhnk et al. 2020; Raabe et al. 2020a). Despite strong similarities in their embedding, designs, or practices, differences are associated with the innovation type (process, product/service, business model (Fichman et

al. 2014)), the degree of innovation (incremental, radical, or disruptive focus (Christensen 1997; Dahlin and Behrens 2005)), the digital innovation stages (Fichman et al. 2014) covered, or their market focus. In our prior research on DIUs (Raabe et al. 2020a), we separated DIU modes based on these differences. However, this intraorganizational view misses an interorganizational perspective 'across firm boundaries' and does not really consider ecosystems despite their high relevance in digital innovation research.

The ecosystem concept is of increasing significance within the field of managing technology and innovation (Tsujimoto et al. 2018). This is highlighted by numerous recent calls for papers (e.g. MIS Quarterly 2019, ECIS 2020, ICIS 2020, HICSS 2021) (Guggenberger et al. 2020). This explosion of interest has resulted in a broad range of different (sub-)types and peculiarities of ecosystems causing a plethora of sometimes competing definitions and descriptions (e.g. business, platform, service, software, or innovation ecosystems (Guggenberger et al. 2020)) (Gomes et al. 2018). The concept analyzes organic networks based on both positive and negative aspects (e.g. ecosystem-level competition, predation, or destruction) (Tsujimoto et al. 2018). Their business and non-business actors have different attributes, decision-making principles, or purposes, which can cause unintended results at the ecosystem level (Tsujimoto et al. 2018). In addition to finding decision-making principles and behavioral chains that strongly affect the growth and decline of the ecosystem (Tsujimoto et al. 2018), other main objectives are generally innovation and, more generally, value creation (Guggenberger et al. 2020). We will especially focus on these 'other objectives' and further draw on the innovation ecosystem concept (and especially on its nascent subtype of digital innovation ecosystems), as it "has emerged as a promising approach in the literature on strategy, innovation and entrepreneurship" (Gomes et al. 2018, p. 30).

Digital innovation ecosystems draw on business ecosystems (Moore 1993) and differ in terms of value, as business ecosystems primarily (though not explicitly) relate to value capture, and digital innovation ecosystems relate to value creation (Gomes et al. 2018). Value capture is defined as "the individual firm-level actualized profit-taking; that is, [the path] firms eventually pursue to reach their own competitive advantages and […] reap related profits" (Ritala et al. 2013, p. 248); value creation refers to "the collaborative processes and activities of creating value for customers and other stakeholders" (Ritala et al. 2013, p. 248). Ecosystem leaders create opportunities for other actors and capture value by providing services or goods while contributing to the overall health of an ecosystem (Beltagui et al. 2020). Digital innovation ecosystems emerge through the interplay of

adaptation and exaptation and evolve through various phases (Beltagui et al. 2020; Chae 2019; Kim et al. 2017). "Whereas adaptation refers to features that develop for a specific function, […] exaptation refers to features that are later found to be useful for unintended functions" (Beltagui et al. 2020, p. 4). Digital innovation ecosystems underlie various tensions that need to be addressed and balanced. They need to be simultaneously stable and evolvable (Tilson et al. 2010; Wareham et al. 2014). Stability assures that financial and human resource investments of complementors and customers can yield long term returns (Wareham et al. 2014). Evolvability refers to adequately adjust to changes in customer requirements or market shifts (Wareham et al. 2014). Other paradoxical tensions that characterize ecosystems are (1) standard–variety, (2) control–autonomy, and (3) collective–individual (Wareham et al. 2014). While these tensions are especially crucial for architecting or creating digital innovation ecosystems, Selander et al. (2013) describe the participation within ecosystems and focus on non-focal actors: the ecosystem participants who are at the boundary of ecosystems. They argue that ecosystem participants should not rely on single ecosystems (Selander et al. 2013). Their model of capability search and redeem suggests that "it is imperative that non-focal actors pursue a pluralistic strategy, operating across digital [innovation] ecosystems and avoiding investing all efforts in the same ecosystem" (Selander et al. 2013, p. 194). Eaton et al. (2015) emphasize the complex interplay of (non-)focal actors within ecosystems. They claim that these actors familiarize themselves with the technology and make independent decisions, which in turn may influence others' (Eaton et al. 2015).

Researchers have compared digital innovation ecosystems to other ecosystem types, analyzed designs and domains, introduced strategies for adaptation and exaptation for focal and non-focal actors, or studied their evolution (e.g. Beltagui et al. 2020; Chae 2019; Eaton et al. 2015; Gomes et al. 2018; Kim et al. 2017; Selander et al. 2013; Wang 2019; Wareham et al. 2014). However, a connection to DIUs has rarely been explored thus far. It has only been introduced by Svahn et al. (2017) who studied the establishment of a temporary DIU within Volvo Cars as a first step in developing expertise for cross-fertilization and to increase continuous and incremental product development. This initial step assisted the company in engaging in external collaboration (1) with new partners, (2) to build a dynamic aftermarket while maintaining internal collaboration for competitive advantage, and (3) to identify and access new revenue streams while preserving internal coordination of existing value chains (Svahn et al. 2017). Since this was the only information systems research paper we could find addressing both DIUs and an

interorganizational ecosystem perspective, we consider this a research gap and thus strive to gain further insight through an exploration of DIU cases.

11.3 Research Methodology

We followed Habersang et al.'s (2019) qualitative meta-analysis (meta-synthesis) research design. "A qualitative meta-analysis is a research design for synthesizing primary qualitative data from case studies" (Habersang et al. 2019, p. 22). It allows the refinement, extension, or generation of new theory by identifying recurrent patterns in the re-examined cases (Habersang et al. 2019; Hoon 2013; Rauch et al. 2014). This relatively new design is ideal for addressing this research gap, while answering our research questions and "provid[ing] more robust, generalizable and comprehensive findings" (Habersang et al. 2019, p. 22). "[Q]ualitative case studies provide rich, contextualized empirical descriptions of the dynamics of a single setting across multiple levels of analysis" (Habersang et al. 2019, p. 22). Critics could claim that single case studies only represent one case and thus may not be representative and generalizable (Habersang et al. 2019; Hoon 2013), as they do not offer any generic conclusions for other cases (Dyer and Wilkins 1991; Habersang et al. 2019). Synthesizing multiple cases enables us to analyze a broader range of objectives and areas of activity, which facilitates discovery of new potentials for DIUs. This approach is suitable because qualitative meta-analyses can generate new (inductive) theories that can build links between rich qualitative evidence and deductive mainstream research (Hoon 2013).

Our literature search for single and multiple case studies on DIUs was carried out in two stages. First, we considered six research articles based on our knowledge base, as these authors initially described DIUs as a nascent phenomenon: Barthel et al. (Barthel et al. 2020a), Fuchs et al. (2019), Holotiuk & Beimborn (2019), Jöhnk et al. (2020), Raabe et al. (2020a), and Svahn et al. (2017). Second, we screened for relevant peer-reviewed articles within the AIS eLibrary, ACM Digital Library, and EBSCOhost Business Source Complete on 06-01-2020. Our search query included the following terms: '*digital innovation unit**', '*digital innovation lab**', '*digital unit**, or '*digital transformation unit**'. At least one of the terms needed to be included within the title, abstract or full text. We did not differentiate between research-in-progress and full papers, as long as sufficient data on the DIU cases were described (e.g. Barthel et al. (2020b)). After conducting a backward search, our data pool included 20 articles.

As described by Hoon et al. (2013) and Rauch et al. (2014), we defined criteria for inclusion and exclusion, rigorously ensuring the quality of our final data pool. We selected and included single and multiple case studies based on the following criteria of relevance. First, we only included case studies, which were described in depth (e.g. within the methodology section or within a dedicated section) and followed a systematic approach (e.g. Eisenhardt (1989) or Yin (2014)). Second, the described cases needed to match our general definition of DIUs ('established to accelerate digital transformation'; 'dedicated organizational units that work with a high degree of freedom across firm boundaries and serve as enablers for embedding digital technologies into their incumbent firms'). Third, the cases needed to include information about all the following dimensions: (1) main objectives & areas of activity, (2) innovation orientation, (3) market focus of the innovation, (4) staffing, (5) importance of external partners, and (6) their governance & structures, as described in the taxonomy of digital units by Fuchs et al. (2019). We excluded cases that were solely responsible for providing and maintaining IT services (e.g. Paletti's (2018) case of 'Online at TfL'), as these are common tasks of a regular IT function ('service provider' (Guillemette and Paré 2012)) and thus, do not fit our definition of DIUs.

In total, we included 14 articles with 28 mentioned cases on DIUs and their areas of activity in this study. We also included works by authors (Barthel et al. (2020a), Göbeler et al. (2020), Jöhnk et al. (2020), and Raabe et al. (2020a)) who used their empirical findings to describe good/best practices or types with detailed information about the areas of activity of the DIUs. Thus, the number of good/best practices or types of DIUs described is 10. The cases are located in different countries and represent multiple industries. Therefore, they provide a good overview of established DIUs (Table 11.2 lists all cases, their areas of activity, and categorized objectives). We analyzed and synthesized the areas of activity in three steps. In the first step, we followed the inductive category development approach discussed by Mayring (2014) to identify all described areas of activity within the cases. Inductive or open coding is an interpretive process and helped us to gain new insights "by breaking through standard ways of thinking about or interpreting phenomena reflected in the data" (Corbin and Strauss 1990, p. 12). In the second step, we iteratively clustered and synthesized the areas of activity, until the final set emerged. In the third step, we classified, if possible, the final areas of activity into the objectives described by Fuchs et al. (2019): digital innovation, cultural change, or digital expertise. For our data analysis, we used the MAXQDA software program.

11.4 Results

Based on our data, we were able to identify and synthesize seven final areas of activity. Most of these areas fit well within Fuchs et al.'s (2019) objectives. To address the areas of activity that did not fit within the established objectives, we included two other dimensions: "Organizational Design Change" and "Digital Innovation Ecosystem". We think it is crucial to separate and subdivide the objectives, as these may have different impacts on the main organization.

"Organizational Design Change" dictates that DIUs should initiate and enable the realization of various organizational concepts: contextual (Jöhnk et al. 2020), structural (Göbeler et al. 2020), or temporal ambidexterity (Holotiuk and Beimborn 2019), or a structural IT fast lane for digital endeavors (i.e., bimodal, trimodal, or multimodal IT (Raabe et al. 2020b)). Triggering organizational change requires high levels of responsibility and authority. Thus, this objective has a strategic and major impact on the main organization.

The objective "Digital Innovation Ecosystem" entails strengthening the ecosystem perspective and refers to the exploration of digital technologies and their ecosystems. This includes participation and cooperation within existing ecosystems and may result in creating new ones. This objective assists in protecting day-to-day business and has significant influence on the other objectives Digital Innovation and Digital Expertise, as digital technologies are selected based on the ecosystem and digital expertise needs to be accumulated for successful integration. Table 11.1 lists the areas of activities, their classification within the objectives within the cases. An 'x' indicates the overlying objective, and an '(x)' signals an indirect connection. Table 11.2 lists all DIU cases with their area(s) of activities. The order has no significance. The cases were arranged alphabetically (based on the authors). We included the authors, the cases, their industries, and the types. 'MC' stands for multiple case; 'SC' for single case and refers to whether the types are derived from one or multiple cases. The sum without brackets refers to the cases C1–C28; the sum within brackets stands for the types T1–T10. As almost all DIUs developed digital solutions, we further distinguished their areas of activity by digital innovation stages (inspired by Fichman et al. (2014)). We differentiated between discovery, acceleration, pre-development (prototype status), development (minimum viable product / minimum awesome product status), (internal/external) diffusion, and impact measuring. We referenced the individual cases by their numeration (e.g. C1 refers to Barthel et al.'s (2020b) case). In the following,

we will introduce and describe each area of activity in detail by giving examples from the cases.

Table 11.1: Areas of Activity and Objectives

Source: Own Representation

No.	Areas of Activity	Objectives[1]				
		DI	CC	DE	ODC	DIE
#1	Explore new digital technology trends: evaluate their strategic fit with the business	x				x
#2	Discover, develop, implement, and diffuse digital solutions	x				(x)
#3	Foster a "Digital Culture"		x		(x)	
#4	Develop and leverage digital expertise (and agile methods)		(x)	x	(x)	(x)
#5	Participate and cooperate in existing digital innovation ecosystem(s):	(x)		(x)		x
#6	Build (complimentary) digital innovation ecosystem(s)	x		(x)		x
#7	Enable organizational designs/concepts (suitable for fast innovation integration)		(x)	(x)	x	

[1] DI = Digital Innovation; CC = Cultural Change; DE = Digital Expertise; ODC = Organizational Design Change; DIE = Digital Innovation Ecosystem

Table 11.2: Identified DIU Cases and Their Areas of Activity

Source: Own Representation

Author/s	DIUs & Industry Case ID (C#) / Type ID (T#)	Areas of Activity (see Table 11.1) #1	#2	#3	#4	#5	#6	#7
Barthel et al. (2020b)	**C1**: Chemicals	x	From Discovery to (internal and external) Diffusion	x				
	C2: Tools	x	From Discovery to (internal and external) Diffusion				x	
Chanias (2017)	**C3**: Finance				x	x		x
Dremel et al. (2017)	**C4**: Car		From Development to (internal) Diffusion	x	x			
Fuchs et al. (2019)	**C5**: Steel		From Discovery to (external) Diffusion	x	x			
	C6: Food		From Discovery to Pre-Development	x	x			
	C7: Chemicals		From Discovery to (internal and external) Diffusion		x	x		
	C8: Investment		From Discovery to (internal and external) Diffusion	x	x			
	C9: Tools		From Discovery to (internal and external) Diffusion	x	x			
Gimpel et al. (2018b)	**C10**: Optics		From Discovery to Pre-Development		x			
Holotiuk & Beimborn (2019)	**C11**: Insurance		From Discovery to (internal and external) Diffusion					x
	C12: Transport	x	From Discovery to (internal and external) Diffusion					x
	C13: Banking		From Discovery to (internal and external) Diffusion					x
	C14: Logistics	x	From Discovery to (internal and external) Diffusion					x
	C15: Logistics		From Discovery to (internal and external) Diffusion					x
	C16: Banking		From Discovery to (internal and external) Diffusion	x		x		x
	C17: Apparel		From Discovery to (internal and external) Diffusion					x
	C18: Banking		From Discovery to (internal and external) Diffusion					x
	C19: Insurance		From Discovery to (internal and external) Diffusion	x				x
Holotiuk (2020)	**C20**: Banking	x	From Discovery to (internal) Diffusion	x	x	x	x	
Hund et al. (2019)	**C21**: Logistics		From Acceleration to (internal) Diffusion					
	C22: Credit		From Acceleration to (internal) Diffusion			x		
	C23: Banking		From Acceleration to (internal) Diffusion					
	C24: Banking	x	From Acceleration to (internal) Diffusion			x		
Rahrovani & Pinsonneault (2017)	**C25**: Banking		From Discovery to (external) Diffusion				x	
Svahn et al. (2017)	C26: Car	x			x	x		x
Wulf et al. (2017)	**C27**: Car	x	From Discovery to (internal) Diffusion		x			
Zimmer (& Niemimaa) (2019; 2019; 2020)	**C28**: Car		From Discovery to (internal and external) Diffusion	x	x			x
Barthel et al. (2020a)	MC, **T1**: Internal Facilitator		From Discovery to (internal) Diffusion					
	MC, **T2**: External Enhancer		From Discovery to Pre-Development					
	MC, **T3**: External Creator		From Discovery to (external) Diffusion			x		
Göbeler et al. (2020)	MC, **T4**: Active Engagement	x	From Development to (internal) Diffusion	x	x			
	MC, **T5**: Passive Enablement	x		x	x			x
Jöhnk et al. (2020)	SC, **T6**: Digital Unit		From Discovery to (internal) Diffusion		x			
	SC, **T7**: Incubator		From Discovery to (external) Diffusion			x		
	SC, **T8**: Cultural Change			x	x			
Raabe et al. (2020a)	MC, **T9**: Coaching & Screening	x	From Discovery to Pre-Development	x	x	x		
	MC, **T10**: Center of Excellence		From Discovery to (internal) Diffusion and Impact					
Σ		8 (3)	26 (8)	10 (4)	12 (5)	7 (3)	3 /	12 (1)

11.4.1 Explore new digital trends and evaluate their strategic fit with the incumbent firm #1

We identified 8 cases (3 types) of DIUs exploring new digital trends independently from the main organization. Within this area of activity, the exploration needs to be independent without prior influence from the main organization (C12, C20, C24, and T9). This is to ensure that DIUs are given the maximum degree of freedom to identify current digital trends that could disrupt markets. For example, C2 explores digital trends, evaluates and estimates possible future benefits, costs, and potential for scaling up the digital technology. Type T9 has a strong focus on trend screening, for which a dedicated team is responsible.

11.4.2 Discover, develop, implement, and diffuse digital solutions #2

Not surprisingly, almost all DIUs focus on digital solutions (26 cases, 8 types). As stated above, we made a further distinction by subdividing the areas of activity according to the digital innovation management stages. The discovery stage refers to the identification of (business) problems within the main organization (C14) or to the analysis of customer needs in order to solve their pain points (C1 and C2). This is achieved either actively by generating ideas themselves (C4, T9, and T10) or passively by engaging employees and customers through appropriate techniques, such as idea/innovation pitches and other appropriate formats (C10, C14, C16, C28, and T9). In some cases (C21–24), discovery is not in a DIU's area of activity. These DIUs accelerate existing ideas from the main organization, so that they may eventually mature into an innovation. Pre-development refers to the development of mockups or prototypes without further implementations. For example, DIU C9 hosts rapid-prototyping workshops in order to qualify and enable employees of the main organization to use agile working methods. Development refers to the implementation of a digital solution. The developed solutions vary and DIUs strive to focus on digital business processes (C16, C20, and T1), products and services (C4, C7, C9, C13, C18, C20, C27, T6, and T10), and business models (C1, C7–C9, C25, C28, and T7). Diffusion differs based on whether a DIU focuses on integrating their solutions into their main organization (internal, e.g. C21–24, T1, and T4) or/and diffuses it directly to the market (external, e.g. C5, T3, and T7). DIUs that integrate their solutions into the main organization (internal diffusion) tend to develop digital products, services, or processes. DIUs focusing on external diffusion strive to develop new digital business models for existing or potentially new customers (C25 and C28). The impact stage only received

attention from type T10. It measures and monitors the impact of a digital technology that was implemented and integrated within its main organization.

11.4.3 Foster a "digital culture" #3

We identified 10 DIUs (4 types) that strive to address cultural aspects. This includes enabling organizations to build an open culture of learning-from-failure, encouraging employees to innovate, fostering a digital and agile mindset, and improving communication between employees (C4–C6, C8, C9, C16, C19, C20, T4, T5, and T8). For example, T8 is a dedicated unit that is explicitly focused on cultural change without addressing the development of digital solutions or exploring new digital trends.

11.4.4 Developing and leveraging digital expertise and agile methods #4

We noted 12 DIU cases (5 types) within this area of activity. Developing and leveraging digital expertise and agile methods results in supporting or facilitating work within the main organization by providing digital capabilities, skills, tools, and IT infrastructure (T5). The development of new expertise can refer to new (agile) working methods, but also to technical skills in digital technologies. This involves leveraging core competencies (C1) or providing specific digital skills, for example in big data and predictive analytics (e.g. C4), by hosting workshops, hackathons, and/or open space initiatives (e.g. C10, C28, and T9). This either happens by qualifying current employees or by acquiring new digital talent. "A key measure was to bring experts from different areas of the holding company and the subsidiaries together to elaborate on concepts for an end-to-end digitization of customer journeys" (Chanias 2017, p. 27) (C3). For example, DIU C4 strives to replace external consultancies and plans to improve their own expertise in specific digital trends to become interdependent. T5 aims to empower employees in the main organization to evaluate current trends. Thus, it is strongly connected to exploring new digital trends (#1).

11.4.5 Participate and cooperate in existing digital innovation ecosystem(s) #5

Although it is defined that DIUs work across firm boundaries (Raabe et al. 2020a), only 7 cases and 3 types name explicitly the participation and cooperation in ecosystems as a crucial area of activity. The DIUs addressing this area of activity focus especially on collaboration or networking with (potential) external partners (C3, C16, C24, C26, T3, T7, and T9), acquisition of startups with a digital focus (T7), or investment in digital pioneers (T7). As stated earlier, C26 assists in collaborating with new partners and supports in

building a dynamic aftermarket while maintaining internal collaboration (Svahn et al. 2017). This is strongly connected to building digital expertise, as it assists in the acquisition of digital talent (C3, C28).

11.4.6 Build (complementary) digital innovation ecosystems(s) #6

Building (complementary) digital innovation ecosystems is closely related to the development of digital solutions (#2). However, since external diffusion and impact measuring are hardly addressed, we have defined this area of activity separately to highlight the ecosystem perspective. The number of DIUs that address participation in ecosystems (#5) explains the low number of DIUs covering the creation of new ecosystems. Only 3 cases focus on establishing and building new ecosystems, for example, by establishing new digital platforms to connect with partners and new sets of actors (C2, C20, and C25). For example, C20 strives "to provide a technological [digital innovation ecosystem], which allows [C20] to cooperate with different external partners and […] offer digital services via [a]pplication [p]rogramming [i]nterfaces (APIs)" (Holotiuk 2020, p. 8).

11.4.7 Enable organizational designs #7

In this final area of activity, we identified the enablement of organizational designs or concepts that are suitable for fast digital innovation integration in 12 cases (1 type). Strongly connected to the objective of organizational design change, this area of activity refers to planning and designing organizational concepts, such as ambidexterity or *modal IT structures to ensure fast integration mechanisms for digital technologies. For example, T5 assists as a facilitator to initiate ambidextrous activities within the main organization. Like T5, C28 initiates structural ambidexterity by offering a single point of contact for orchestrating all digital transformation efforts and triggering design changes.

11.5 Discussion

This paper addresses the questions on the objectives and areas of activity and that the interorganizational ecosystem perspective is addressed in DIUs by conducting a meta-analysis of 28 DIU cases and 10 types. The results show that there is a link between DIUs and the digital innovation ecosystems mentioned in the cases, as collaboration with external partners and establishing networks is crucial for DIUs and their incumbent firms, as described by Svahn et al. (2017). Targeting the ecosystem is seen as an important point for DIUs within the cases. However, the importance of external collaboration is ignored in

the DIU literature, as the intraorganizational perspective (especially the integration of digital technologies into incumbent firms) is focal. We therefore expanded the objectives of DIUs initially stated by Fuchs et al. (2019) and introduced organizational design change and digital innovation ecosystem as new additional objectives of DIUs. We have ultimately identified seven areas of activity addressing both intra- and interorganizational perspectives.

Although many cases deal with the discovery stage of digital innovations, we were surprised that discovery did not refer to the identification or compilation of digital innovations on the market but the business problems of the main organization. This also explains the strong funding of business problem-related ideas through specific initiatives and formats. As stated by Göbeler et al. (2020), funding business problem-related ideas primarily assists on the promotion of incremental digital innovations and improves efficiency within the main organization. However, this sole perspective does not coincide with the initial intention of DIUs, as they are designed and established to accelerate especially radical and potentially disruptive digital innovations (Raabe et al. 2020a). Although strong internal collaboration with the main organization is crucial (Raabe et al. 2020b), strong internal collaboration could be a hindrance. A business problem-based approach may force a limited perspective and put digital technologies and their ecosystems in the background. We therefore identified another approach currently pursued by DIUs: digital innovation-driven business change. These approaches are both pursued by DIUs and crucial in order to accelerate digital endeavors. In the following, we describe these two approaches as a "two-fold approach", as it has significant theoretical and managerial implications for DIUs.

11.5.1 A two-fold approach for DIUs

Business problem-based digital innovation selection refers to and is derived from the most commonly identified area of activity in the cases: "Discover, develop, implement, and diffuse digital solutions" (#2). It has been previously described within Barthel et al.'s (2020a) ideal type of internal facilitator (T1) or Raabe et al.'s (2020a) practice of coaching & screening type (T9). First, business problems are compiled. This occurs either actively by analyzing the main organization or passively by initializing open space initiatives or idea acceleration programs. Second, current digital technologies are explored and possible solutions to these problems are developed. Therefore, digital innovation ecosystems are searched for solutions. Business problem-based digital innovation selection may foster

radical innovations, but the close connection to the main organization could harm innovation behavior. Hence, it assists primarily in accelerating incremental innovations.

Digital innovation-driven business change refers to a stronger need for highlighting digital innovation ecosystems, which is often neglected in the literature due to the stronger intraorganizational focus. Without being biased by incumbent firms, current digital technology trends are explored and evaluated as a first step. This ensures that particularly radical and potentially disruptive innovations are explored and evaluated. The size and set of actors are important indicators for evaluating the impact of a digital innovation. Thus, analyzing digital innovation ecosystems is crucial. Specifically targeting emerging ecosystems could attract young digital talent. Evaluating potential threats and risks is also crucial, as this may protect an incumbent firm's business model from being disrupted. In the event that a potentially disruptive digital innovation is detected, a DIU then makes recommendations on whether its incumbent firm has to adapt their business model, extend and update current technologies, or participate in emerging ecosystems and foster growth and internal disruption (Beltagui et al. 2020). In this second step, a DIU requires a high degree of freedom in order to initiate (radical) change. Business change refers to both changing processes within the main organization and adapting business models.

11.5.2 Navigating through ecosystems

The cases revealed that digital innovation ecosystems are considered in DIUs. Thus, navigating through them and collaborating with external partners is key for DIUs. DIUs should not solely focus and participate in one but multiple ecosystems as non-focal actors (Selander et al. 2013). Navigating through ecosystems does not only refer to participation and cooperation; it also includes the creation of new ecosystems as a result of this exploration. In terms of building ecosystems (e.g. as platform creator) DIUs should be aware of the described tensions that characterize ecosystems (Wareham et al. 2014). Figure 11.1 illustrates the two-fold approach. It should motivate both the intra- and interorganizational perspectives, in which the objective digital innovation ecosystem plays a major role. Digital innovation ecosystems affect the other objectives, as the development of digital solutions requires specific digital expertise and depends on the technologies screened, observed, and evaluated. Depending on the influence of a digital innovation, this may result in cultural and organizational design change. The solid and dotted arrows within a DIU from the objectives to the areas of activity represent the allocations from Table 11.1. These objectives do not necessarily have to be covered within one DIU; they can be

structurally separated and managed through multiple concurrent initiatives (Jöhnk et al. 2020).

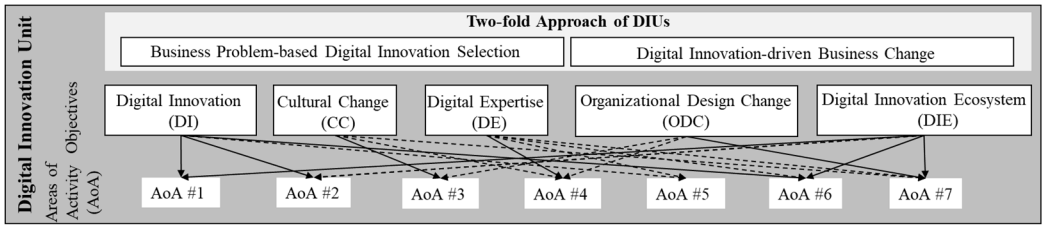

Figure 11.1: The Two-Fold Approach, Objectives, and Areas of Activity of DIUs
Source: Own Representation

11.6 Conclusion and outlook

We extended the objectives of DIUs by considering both the intra- and interorganizational perspectives. We formulated seven areas of activity that are currently pursued within DIUs. Not surprisingly, digital innovation is the most addressed objective. However, we noticed that DIUs pay a lot of attention to current business problems in developing solutions for their main organization to improve efficiency. This approach does not lead to the promotion of radical change, but rather incremental digital innovations, as already described by Göbeler et al. (2020). DIUs are encouraged to (1) analyze emerging ecosystems independently of the business, (2) participate and cooperate in them, or even (3) create new ones. The identified areas of activity highlight their status as a strategic unit to accelerate digital endeavors, protect day-to-day business, and bring significant change within incumbent firms by navigating through ecosystems. This article does not come without limitations. DIUs occur in various forms and have multifaceted names. Thus, other terms might need to be included for DIUs. Our qualitative meta-analysis includes DIU cases and types equally, although these types were derived empirically from other DIUs. Further research can be built on our results. We extended the objectives of DIUs and identified a link to digital innovation ecosystems. An overarching view that takes into account corporate and IT governance remains necessary. Such a perspective would explore methods of positioning DIUs within incumbent firms for effective and efficient digital innovation management. We have raised this issue in our prior articles (Raabe et al. 2020b; Raabe et al. 2020a), but we did not deeply explore this area. An in-depth case study with firms that, for example, have created a digital innovation fast lane with DIUs might be appropriate. A longitudinal analysis of the evolution of DIUs is also currently missing. As there is a lot of "talk" of being digital-first, but perhaps not enough "walk", we find it intriguing to elaborate more on the aspect of instilling especially a digital culture in incumbent firms.

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12 Realizing Organizational Ambidexterity: A Taxonomy of Digital Accelerators and Their Integration Mechanisms for Digital Innovation

Brauer, P., Raabe, J.-P., and Schirmer, I. 2021. "Realizing Organizational Ambidexterity: A Taxonomy of Digital Accelerators and Their Integration Mechanisms for Digital Innovation," *Pacific Asia Conference on Information Systems (PACIS)*.

Abstract. The innovator's dilemma leads organizations to follow exploration and exploitation activities while simultaneously striving for ambidexterity. Whereas structures, modes, or conditions of ambidexterity have received much attention in recent studies, research on how the integration of digital innovation is achieved is still scarce. This capability is often ascribed to digital innovation units (DIUs), which are responsible for the development and integration of digital innovations. Within the scope of our qualitative-empirical study, we discovered how the integration of digital innovation is potentially covered by digital accelerators, an instance of digital innovation units. A categorization of digital accelerators and their integration mechanisms is achieved through a taxonomy. We propose that digital accelerators act as middleware between the frontend and backend of innovation activities. Especially, participation in digital innovation ecosystems and external validation create a meaningful support for realizing organizational ambidexterity with digital accelerators.

Keywords: Digital accelerator, Digital Innovation Unit, Ambidexterity, Integration.

12.1 Introduction

Due to the evolution of information and communication technologies in recent years, organizations adapt not only their technology infrastructure but also their business infrastructure, which causes not only firms to rethink their strategy but also researchers to elaborate on new approaches, such as claims for a digital business strategy to align business and information technology efforts (Bharadwaj et al. 2013). They need to reorganize and adapt their strategies, structures, capabilities, and/or culture (Tushman and O'Reilly 1996). Organizations are responsible for finding a balance between exploration and exploitation

activities, which is called organizational ambidexterity (Park et al. 2020). March (1991) describes these activities in terms of organizational learning. Variation, experimentation, and discovery are associated with exploration, while exploitation is driven by refinement, efficiency, and execution.

In terms of exploration, accelerating (especially digital) business models seems to be a promising and crucial task for incumbents to foster and strengthen their activities in the *fuzzy frontend of innovation*. Problem identification, idea screening, and evaluation processes can be counted among these activities. It also includes such activities as finding possible solutions to specified problems using, for example, idea generation. This phase is highly influenced by market and technical uncertainty (Gassmann and Schweitzer 2014). Activities that follow discovery and are located in the development and commercialization stages within incumbent firms are referred to as the *backend of innovation* (Katz 2012). Topics such as product, logistics, marketing, field support, manufacturing, and customer service may be covered here. Wilson et al. (2013) noted that aligning business and technology is critical to creating value from digital innovations. They show the importance of collaboration and integration of digital innovation and that it depends not only on a great idea but also on its usability for incumbent firms, especially its integration into an existing structure. Connecting the fuzzy frontend of innovation activities with the backend of innovation seems to be a particular hurdle for incumbent firms.

Thus, incumbent firms strive to establish dedicated innovation units that may act as *middleware* to connect both the *fuzzy frontend* and *backend of innovation*. So-called digital innovation units (DIUs) can act detached from existing structures and are embodied in various setups concentrating on digital innovations (Raabe et al. 2020a). They show reduced socio-technological complexity, which helps them in fostering the development and diffusion of digital innovations and gives them the freedom to identify opportunities (Arvidsson and Mønsted 2018). We focus on digital accelerators that are one specific instance of DIUs concentrating on digital business model innovations (Raabe et al. 2020a). Accelerators identify, prioritize, and select external startups or firms to further develop and scale their business ideas (Sindemann and Buttlar 2019). Bergek and Norrman (2008) summarize them as organizations that offer "joint location, services, business support and networks to early stage ventures" (p.20). To date, however, research on digital accelerators and their contribution to incumbent firms in supporting innovation management has been sparse. Following Iho and Missonier's (2020) initial research on different integration mechanisms in (structural) ambidextrous settings, we seek deeper insights, especially for

digital accelerators that tend to realize and enable structural ambidexterity. Therefore, the following research questions (RQ) are proposed:

RQ1: What are the characteristics of digital accelerators?
RQ2: What mechanisms for integrating digital innovations are used by digital accelerators?

The study aims to explore the link ('middleware') between the frontend and the backend of innovation in ambidextrous environments. In the case of structural ambidexterity, such as separate business units for exploration and exploitation activities, it seems challenging to align with organizational goals, as current research on this is still in its infancy. Parts of an organization may need to standardize; others may need to differentiate. Nevertheless, the need for unified efforts remains (Lawrence and Lorsch 1967).

The remainder of the paper is structured as follows. In the Related Research section, we briefly describe digital accelerators as digital innovation units, ambidexterity, and integration mechanisms. Afterwards, we outline our research methodology and present our main results. Finally, we discuss our findings and conclude with future avenues for research.

12.2 Related Research

12.2.1 Digital Accelerators as an Instance of Digital Innovation Units

Incumbent firms strive to establish dedicated innovation units that focus on the fuzzy frontend of innovation. So-called digital innovation units (DIUs) can act detached from existing structures and are embodied in the form of various types (Sindemann and Buttlar 2019). DIUs perform innovation and exploration activities to contribute to an organization's digital transformation as part of the digitalization strategy (Fuchs et al. 2019; Raabe et al. 2020a). To enable autonomous behavior, they profit from access to financial and human resources. The activities are performed in existing business areas or even new ones (Fuchs et al. 2019), while DIUs act as internal facilitators, external enhancers, or external creators (Barthel et al. 2020a). Incumbent firms establish—among other instances—digital accelerator programs to foster collaboration with startups that tend to establish new business model innovations.

Bergek and Norrman (2008) summarize accelerators as organizations that offer "joint location, services, business support and networks to early stage ventures" (p.20). They might appear in the form of business incubation centers, university business incubators,

independent private incubators, and corporate private incubators (Grimaldi and Grandi 2005). Zedtwitz and Grimaldi (2006) refer to regional business incubators, university incubators, independent incubators, and company-internal incubators. Cohen (2013) argues that accelerators and incubators may offer similar services but differ in various ways. According to her, accelerators help ventures build initial products and find a suitable target group while providing financial resources. Cohorts of startups may run through programs of short durations finishing with a graduation event, profiting from working space and networking opportunities (Cohen 2013). Among other characteristics, the duration and cohort are a vital difference between incubators and accelerators. Incubators may run from one to five years with continuous participation, while accelerators take around three months in the form of cohorts (Cohen 2013; Zinke et al. 2018). Velten et al. (2016) agree on the general duration difference but describe six to 24 months in the case of incubators compared with three to six months on the accelerator site. Bogott (2017) mentions human resources and infrastructure as a uniquely incubator offering. Financial support is seen as a characteristic of both accelerators and incubators (Bogott 2017). Accelerators might have a strong focus on customers and investors to link with ventures (Zinke et al. 2018). While Cohen (2013) sheds light on accelerators compared with incubators and business angels, Zinke et al. (2018) bring up technology centers that show the characteristics and elements of incubators.

As shown, there is no standardized categorization of incubators and accelerators in the management literature. Additionally, the different forms lack standards in real environments: "Despite the apparent similarities between different definitions, the incubator concept has shown to be anything but clear in practice" (Bergek and Norrman 2008, p. 20). In our study, we define—quite broadly—and refer to DIUs, which provide the mentioned startup support as accelerators (which include incubators).

Despite the mature state of previous research on their structures, a holistic view of the connection between accelerators and the innovation management of incumbent firms is scarce and seems to be a gap in information systems research.

12.2.2 Organizational Ambidexterity

There are multiple fields worth exploring in the context of organizational ambidexterity. These include organizational learning, technological innovation, organizational adaptation, strategic management, and organizational design (Raisch et al. 2009). Research on organizational ambidexterity has its roots in organizational learning theory. March

(1991) differentiated organizational learning into exploration and exploitation and linked the balancing of those streams to firm survival. While exploitation is linked to production and efficiency, exploration activities are framed by risk-taking, experimentation, and innovation (March 1991). On the one hand, an organization that only follows exploration would not reap the benefits of its expenditures, according to March (1991) On the other hand, organizations with a pure exploitation approach may "find themselves trapped in suboptimal stable equilibria" (March 1991, p. 71). Exploitation can also be associated with an organization's existing capabilities, while exploration is associated with new knowledge and capabilities (Lavie et al. 2010). Tushman and O'Reilly (1996) sum up the dilemma of exploration and exploitation when they state that successful organizations respond to incremental changes caused by technology, competitors, or other significant changes in environmental conditions. These conditions change more frequently, so discontinuous or revolutionary changes are necessary (Tushman and O'Reilly 1996). While organizations need to align strategy, structure, and culture, radical changes in technologies force them to disrupt this alignment again. This emphasizes the need for ambidextrous organizational setups.

Ambidextrous organizations have the "ability to simultaneously pursue both incremental and discontinuous innovation and change results from hosting multiple contradictory structures, processes, and cultures within the same firm" (Tushman and O'Reilly 1996, p. 24). In today's constantly changing market, Dixon et al. (2017) depict dynamic ambidexterity as a dynamic capability that "enables a dual strategy of resource exploration and resource exploitation to be maintained through the ongoing rebalancing of resources and capabilities" (Dixon et al. 2017, p. 12).

While "being ambidextrous is imperative to companies' short-term performance and long-term survival" (Wang and Rafiq 2014, p. 72), there are several approaches to setting up ambidexterity. Common modes are structural, sequential, contextual (O'Reilly and Tushman 2013), and temporal ambidexterity (Holotiuk and Beimborn 2019). An organization can simultaneously pursue exploration and exploitation in separate business units for each paradigm following structural ambidexterity (O'Reilly and Tushman 2013) Different competencies, systems, incentives, processes, and cultures, each internally aligned, are needed for each business unit (O'Reilly and Tushman 2008). If both approaches are pursued simultaneously in one business unit, contextual ambidexterity is realized. Contextual ambidexterity can also be described as "building a business unit context that encourages individuals to make their own judgements as how to best divide their time

between the conflicting demands for alignment and adaptability" (Gibson and Birkinshaw 2004, p. 211). Stadler et al. (2014) mention the approach of individuals switching between contexts as a behavioral solution to the innovation dilemma. A reaction to changing environmental or competition conditions, for example, can also be achieved by sequential ambidexterity, where an organization changes over time between exploration and exploitation but does not pursue both at the same time (O'Reilly and Tushman 2013). A way to make use of temporal ambidexterity is to send employees to digital innovation units, distinct business units for exploration, and back again. Temporal ambidexterity is built "on transferring people between a unit for exploration […] and the units of the remaining organization on a full-time basis for a limited timeframe" (Holotiuk and Beimborn 2019, p. 16). The employees are enabled to work full time collaboratively and cross-functionally on digital innovation while they bring knowledge from the operating business to the explorational work (Holotiuk and Beimborn 2019).

These modes are not mutually exclusive and may exist concurrently. For example, DIUs in general may be considered in hybrid ambidexterity modes, as presented by (Jöhnk et al. 2020). Hybrid ambidexterity is achieved by a simultaneous approach to structural as well as contextual ambidexterity (Jöhnk et al. 2020). According to the authors, it is realized by pursuing multiple simultaneous digital transformation initiatives, such as an accelerator to realize structural ambidexterity. Apart from the organizational setup of ambidexterity, an ambidextrous organizational culture is needed (Wang and Rafiq 2014). In detail, organizational diversity and a shared vision foster contextual ambidexterity and innovation outcomes accompanied by individual involvement from the bottom-up (Wang and Rafiq 2014). Whereas structures, modes, or conditions of ambidexterity have received much attention in recent studies, research on how integration is achieved is still scarce (Stadler et al. 2014).

12.2.3 Integration Mechanisms to Enable Digital Innovation

Integration mechanisms have been discussed in various nuances in the context of ambidextrous organizations, ranging from formal to informal forms to mechanisms especially adopted in the pursuit of digital innovation. Chen and Kannan-Narasimhan (2015) mention four integration archetypes for ambidextrous organizations. The realization of structural ambidexterity confronts organizations with the challenge of aligning their ambitions with the common organizational goal. Alignment can be achieved through integration: "Integration is defined as the process of achieving unity of effort

among the various subsystems in the accomplishment of the organization's task" (Lawrence and Lorsch 1967, p. 4). Iho and Missonier (2020) look at seven integration tools by Castañer and Ketokivi (2019) who aimed to align pooled, sequential, or reciprocal integration of exploitation and exploration units: Authority, formalization, cross-unit structure, collective incentives, communication, multi-skilling, and socialization. Integration mechanisms are needed to align different entities, such as traditional IT departments for exploitation tasks and agile IT departments in charge of exploring new opportunities (Iho and Missonier 2020).

Kauppila (2010) adds an interorganizational approach to the discussion of ambidexterity and elaborates on different mechanisms for switching between exploration and exploitation modes: matrix organizational structure, formal product development process, project management skills, job rotation, physical proximity, and shared customer-oriented culture (Kauppila 2010).

Integration mechanisms are also needed to connect accelerators with their firms. One of the accelerator's tasks is corporate venturing. Corporate venturing, the ability of firms to found new legal entities or business models (Burgers et al. 2009), can also be an approach to radical innovation and is considered an exploration activity. Therefore, if structurally differentiated, it requires integration into the organizational system. Thus, Burgers et al. (2009) suggest formal and informal integration mechanisms. Cross-functional interfaces are a formal integration mechanism, as is a top management team, as a contingency reward. A shared organizational vision and social integration of the top management team are considered informal integration mechanisms (Burgers et al. 2009). Jansen et al. (2009) also emphasize the need to coordinate and integrate ambidextrous approaches. They see contingency rewards for the senior team, social integration of the senior team, cross-functional interfaces, and social relationships or connectedness as integration mechanisms that are closely related to the mechanisms presented by Burgers et al. (2009).

Following Gassmann et al. (2012), radical (digital) innovation as an activity of an exploration unit can be integrated into the operating business and its exploiting behavior through external validating, liaison channeling, showcasing innovation, network building, and integrative innovation planning. These modes and mechanisms for innovation transfer by Gassmann et al. (2012) seem promising to elaborate on how an accelerator may integrate digital innovations into incumbent firms.

12.3 Research Methodology

To identify integration mechanisms, we initially needed a categorization of digital accelerators that were in part strongly differentiated. Hence, we focused on first developing a taxonomy of digital accelerators. This allowed us to characterize digital accelerators based on goals, organizational aspects, and the nature of the collaboration with startups during their participation. As we aim to show how an accelerator might assist in integrating the frontend with the backend of innovation, we examine the underlying material for notes on integration mechanisms. We aimed for a characterization of the collaboration between accelerators and startups, with an additional focus on measures for the growth of digital business model innovation and how growth can be determined.

12.3.1 Data Collection

The taxonomy is based on a qualitative-empirical study. The qualitative data was gathered through semi-structured interviews with experts from the field of accelerators. In this case, the expertise was twofold: (1) We considered CEOs and managers of accelerator programs and (2) startup founders who took part in an accelerator program before. Table 12.1 lists the interviewed experts with information about their position. We clustered the team sizes of the digital accelerators based on the given sizes within the study to put the interviewees' positions into context. The interviewees were recruited via business networks, e-mail, and phone. In total, we conducted 19 semi-structured interviews. The interview execution took place from January to April 2020. The conversations were audio-recorded. They followed a guideline of open questions that contained three main parts: the collaboration goals of accelerators and startups, challenges to address during the participation or resulting from the collaboration, and the growth of digital business models.

Table 12.1: List of Interviewees and Further Characteristics

Source: Own Representation

Interview	Type (accelerator participated in)	Interviewee Position	Team Size* / Startup Industry
A01	Accelerator	CEO	Large
A02	Accelerator	CEO	Medium
A03	Accelerator	Program Manager	Medium
A04	Accelerator	CEO	Medium
A05	Accelerator	CEO	Medium
A06	Accelerator	Program Manager	Small
A07	Accelerator	Project Assistant	Medium
A08	Accelerator	Program Manager	Medium
A09	Accelerator	Community Manager	Small
A10	Accelerator	CEO	Medium
S01	Startup (A02)	Founder	Building management
S02	Startup (A06)	Founder	Spend analytics
S03	Startup (A06)	Founder	E-Commerce
S04	Startup (A01)	Founder	Media (Content platform)
S05	Startup (A06, A03)	Founder	Food industry
S06	Startup (A04)	Founder	Media (Content platform)
S07	Startup (A04)	Founder	Social Media (Publishing)
S08	Startup (A03)	Founder	Sales
S09	Startup (A02)	Founder	Energy

* We considered an accelerator size of up to three employees as small, four to eight as medium, and eight or more as large

12.3.2 Data Analysis

The transcribed interviews were analyzed along with a qualitative content analysis. The data analysis was conducted in a hybrid mode. We coded the material deductively at first, based on categories from literature findings. As parts of the material were still uncovered, we added inductive coding with categories derived directly from the material (Mayring 2015). Table 12.2 shows a coding sample of two deductive codes (lack of financial resources and education) as well as one inductive code (individualization of the offer).

Table 12.2: Coding Examples

Source: Own Representation

Code	Example	Interview
Lack of financial resources (deductive)	"Yes, we wanted to have an MVP, the trainings, and above all just get as much money as possible and develop again."	S02
	"A startup cannot guarantee what a purchasing department has naturally agreed with other suppliers. A startup cannot do that. Sometimes it just takes a long time and of course a corporate often forgets that a startup is bankrupt much faster, so the burn rate is sometimes so small that it is always a challenge."	A02
Education (deductive)	"Everything is currently done in such a way that the teams pick topics from the curriculum at the beginning, workshops and so on, and then I put together the program for each team or for the teams that have made the same selection."	A06
	"[…] then we want to move in another direction soon, a so-called blended learning, which we also create online offers for it if necessary."	A08
Individualization of the offer (inductive)	"Nevertheless, a generic approach that you have to take when you bring together several groups, for example the startups, is not always the best choice and then it makes sense to do individual coaching."	S01

Table 12.3 lists the codes, frequencies, and occurrence of the codes. The codes marked with an asterisk were created inductively. In total, we established 19 codes and 552 coding segments spread over the sum of 19 interviews.

Based on the analysis results of the generated content, a taxonomy was derived following the taxonomy development by Nickerson et al. (2013). At the beginning of the implementation, the meta-characteristic was defined. This is the design of the accelerator offering with respect to the different stages of the innovation process. In contrast to the rule described by Nickerson et al. (2013) that only one characteristic of a dimension can apply to an object, it is assumed here that several characteristics can apply to an item within a dimension. In the first iteration, the conceptual-to-empirical approach is taken. Since the truncation conditions do not yet apply, the objects are examined for further characteristics in a second iteration (empirical-to-conceptual). Further iterations were performed until all objects could be mapped by the taxonomy, leading to the following findings.

Table 12.3: List of Codes Used in Our Qualitative Content Analysis
Source: Own Representation

Codes	Frequency	Interview
Startups take part during early stage	32	A01-A10, S02-S09
Lack of financial resources	8	A01-A02, A10, S02, S04, S07
Lack of experience and knowledge of startups	25	A01, A03-A05, A08-A09, S02, S04-S08
Limited networking of the startups	3	A05, A09, S04
Restrictive general conditions of the startup environment	1	S06
Lack of suitability of and limited access to human resources	10	A01-A02, A04, A06-A07, A10, S01, S04, S09
Design of services: startup requirements	20	A02-A04, A06, A07, A10, S01, S02, S03, S05-S07, S09
Shared office space and services	12	A03, A05-A07, S11-S12, S18-S19
Provision of capital	46	A01, A02, A04-A08, A10, S01-S09
Advisory activities and mentoring	89	A01-A10, S01-S08
Education	35	A02-A03, A06-A09, S01-S06, S08-S09
Network	112	A01-A10, S01-S09
Bureaucratic support	1	S06
Network as a resource	37	A01-A03, A05-A10, S01-S08
Cohort structures and program character	19	A02-A04, A07-A09, S01, S02, S06-S07
Individualization of the offer	19	A02-A04, A06-A08, S01, S02, S04-S07
Characteristics of failure	18	A01-A10, S01, S03, S07
Evaluation of the cooperation	15	A02-A10
Growth criteria	49	A01-A10, S01-S09

12.4 Results

The following taxonomy (Figure 12.1) categorizes digital accelerators along different dimensions in organizational and design directions. It entails the integration mechanisms of digital innovation for ambidextrous organizations. After a description of the various dimensions and characteristics, we offer a look at how often the various characteristics were uncovered.

The taxonomy characterizes digital accelerators along three categories of dimensions, with each dimension containing multiple characteristics. The Goals & Organization category is subdivided by the dimensions "goals", "organizational embedding", and "revenue model". The dimensions "innovation process coverage" and "focus within startups" belong to the Orientation category. The design of the offering is the third category, which includes the dimensions "services", "program duration", "individualization", and "expert involvement".

	Dimensions	Characteristics					
Goals & Organization	Goals	Capital increase through the sale of shares	Technoloy know-how	Innovation impulses for companies	Indirect increase of revenue	Regional development	
	Organizational embeddedness	Independent organization		Business area of an organization		Offering of an association	
	Revenue model	Charged services	Coworking for program external startups	Activities in corporate innovation management	Funded by invested companies	Funded by parent company	Public funding
	Integration mechanism	External validation	Liaison channeling	Showcasing innovation		Ecosystem participation	
Orientation	Innovation process coverage	Development		Launch		Diffusion	
	Focus within start-ups	Industry		Region		Type of business model	
Design of the offering	Services	Shared office space	Consulting	Education	Provisioning contacts	Financial support	
	Program duration	Short-term		Mid-term		Long-term	
	Individuali-zation	Partly individualized with workshop program		Partly individualized with individual consulting		Complete individualization	
	Expert involvement	Internal experts			External experts		

Figure 12.1: Taxonomy of Digital Accelerators

Source: Own Representation

Digital accelerators pursue different goals with their support of startups. One of the most important goals was to increase the capital of the accelerator by selling company shares in startup exits (e.g., A01, A04, and A05): "And that is of course also our goal when we enter into investments at the beginning, that we increase their value as best as possible through our participation and our support and then with the goal of selling them at some point, of course" (A10). Developing the accelerator's region also played an important role (A06, A08,

A10, and A07), for example, creating new jobs. "So we are the initiative promoted by the city, [...] media and digital scene and want to expand the location and of course it is also about [...] promoting new ideas in this area" (A07). Other accelerators strive to create innovation impulses for local companies that are involved in partnerships or network activities (A02, A06, and A08). "So our goals are that […] new companies are founded here, that jobs are created, that investments are made here in the region […] also to enable our cooperation partners to have contact with startups, so that they also have access to innovative solutions" (A06). Startups are also perceived as a source of technology know-how (A05). Accelerators may increase their revenue indirectly by offering additional services after finishing the program (A03).

For the second dimension, our data allowed us to derive three types of organizational settings. Accelerators were either independent organizations (A01, A02, A04, and A05), a separate business area of an organization (A03, A06, A07, A09, and A10), or listed as the offering of an association (A08). The revenue channels of the considered accelerators were diverse. One of the accelerators charged for the services provided to startups (A01), while most of the other accelerators offered services without demanding payment. The accelerators were funded by investing companies (A04), by the parent company (A02) or received public funding (A07, A08, A10); for example, "We are publicly funded; we don't get shares" (A08). Others engaged in corporate innovation management activities (A05, A06, A09) and profit from knowledge increase: "But this is also a vehicle for us, because in addition to incubation, we also do corporate innovation management and other things. This means that we learn a lot about what's going on in the scene, about what's technologically possible, about what innovations are out there. We stay incredibly well up to date with the latest technology" (A05). Additionally, coworking services for program-external startups were mentioned as a source of income (A03, A09).

The focus of the accelerators can be divided into the coverage of the innovation process and the focus of the participating startups. The innovation process displayed here was derived from Vahs and Brem (2015) and Fichman et al. (2014). We could not recognize discovery activities, but accelerators may assist in innovation decisions; this idea should be further elaborated during the development phase. During development, a startup is assisted, for example, in building a prototype. We also considered the launch and diffusion of the innovation as conceivable steps. A closer look at the participating startups offered a further distinction between industry (A08, A09, A10), region (A02), and type of business model (A01). Two of the accelerators focused on marketing and media startups (A04, A07), while

another accelerator supported "startups with e-commerce ideas, in the form of contacts to the corresponding companies, but also contacts to the larger and wider network" (A09).

In the case of services, there are many options accelerators are offering: a shared office space, consulting, education, provisioning contacts, or financial support (A01). This offer may come in exchange for company shares (A04) or even without shares (A02, A03, A06, A07, A08, A09, and A10). The duration of accelerator programs varies. We define programs with a length of three months (A02 and A09), four months (A03 and A07), five months (A06), or six months (A04) as short-term. One program lasts from 12 to 18 months and is considered to be of mid-term duration (A08). Some of the programs are not limited in time; the support of an accelerator was therefore considered long-term (A01, A05, and A10). "We are relatively small, which means that we usually have between six and ten startups running, but then over several years, and the effort involved is of course dramatically different" (A05).

Participating startups may also profit from the individualization of the accelerator offering. Individual support is seen as important (A10). Accelerators offer non-mandatory workshops (A07 and A10), partly mandatory (A04 and A06), or no preset of workshops at all (A05). "[S]ome workshops they are obliged to attend, like the onboarding week, […] the rest is currently the case with us, that the teams choose topics from the curriculum, workshops and so on, and then I put together the program for each team or for the teams that have made the same choice" (A06). Some accelerators let startups choose between workshops (A02 and A07) or even take individual sessions (A03, A06, A08, and A09). Therefore, we decided on the characteristics partly individualized with workshop programs and partly individualized with individuals consulting or complete individualization. "So we are the first point of contact for every topic, if we can help them immediately, we help them either with personal advice or that we either recommend people who can help them […] or finally coaches who can help them in sparring to get a certain issue done" (A08). The accelerators often called in experts for occasions such as workshops (A03 and A06) and consulting (A06) or as mentors (A07). The accelerator staff was completed with internal as well as external experts (A02 and A09). One can consider it a capability of accelerators to match a startup to a suitable expert (A03). "So, the knowledge does not lie with us employees […] but we know who has it in our network and that's where we put them" (A03).

Along with the modes of innovation transfer (Gassmann et al. 2012) and considering the areas of activities by Raabe et al. (2021a), we identified four possible ways in which

accelerators work as integration mechanisms for digital innovation. At first, we discovered that digital accelerators may show external validation. "[W]e always make sure to partners and companies that the startup has a certain maturity and quality […] we could then actually pass them on to the corresponding companies without having a guilty conscience" (A09). They prepare and qualify startups with mentoring and education for cooperation with corporates (A03, A04, and A06). "And with the accelerator and with the startups, that's one side that we play on, we also do something like corporate services and for these corporate services we try to prepare the startups so that it can really work with the corporates. Because the ecosystem here is super young, the teams are super young and very much at the beginning and quickly break down, and you simply have to prepare them for this customer world" (A03). The selection of startups is made by accelerator managers who often have strong experience in working with or within corporates and in the business area (A04, A05, A08, A09, and A10). They act as validators and might improve the acceptance of startups. Another mechanism we discovered is liaison channeling, realized through personal ties to the corporate. Accelerators tend to refer startups to key persons in corporates (A02, A03, and A10). "[…] the startups can't just run towards the controlling department or the purchasing department or the sales department, but of course they have to be introduced" (A02). This is realized, for example, in the form of a buddy system (A02). "[W]e had a buddy system, e.g. every startup had a colleague from the team, one or two actually, who were responsible for the startup, who took over this matchmaking in the group" (A02). In some cases, accelerators offer access to internal conventions or events of corporates, offering startups a chance to showcase their innovation (S01): "We also exhibited at the fair, […] that was really cool" (S01). Other events organized by the accelerators work as a matchmaking platform between corporates and startups (A04 and A09). Additionally, coworking areas act as social platforms (A03) and are also an example of the mechanism of network building. The mechanism integrative innovation planning is realized by pilot projects between corporates and startups (A02, A04, and A06). Pilot projects must be low cost to achieve acceptance of corporate units (A04). "The media companies know, of course, that what they are using is not a finished product, that it is not yet one hundred per cent complete, but that it is on its way to becoming a finished product and they are, so to speak, involved in the development" (A04). The collaboration and networking with external partners as well as investment in digital pioneers is considered an activity of DIUs, according to Raabe et al. (2021a). Therefore, we combine the aspects of network building and integrative innovation planning mentioned by Gassmann et al. (2012) under the characteristic of ecosystem participation. Figure 12.2 depicts the

frequency of characteristics that categorize the different accelerators. Up to three accelerators mentioned the non-highlighted characteristics. The light gray–shaded characteristics were mentioned by four to six accelerators, and the darker gray ones were mentioned by seven to ten accelerators.

	Dimensions	Characteristics					
Goals & Organization	Goals	Capital increase through the sale of shares	Technoloy know-how	Innovation impulses for companies	Indirect increase of revenue	Regional development	
	Organizational embeddedness	Independent organization		Business area of an organization		Offering of an association	
	Revenue model	Charged services	Coworking for program external startups	Activities in corporate innovation management	Funded by invested companies	Funded by parent company	Public funding
	Integration mechanism	External validation	Liaison channeling	Showcasing innovation		Ecosystem participation	
Orientation	Innovation process coverage	Development		Launch		Diffusion	
	Focus within start-ups	Industry		Region		Type of business model	
Design of the offering	Services	Shared office space	Consulting	Education	Provisioning contacts	Financial support	
	Program duration	Short-term		Mid-term		Long-term	
	Individuali-zation	Partly individualized with workshop program		Partly individualized with individual consulting		Complete individualization	
	Expert involvement	Internal experts			External experts		

Figure 12.2: Taxonomy of Digital Accelerators: Frequency of Characteristics

Source: Own Representation

12.5 Discussion and Conclusion

The accelerators followed diverse goals, but innovation impulses for firms and regional development were repeatedly mentioned. This can imply an interorganizational focus crossing the boundaries of accelerators and reaching out to other firms and institutions. Not all accelerators are legal entities; some are business units of an organization. In this case, we did not discover a specific focus as well as in regard to the focus within startups, which could be industry, business model, or region. Regarding the revenue model, specific channels were detected. Some accelerators were cross-financing their startup activities with coworking offerings or activities in corporate innovation management activities (A05 and A06). A link can be drawn from the corporate management activities to the integration mechanism of ecosystem participation. This was, next to external validation, the main mechanism. The concrete realization of those mechanisms in practice is shown in Table 12.4.

The innovation process coverage implies a strong focus on the development phase. This supports our assumption that an accelerator acts as a link ("middleware") between the frontend and backend of innovation activities. Frontend activities, such as problem identification or idea screening (Gassmann and Schweitzer 2014), were not focused by accelerators. They rather built their activities on validating business models and prototypes and testing those artifacts with potential customers. Potential commercialization activities, which are considered to be located in the backend of innovation activities (Katz 2012), were not at the center of the accelerator's attention. Interestingly, the accelerators could not be clearly distinguished by their service offerings. Often, a mixture of consulting, education, provisioning of contacts, and financial support was mentioned. We argue that this emphasizes the enriching work of digital accelerators in enabling startups for the backend of innovation activities and resulting requirements. Most of the accelerators were partly individualized, with additional workshop programs. There is no program solution that meets all the needs of the participating startups. Many digital accelerators were structured in short-term programs and engaged internal and external experts.

Table 12.4: Realization of Integration Mechanisms in Digital Accelerators
Source: Own Representation

Integration Mechanisms	Realization
Ecosystem participation	Managers were approached to co-innovate in a certain business area of a corporate (A01)
	Pilot projects with corporates (A02, A04, A06)
	Coworking area as a platform for the local innovation ecosystem (A03)
	The startups often do not yet have a fully developed business model and can test it with cooperating companies within the framework of the program. (A04)
	Engaging in regional startup hub (A04)
	Arranging contacts in certain industry between corporates, startups, investors (A07, A08, and A10)
	Organized accelerator events, such as matchmaking platforms for corporates and startups to cooperate (A04, A09)
Liaison Channeling	Accelerator managers provide contacts to key partners in the operating groups' business units (A02, A03, and A10)
	Implementing special matchmaking formats, e.g. buddy systems (A02)
Showcasing innovation	Startups are enabled to present their products and services at the group's conventions (A02)
External Validation	Prepare and qualify startups with mentoring and education for cooperation with corporates (A03, A04, and A06)
	Accelerator managers act as validators qualified by their corporate or founding experience, which influences their choice and actions in supporting startups (A04, A05, A08, A09, and A10)

Within the scope of our qualitative empirical study with 10 accelerators and 9 startups, we discovered how an integration of digital innovation is potentially covered by accelerators. In our research, we experienced a strong focus on the development phase of innovation. This is in line with Raabe et al. (2021a). The incidence of exploitation activities in collaboration with accelerators was not uncovered. The interorganizational aspect of digital innovation in combination with accelerators occurred mostly through the integration mechanisms of external validation and ecosystem participation. This was also reflected in the service offering, as startups were provided with contacts along with other services, such as consulting, education, and financial support. We therefore propose that digital accelerators act as middleware between the frontend and backend of innovation activities. Particularly, the participation in digital innovation ecosystems and external validation assist in creating and realizing organizational ambidexterity with digital accelerators.

In accordance with Iho and Missonier (2020), we built on the differentiation and interdependence dilemma of exploration and exploitation to achieve structural ambidexterity and present the realization of structural ambidexterity with a specific unit concentrating on the exploration of digital innovation. We offer the possibility for practitioners to categorize different forms of accelerators in a unified system. Using our taxonomy, practitioners are enabled to put the often-mentioned activities (networking, consulting, education, etc.) into context. Our taxonomy can be used to take the first steps towards an accelerator to be created in the future. It allows a comparison of different design options, for example, different revenue channels or integration mechanisms. Potentially, practitioners can detect a niche in accelerator design and develop their unique selling points and contributions to the ecosystem.

Our research does not come without limitations. For our analysis, we interviewed accelerators that described themselves as accelerators for early-stage startups. The interviewed accelerators do not focus on the internal or external diffusion of innovations but rather increasingly support the development phase of the startups. Thus, the integration or diffusion of digital innovations was not a core task of the analyzed accelerators.

Future research should determine how publicly and privately funded digital accelerators act differently in the innovation ecosystem and how co-innovation is driven. Furthermore, a long-term study of startups participating in the program of a digital accelerator would be interesting. Influencing factors, such as the personality and experience of the startup team,

as well as the industry and the business model applied, result in a high degree of complexity. This complexity, in turn, holds great potential as a starting point for future research.

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13 The Status Quo of Digital Innovation Units: "A Day Late and a Dollar Short"

Holsten, J. M., Raabe, J.-P., Gebken, L., and Schirmer, I. 2021. “The Status Quo of Digital Innovation Units: "A Day Late and a Dollar Short"," *Americas Conference on Information Systems (AMCIS)*.

Abstract. This paper examines digital innovation (DI) types and digital trends that are especially addressed within digital innovation units (DIU). As research on DIUs is still scarce, we collected website data from German DAX30 incumbents to identify dependencies between different DIU setups, DI types and digital trends. Not surprisingly, our results show that DIUs primarily focus on digital products and business models related to AI, IoT/Smart x and Data Analytics. Differentiating between four DIU setups, we could not find particular digital trends being addressed by specific setups. In addition, drawing on the Gartner Hype Cycle (GHC), we show that DIUs mostly pay attention to digital trends in more mature stages. We conclude and recommend the need for DIUs to focus on radical DIs to be as innovative as they should be and to pay attention on digital trends in the earlier stages of the GHC to promote radical DIs.

Keywords. Digital Innovation Units, Digital Innovation Labs, Digital Innovation, Digital Trends.

13.1 Introduction

Expansive progress through digital technologies is creating dynamic conditions in the economy (Raisch et al. 2009). Enterprises are challenged to find novel ways to generate revenue in order to survive in a constantly changing market (Fuchs et al. 2019). Currently, the successful development and integration of digital innovations (DI) is becoming crucial for all economic actors (Barthel et al. 2020a). Identifying DI hypes or trends present a key factor for success in order to sustain or even gain competitive advantage (Raabe et al. 2021a). A trend refers to “a general direction of change […] that is developing and becoming more common” (Merriam-Webster 2021). The nature of products and services as well as their structures have been radically transformed by DIs, a new generation of

innovation processes has emerged, and, more broadly, entire industries have been transformed (Nambisan et al. 2017). On the one hand, enterprises must be able to react quickly to market changes and unpredictable situations through the use of DIs; on the other hand, existing day-to-day business must be improved and potentials exploited to ensure stability (Jöhnk et al. 2020). DIUs, also referred to as digital innovation labs (Holotiuk and Beimborn 2019), digital units (Fuchs et al. 2019), or digital transformation initiatives (Jöhnk et al. 2020) offer a promising way to meet these challenges (Raabe et al. 2020b). These units provide space for creative, interdisciplinary work and collaboration, as well as for cooperation between firms, start-ups, and academia with the goal of successfully dealing with DIs (Velten et al. 2016). They operate autarchic in terms of location, thinking, collaboration or communication (Holotiuk and Beimborn 2019). Different DIU setups with various characteristics are emerging. Although Raabe et al. (2021a) point out different objectives and areas of activity, specific foci on digital trends and their degree of change in organizations remain unclear. This is surprising, as researchers mention a dependency between different DI types and DIU characteristics (Fuchs et al. 2019; Holotiuk and Beimborn 2019; Velten et al. 2016). The uncertainty about the specific foci on digital trends might be one point why DIUs are criticized in practice (Raabe et al. 2020b). Thus, it seems necessary to gain a deeper understanding of DIU setups and their foci, as this has serious managerial and theoretical implications for the establishment of DIUs in incumbent firms. By analyzing the DIUs of DAX30 incumbents, we seek to gain insights into DIUs and their focus on digital trends as well as dependencies between digital trends, DI types, and different DIU setups. Therefore, we aim to answer the following research questions (RQ):

RQ1: Which DI types and digital trends are currently being addressed by DIUs?
RQ2: To what extent do DI types and digital trends relate to DIU setups?

The remainder of the paper is structured as follows. In the Related Research section, we briefly describe DIs and DIUs. We then outline our research methodology and present our main results. Finally, we discuss our findings and conclude with future research opportunities.

13.2 Related Research

For enterprises, ‘digital’ is becoming a key success factor (Nambisan et al. 2017). As DI differs significantly from prior non-digital innovation (Yoo et al. 2010), incumbent firms strive to establish DIUs to accelerate their DI efforts (Raabe et al. 2020b). Before we go into

more detail about the DIU concept, we would like to define our understanding of DI and its different characteristics. DI is defined as "a product, process or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT" (Fichman et al. 2014, p. 330). In addition to Fichman et al. (2014), we also include service innovations as defined by Edwards-Schachter (2018) separating products and services. Figure 13.1 shows the main differences and characteristics of the different DI types product, service, process and business model. Throughout the paper, we will frequently mention the term digital trend, which carries the same meaning as the definition of DI.

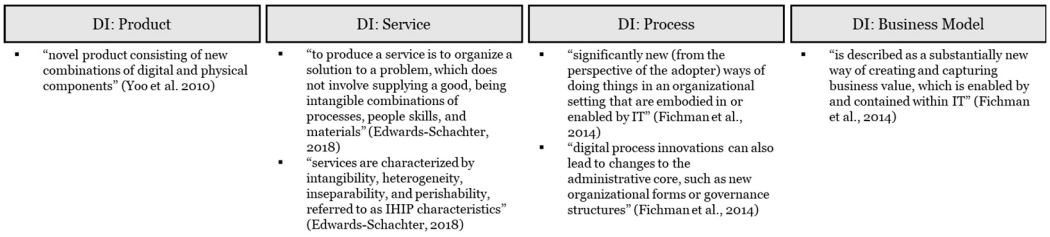

Figure 13.1: Definitions of Different DI Types

Source: Own Representation

Various authors in information systems research have previously analyzed DIUs in the context of enabling (IT) ambidexterity (Holotiuk and Beimborn 2019; Jöhnk et al. 2020), loose-tight coupling (Barthel et al. 2020a), or bimodal IT (Raabe et al. 2020a) and present initial setups, practices, and their value contribution within incumbents. DIUs are intended to "serve as [an] enabler for the integration of DI into the main organization" (Raabe et al. 2020b, p. 4). They foster an innovation-friendly culture, strengthen 'digital expertise' within an incumbent firm and/or implement digital solutions (Fuchs et al. 2019). More recently, authors distinguish DIUs between two (Göbeler et al. 2020; Raabe et al. 2020a) or three setups (Barthel et al. 2020a; Jöhnk et al. 2020). As Jöhnk et al. (2020) and Raabe et al. (2020a) note, these setups are not mutually exclusive and may coexist within incumbent firms as multiple concurrent initiatives. The different DIU setups have strong similarities in terms of their design and embedding but differ in terms of their objectives and foci. These differences may be based on the DI type (process, product, service, business model (Edwards-Schachter 2018; Fichman et al. 2014)), the degree of change (incremental or radical (Christensen 1997; Dahlin and Behrens 2005)), or DI stages covered (discovery, development, internal/external diffusion, impact (Fichman et al. 2014)). Based on prior research, we would like to distinguish DIUs into 'Coaching & Screening' (C&S) (Raabe et al. 2020a), 'Center of Excellence' (CoE) (Raabe et al. 2020a), 'External Creator' (ExC)

(Barthel et al. 2020a), and 'Incubator' (Inc) (Jöhnk et al. 2020) units, as they complement each other based on the differences mentioned above. Figure 13.2 shows their main characteristics.

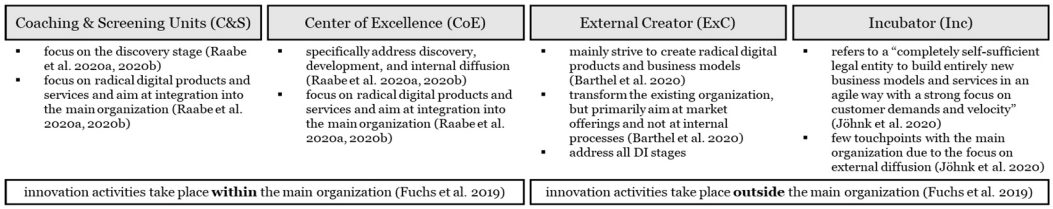

Figure 13.2: DIU Setups and Their Characteristics
Source: Own Representation

Since DI primarily causes a shift in the locus of innovation towards an increased open and collaborative setting involving various partners (Nambisan et al. 2017), a stronger interorganizational perspective is emphasized for DIUs: "[W]hile DIUs enforce an intraorganizational cultural and overarching organizational design change, they also impose an interorganizational perspective with customer-oriented digital expertise and innovation, as well as cultivation of digital innovation ecosystems" (Raabe et al. 2021a, p. 5902). One tool that has been well-established in practice and that may relate to DIUs and their foci is the Gartner Hype Cycle (GHC). "The Hype Cycle is a graphical depiction of a common pattern that arises with each new technology or other innovation" (Fenn and Blosch 2018). As outlined in Dedehayir and Steinert (2016), the hype cycle model is an important tool for understanding and predicting the adoption of technological innovations. Therefore, we understand the GHC as a tool whose pattern is broadly similar to the hype course of some DIs (van Lente et al. 2013), providing us with the current and forecasted maturity state of several DIs. Each year, in addition to the GHC for Emerging Technologies, Gartner publishes various hype cycles that have a more specific focus on certain topics and industries. In the GHC, time is shown on the horizontal axis (see Figure 13.6 and Figure 13.7 within the Results section), as individual trends mature over time and thus progress through the phases of the GHC, whilst the vertical axis is labeled expectation and measures the market's assessment of the future value of trends (Fenn and Blosch 2018). Therefore, the GHC curve shows how expectations rise and fall over time as the trend progresses. A trend goes through five distinct phases: (1) Innovation Trigger, the point at which the innovation reaches the public, (2) Peak of Inflated Expectations, where expectations for the innovation exceed reality, (3) Trough of Disillusionment, the phase in which real-world results replace initial expectations and reveal problems with the innovation, (4) Slope of Enlightenment, in which the technology's adopters overcome the

initial hurdles and begin to derive benefits from the innovation, and finally, (5) Plateau of Productivity, the phase in which the innovation has become established in society and the market and an increasing number of firms are accepting the innovation (Fenn and Blosch 2018). Among other authors, we stated in our prior research the importance of DIUs and their concurrent initiatives, as they support in identifying current digital trends that could potentially disrupt and harm an incumbent firms' day-to-day business (Raabe et al. 2021a). Although the importance of digital trends is stated in general within research papers, we can hardly identify any specific digital trends within these papers. A status quo of digital trends addressed by DIUs is missing in research.

13.3 Research Methodology

Despite a high rate of DIU publications within recent years, research on DIUs is still on a nascent state. Research articles that are published peer-reviewed go through a time-consuming process that reduces the topicality of the data. To answer our research questions, we strive to obtain data with the highest topicality. Besides this, a broad overview of DIUs and their digital trends is important for our research to generate a fruitful database that allows further analysis to be conducted. Therefore, we need an approach that allows us to examine as many DIUs as possible to get a broad overview while maintaining a high degree of data timeliness. Amongst analyzing current research papers on DIUs, their characteristics, and their foci (as described within the related research section), we conducted a qualitative content analysis and used vom Brocke et al.'s framework for analyzing qualitative content that includes peer-reviewed articles as well as content published in press, magazines, blogs and websites of diverse incumbent firms and their DIUs ("white paper"). This includes analyzing published texts, videos, links and back links to other websites on the above-mentioned websites. Since many DIU cases (e.g. Jöhnk et al. 2020; Wulf et al. 2017; Zimmer and Niemimaa 2019) are from German firms, we decided to focus on DAX30 incumbents as our research scope, as they represent the majority of the market capitalization of German listed firms and allow us to analyze DIUs regardless of the industry. We used the Google search engine and extended our search by manually collecting webpage data of DIUs in the DAX30 incumbents by adding the name of the firms to the search query. Our Google search query consisted of a term for DIU or DIU setup (as well as synonyms of the term DIU and the different DIU setups) and the respective name of the DAX30 incumbent. We included the first 40 entries in our data pool; additional entries did not yield meaningful results. Additionally, we ran a search term composed of

'digital innovation*' and the respective DAX30 company name to expand the search to a broader context and possibly identify DIUs that call themselves differently. Therefore, we primarily looked for published data disclosed by the companies themselves. Further, we gathered data from LinkedIn firm profiles. Our initial data pool included 113 potential DIUs. To ensure a high quality of the final data pool, we defined inclusion and exclusion criteria. To include a DIU case, its characteristics had to be consistent with our original definition of each DIU setup (see Figure 13.2). In many cases, several characteristics of different DIU setups could be found in one DIU case. Therefore, the DIU taxonomy of Fuchs et al. (2019) was not applicable. Author 1 assigned the DIU case to the DIU setup that was most outstanding (based on their objectives); Author 2 validated the classification. As shown in Figure 13.2, we classified the DIUs as one of the defined DIU setups Coaching & Screening Unit (C&S), Center of Excellence (CoEs), Incubator (Inc), or External Creator (ExC). We excluded DIU cases that are solely responsible for providing and maintaining IT services (e.g. FleetBoard), as these are common tasks of a regular IT function and thus do not fit our definition of DIUs. In total, we included 78 DIUs in this research. Table 13.1 lists all identified DIUs. 25 of the 78 DAX30 incumbents have at least one DIU. 24 DIUs can be classified as CoEs, 14 DIUs as C&S units, 7 DIUs as ExC and 33 DIUs as Incs. No DIUs could be identified for the firms HeidelbergCement, MTU Aero Engines, RWE and Vonovia.

Following Flick (2018), we conducted an iterative open coding approach, in which we derived codes out of our material inductively. We analyzed and clustered the digital trends in three steps. First, we counted the frequency of all digital trends. In the second step, we examined the digital trends to gain a more detailed understanding. This allowed us to assign the digital trends to each other thematically. As the resulting digital trends differed in granularity, we subordinated specific digital trends to more general categories, e.g. Artificial Intelligence (AI) includes Machine Learning (ML) and Deep Learning (DL). In the third and final step, we assigned rare topics as well as synonyms, abbreviations, and translations to the categorized digital trends. For example, digital trends such as Automotive AI and AI Eye Movement Tracking were categorized as AI. General topics, such as Human Machine Interaction or AgTech, as well as topics without a digital reference from specific industry disciplines (e.g. medical technology with a frequency of one or two) were not considered further. The same applies to trends that we could not define with the help of further web research (e.g. 'Human Augmentivity'). We performed several iterations of the stepwise approach described above to obtain the most feasible assignment of digital

trends to categories and to refine the categorization. Because some digital trends were assigned to multiple categories, the totality of all categories is not free of overlaps. They are not mutually exclusive. We identified 17 main categories that DIUs are engaged with (see Table 13.2). Further, we analyzed the focused DI types within the different DIU setups. Subsequently, we measured the frequency of digital trends addressed within the different DIU setups and classified the digital trends into the GHC phases.

Table 13.1: DAX30 Incumbents and Their DIUs

Source: Own Representation

DAX30	Digital Innovation Units	Setup	DAX30	Digital Innovation Units	Setup
Adidas	Platform A	Inc	DHL Consulting	DigitaLab	CoE
Allianz	Global Digital Factory	CoE	Deutsche Telekom	T-Labs (Telekom Innovation Laboratories)	CoE
	AllianzX	Inc		Deutsche Telekom Digital Co-Innovation Lab	CoE
	AsiaLab	Inc		hub:raum	Inc
	Allianz Digital Accelerator	C&S		ChallengeUp!	Inc
	Allianz Automotive Innovation Center	CoE		UQBATE	ExC
	Travel Innovation Center	CoE		T-Systems Innovation Center	CoE
	Health Innovation Center	CoE		Deutsche Telekom Capital Partners	Inc
	Assistance & Open Innovation Center	CoE	E.ON	:agile	Inc
	Accelerator Allianz	Inc		Scouting and Strategic Co-Investments	Inc
BASF	Creator Space	C&S		#futurelab	ExC
BASF New Business GmbH	Chemovator GmbH	ExC	Fresenius (Fresenius Medical Care)	Venture Fonds	Inc
	Foresight & Scouting	C&S			
	Business Build-Up	CoE	HeidelbergCement	-	
	BASF Venture Capital GmbH	Inc	Henkel vz.	Henkel X	C&S
Bayer	Bayer CoLaborator	Inc	Infineon	Inno.Wafer	Inc
	Netzwerk: LifeHub (G4A Partnerships)	Inc	Linde	Linde Digital Base Camp	CoE
Beiersdorf	NIVEA Accelerator „NX“	Inc		Asia Pacific Digitalisation Hub	C&S
BMW	BMW Startup Garage	Inc	Lufthansa	Lufthansa Innovation Hub	C&S
	BMW Innovation Lab	Inc		Logistics Tech Accelerator	Inc
	rad°hub	C&S		Aviation Blockchain Challenge	C&S
	BMW i Ventures	Inc	Merck	Silicon Valley Innovation Hub	C&S
Continental	co-pace	ExC		China Innovation Hub	CoE
Convestro	Open Innovation Hub (Asia-Pacific Innovation Center)	CoE		Innovation Center	CoE
	Startup Challenge	C&S		Merck Accelerator	Inc
	Covestro Venture Capital	Inc		M Ventures	Inc
Daimler	Lab 1886	CoE		PMatX Incubator	Inc
	M&A Tech Invest	Inc	MTU Aero Engines	-	
	Startup Intelligence Center	Inc	Münchener Rückversicherungs-Gesellschaft	Munich Re – THE LAB	CoE
	JOINT THINK! TANK	CoE	RWE	-	
	DigitalLife@Daimler	CoE	SAP	SAP Labs	CoE
	Startup Autobahn	Inc		SAP Innovation Center Network	CoE
Deutsche Bank	Deutsche Bank Innovation Labs	C&S		Startup.focus	Inc
	Fintech Europe	Inc		SAP.iO Accelerator	Inc
	Blue Water Fintech Space	C&S		SAP.iO Fund	Inc
Deutsche Börse	DB1 Ventures	Inc		DATA SPACE (IoT Startup Accelerator: Data Hub)	Inc
Deutsche Post	DHL Innovation Center	C&S	Siemens	ITS Digital Lab	CoE
	DHL Start-Up Lab	ExC		Siemens Technology Accelerator	ExC
Volkswagen	Ideation:Hub	Inc		Next 47	ExC
	DATA:LAB	CoE		Smart City Digital Hub	CoE
Vonovia	-			Siemens AI Lab	CoE
Wirecard	Wirecard Innovation Lab	C&S			

Table 13.2: Categories and Digital Trends

Source: Own Representation

Category	Digital Trends
AI	Personal AI, AI Eye Movement Tracking, Automotive AI, AI-powered Business Applications, AI Building Management, Emotional Intelligence, AI in Controlling
ML	
DeL (Deep Learning)	
VR	5G Cloud based AR/VR, Virtual Mobility
AR / MR	AR on Remote Environment, (Mobile) AR
Data Analytics	Automotive Mobility Data Analytics, Data Analytics in Healthcare, Data Analytics for Operations Optimization, Predictive Analytics, Data Management, Data Analytics, Personalized Analytics, Advanced Analytics, Data Intelligence, High-Performance Data Compression/Analytics
Big Data	Big Data Analytics
Smart Data	Smart Data Analytics, Smart Data Economy
Blockchain	Distributed Ledger, Blockchain for Supply Chain
Cryptocurrency	Cryptocurrency Applications for SCM
Smart Contracts	
IoT	IoT Platform, Narrowband-IoT, IoT&Wearables, IoT (Wearables), Digital Twin
Smart x	Smart Home, Smart City, Smart Materials, Smart Logistics, Autonomous Smart Cells, Smart Energy, Smart Devices, Smart Factory, Smart Transport, Smart Metering, Smart Building, Smart Textiles
Mobility	Global Mobility, Connected Mobility, E-Mobility, Digital Car, Automotive Mobility Data Insights, Individual Premium Mobility, Autonomous Multi-Modal Mobility, Mobility Diversity, Virtual Mobility, Future Mobility, Mobility Services, Mobility & Sustainability, Shared Mobility, Smart Mobility, Clean Transportation, Connected Cars, Electric Drive, Automotive Cloud, Hyperloops
Autonomous	Autonomous Vehicles, Autonomous Smart Cells, Autonomous Multi-Modal Mobility, Autonomous Driving, Autonomous Flying
Drones	Drone Detection
Mobile x	Mobile Technology, Mobile Payment, Mobile Health Payment, Mobile Identity/Access, LTE-M, eSim, Mobile AR
5G	5G Cloud based AR/VR
Process Automation	RPA, Robotic Process Automation, Automation Technologies
Robotics	Autonomous Robots, Robotic Solutions
Bots	Chatbot, Chat-/Voicebots, Virtual Assistent
3D-Technology	Time-of-Flight 3D Camera, 3D Multiple Object Tracking, 3D
3D-Printing	(Industrial) Additive Manufacturing
Voice Recognition	NLP, Natural Language Processing, Voice Transcription, Automatic Speech Recognition
Cybersecurity	Data Security, Industrial Security, Security, Information Security
Health x	Connected Health, Digital Care Delivery (Telehealth), Consumer Health, Global Health, Mobile Health Payment, eHealth Solutions, Medical Devices, Data Analytics in Healthcare, Healthcare, AI enabled Health Solutions, Telemedicine, Health Monitoring, Patient Monitoring, Liquid Biopsy Technologies, Medical Image Analysis, Multi-Proteomic Biomarkers, Digital Biomarkers
Sensing	Biosensing, Sensor Technology, Biosensing Modalities, Sense-and-Respond Cycles, Bio Sensors
Quantum Computing	Neuromorphic Computing
Connected x	Connected Mobility, Connected Property, Connected Health, Connected Cars, Connected Live, Connected Work, Connected World, Connected Labs, Connected Products, Connected City, Connected, Connectivity
Industry 4.0	Predictive Maintenance, Digital Twin, Smart Factory
Cloud	Automotive Cloud, Cloud Engineering, Cloud Computing, 5G Cloud based AR/VR, Hybrid-/Multicloud, Cloud & Network Infrastructure

13.4 Results

13.4.1 Focused DI Types within the Different DIU Setups

We distinguished DI types between digital product, service, process and business model innovations as shown in Figure 13.1 (Edwards-Schachter 2018; Fichman et al. 2014). Figure 13.3 shows the frequency distributions of the different DI types within each DIU setup. As mentioned by Raabe et al. (2020a), this analysis confirms that CoEs focus on product and service innovations. This may also apply to C&S units, although no clear demarcations are apparent. In addition, we also identified process innovations, which are more often treated as business model innovations in both DIU setups. Incs and ExCs mostly focus on product and business model innovations while no service innovations could be found in ExCs. Internal employees (involved in the process) play an important role in the implementation of process innovations in incumbents. Process innovations are more likely to be found in CoE and C&S units than in incubators and external creators, which have strong ties to external start-ups, rather than involving internal employees with key knowledge in the existing business processes (Holotiuk and Beimborn 2019; Hund et al. 2019; Raabe et al. 2020a; Velten et al. 2016). This could explain a clustering of process innovations in DIUs with CoE and C&S characteristics.

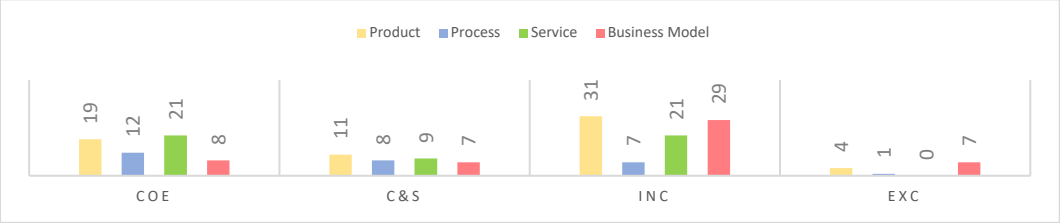

Figure 13.3: Frequency Distribution of the DI Types per DIU Setup
Source: Own Representation

13.4.2 Digital Trends Addressed by the Different DIU Setups

Based on our digital trend listing (see Table 13.2) and the categorization described above, two frequency distributions can be derived. Figure 13.4 and Figure 13.5 show that the digital trend categories AI, IoT/Smart x and Data Analytics are most frequently addressed in the DAX30 DIUs. They are followed by the digital trend categories Mobility, Blockchain, Automation, Virtual Reality/Augmented Reality/Mixed Reality (VR/AR/MR) and Cybersecurity. Less frequently identified were the digital trend categories Health x, Mobile x, Connected x, Industry 4.0, Cloud, 3D Technology, Sensing, Voice Recognition and Quantum Computing. According to both figures, no statement can be made that specific

DIU setups cover specific digital trends. Therefore, we did not find any dependencies between the respective DIU setups and the digital trends.

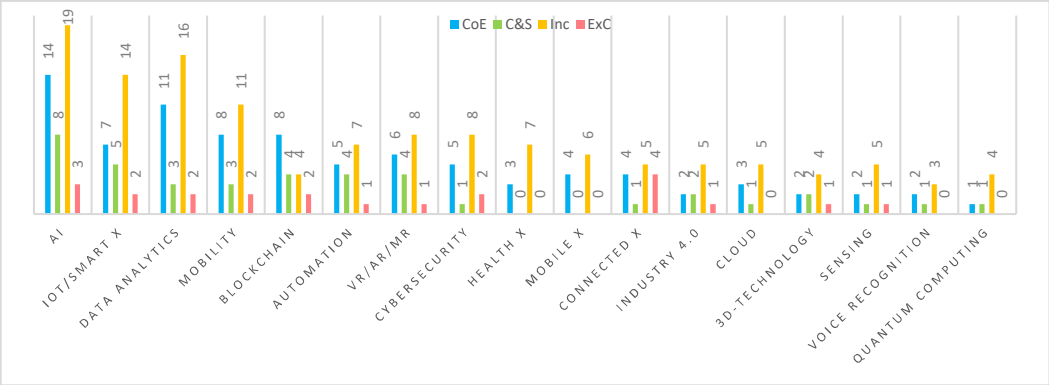

Figure 13.4: Frequency Distribution of Digital Trends in DIU Setups
Source: Own Representation

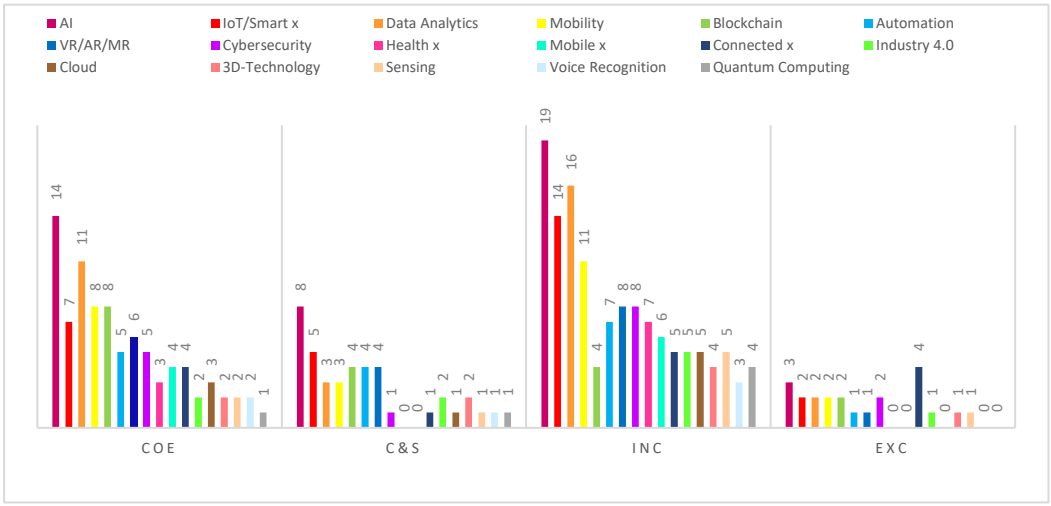

Figure 13.5: Frequency Distribution of Digital Trend Categories per DIU Setup
Source: Own Representation

13.4.3 Digital Trends within the Gartner Hype Cycle

Aiming to support DIUs at identifying potential digital trends, we categorized digital trends into five different phases of the GHC to determine the maturity of digital trends. Due to the high occurrences of the digital trend AI, we included the *Gartner Hype Cycle for Artificial Intelligence 2019* in addition to the *Gartner Hype Cycle for Emerging Technologies 2019*. In the GHC for Artificial Intelligence 2019 (see Figure 13.6), four digital trends can be identified in the Peak of Inflated Expectations (Quantum Computing, Chatbots, Deep Learning and Machine Learning), five digital trends in the Trough of Disillusionment (NLP, RPA, Virtual Assistants, Computer Vision and Autonomous Vehicles) and one digital trend (Speech Recognition) in the Plateau of Productivity. The first important consideration is that none of the classified digital trends are in the first

phase. Second, eight out of ten classified digital trends are behind the peak of the graph and thus on the way or already in the Trough of Disillusionment. Consequently, especially digital trends that have already largely passed through the first two phases and have thus reached a certain degree of maturity in innovation research appear to be of particular interest for consideration in DIUs. Eight digital trends were placed in the GHC for Emerging Technologies 2019, distributed across the first three phases (see Figure 13.7). The digital trends in the Innovation Trigger phase occur a maximum of twice in the DAX30 DIUs, while the digital trends in the Peak of Inflated Expectations and Trough of Disillusionment occur more frequently, with up to six events. It should be noted that Gartner recorded no trends in the last two phases and only three in the Trough of Disillusionment. The assignment of the various DIU setups to the digital trends and thus to the five different phases of the two GHCs (see Figure 13.6 and Figure 13.7) does not allow any significant conclusions to be drawn. Accordingly, it is not possibly to say whether certain DIU setups are focused on particular phases of the GHC and thus particular maturity levels of the digital trends. In summary, we identified in the GHC for Artificial Intelligence 2019 mostly digital trends which are behind the peak of the curve (in the Peak of Inflated Expectation or already in the Trough of Disillusionment). These digital trends may appear more interesting for consideration in DIUs of large firms. This observation cannot be directly confirmed on the GHC for Emerging Technologies 2019, which may be due to the use of different terminology and Gartner's focus on the first two phases.

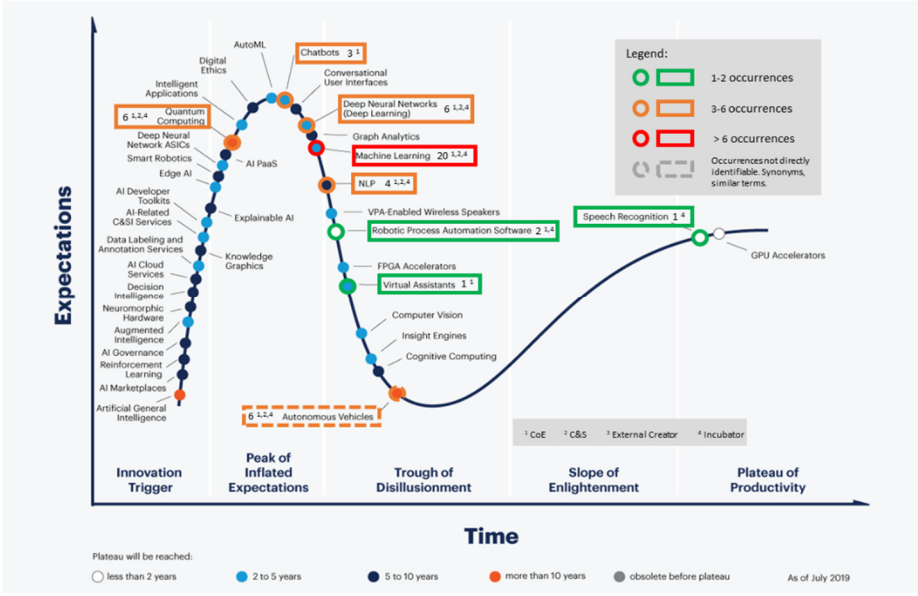

Figure 13.6: Digital Trends within the GHC for AI

Source: Own Representation (Based on Goasduff 2019)

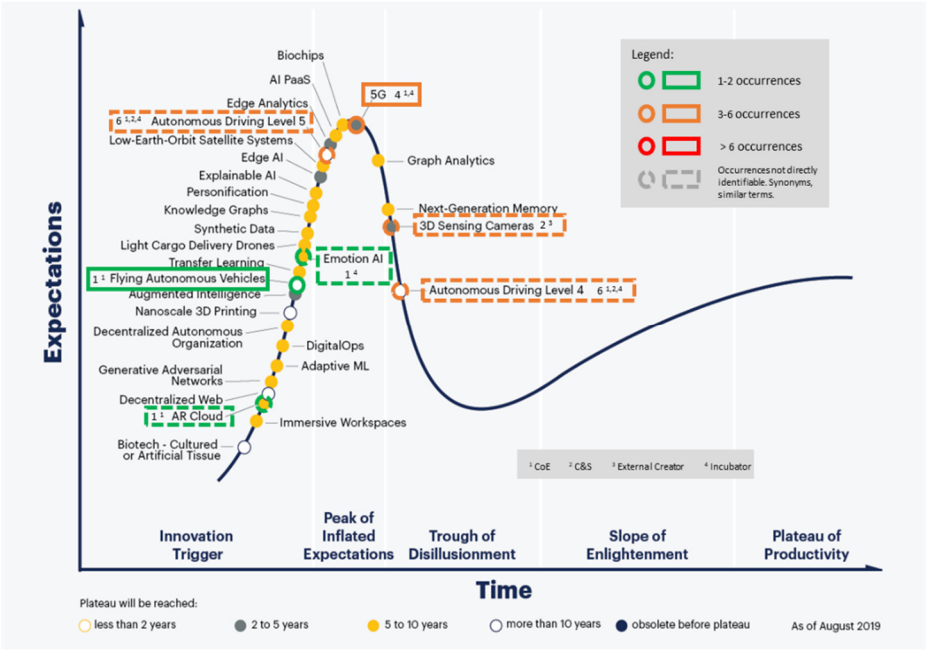

Figure 13.7: Digital Trends within the GHC for Emerging Technologies

Source: Own Representation (Based on Panetta 2019)

13.5 Discussion & Conclusion

In this paper, we address the questions of which DI types and digital trends are currently being addressed by DIUs (RQ1) and to what extent these are related to different DIU setups (RQ2). Referring to our headline, we show the status quo of DI types and digital trends among DIUs. Our results indicate a strong focus on AI, IoT/Smart x and Data Analytics and that the DIU setup (in our case C&S, CoE, ExC and Inc) is not relevant with respect to

the digital trends addressed. Incumbents from different industries establish DIUs of different setups. Thus, the industry does not seem to be relevant for the establishment of DIUs. As we have identified digital trends especially within the GHC for AI, it might be the case that DIUs focus primarily on (big) data-driven topics. Furthermore, our results show that DIUs notably target digital trends in more mature stages of the GHC. This is surprising since we assumed that especially C&S units identify and analyze digital trends within early phases. Although no clear statement can be made about how radical a DI is in more mature stages, one could assume –due to the elapsed time– that DIUs contribute more to incremental DI improvements rather than to radical DI changes (Fuchs et al. 2019; Göbeler et al. 2020; Jöhnk et al. 2020; Raabe et al. 2020a). Thus, we emphasize a stronger focus on emergent digital trends in earlier stages of the GHC to achieve the impact for which DIUs were originally intended. This can also be explained by the challenges faced by DIUs as described above. As Raabe et al. (2020b) list multifaceted challenges across various DI stages, DIUs need a strong raison d'être with significant impact for the main organization. The impact and value creation of DIUs for the main organization may be lacking, as DIUs tend to engage with digital technologies at mature stages ("a day late and a dollar short"). The narrow margin between incremental and radical DIs in DIUs may have too little impact, which may not be sufficiently appreciated by top management. As a result, confidence and belief in DIUs as a significant accelerator for digital endeavors declines. We emphasize the need for DIUs to focus on radical DIs to differentiate and demarcate themselves from the main organization. Therefore, Figure 13.8 depicts factors, which may assist DIUs in order to add significant value and becoming a key function in fostering an incumbent firm's DI capacity. Among the industry of the main organization and the DI type, the years of operation (experience), the importance of internal ties to the main organization as well as the importance of external partners might influence a DIU and its areas of activity (Raabe et al. 2021a). These moderating factors depict an initial state and should be considered when establishing a DIU. They may influence an organizational design of a DIU. However, these factors are not complete and require further adaptation. Our results show a snapshot of digital trends and DIUs in the DAX30 firms. In fact, the GHC is primarily a consulting instrument and thus, we contribute especially for practitioners.

Towards an approach of showing initial moderating factors, we also contribute to research and strive to motivate other information systems researchers to uncover further design knowledge about DIUs and their interconnection with its incumbent firm.

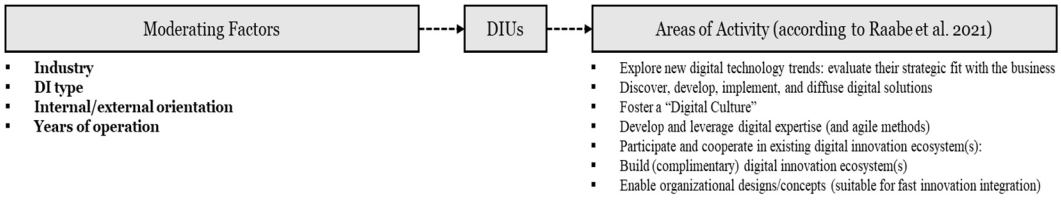

Figure 13.8: A DIU's Moderating Factors and Areas of Activity
Source: Own Representation

This paper is not without limitations. The DAX30 firms, which are listed in the share index based on their turnover figures and size, were used as the data basis for our analysis. As a result, small and medium-sized enterprises (SMEs) were not included in the analysis. Although the DAX30 incumbents operate in various industries, the data may be biased, since there are three car manufacturers among the DAX30 incumbents (BMW, Daimler, Volkswagen), whose DIUs account for 15% of all identified ones. Similar observations can be made for the Health x trend. Four incumbents either having their main business in the health care sector or a direct business link to it (including Allianz, Bayer, Fresenius and Merck) account for a total of 23% of all identified DIUs. Furthermore, we used data from websites, so that the accuracy and completeness of the information on the websites cannot be guaranteed. Although the websites were fully analyzed, it is possible that not all digital trends covered by the DIUs could be identified. This may be due to the DIUs not naming all digital trends on their websites for confidentiality reasons. In addition, varying granularity of the specified digital trends was found, which may be due to an inaccurate specification of digital trends. Among digital trends, we identified other non-digital trends that could support our hypothesis that trends are often addressed in more mature stages of the GHC. It must be noted that CoEs and C&S units often reveal less information about the focused DI types and digital trends than DIUs with externally oriented characteristics (ExCs and Incs). Since we have not validated our results, we recommend evaluating our findings. As indicated in the title, we have analyzed the status quo of DIUs. Our results provide a foundation for future research streams as well as an orientation for decision-making regarding alignment with emerging trends for DIUs and incumbent firms in practice. Therefore, we would like to motivate these connections to DIUs in future research: We are missing a 'big picture' regarding corporate and IT governance. We raised the issue in our prior articles (Raabe et al. 2020a; Raabe et al. 2021a), but we did not delve deeply into it. Among an in-depth case study with firms that realized e.g., a digital innovation fast lane with DIUs for managing innovations, a longitudinal analysis of DIUs seems promising. As incumbent firms tend to formulate and achieve a digital business strategy (Bharadwaj et al.

2013), incumbent firms, their IT function and DIUs are currently experiencing a multitude of changes. Thus, it seems promising to focus on collaboration by analyzing the integration of a DI within a single case study. There seems to be a lot of attention paid to incubators or accelerators, since we identified 33 out of 78 DIUs as Incs, and there might be a stronger motivation for incumbent firms to invest in business model innovations that are separated from day-to-day business. Thus, we emphasize an in-depth analysis of current incubators or accelerators. Since data-driven topics are especially addressed within DIUs, future research may analyze DIU setups with established business intelligence units in incumbent firms. As there is a lot of change going on, there might be different mechanisms for integration needed (e.g., a dynamic capability perspective) to successfully absorb and integrate DIs into organizations.

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14 Towards a Foundational and Extensional Dynamic Capability Perspective on Digital Innovation Units

Hellmich, J., Raabe, J.-P., Gebken, L., and Schirmer, I. 2021. "Towards a Foundational and Extensional Dynamic Capability Perspective on Digital Innovation Units", *Americas Conference on Information Systems (AMCIS).*

Abstract. Digital innovations are fundamentally transforming incumbent firms. Accordingly, many firms established dedicated agile units that focus on digital innovation: digital innovation units (DIUs). DIUs assist incumbents –in addition to other tasks– in identifying digital trends that could harm day-to-day business. Despite recent publications about objectives or structures of DIUs, little attention is given to their dynamic capabilities (DynCaps). Based on a structured literature review on DynCaps, digital innovation, and agility in organizations, our illustration of the Dynamic Capability Jungle provides a structured overview of DynCaps and their interrelationships as well as assists in classifying the plethora of different definitions. We identified foundational and extensional DynCaps needed in or realized within different setups of DIUs. We contribute to research by connecting DynCap research to the nascent DIU research stream. Our Dynamic Capability Jungle may assist in overcoming and tackling multifaceted and sometimes competing concerns while establishing DIUs.

Keywords: Dynamic Capabilities, Digital Innovation, Digital Innovation Unit, Dynamic Capability Jungle.

14.1 Introduction

Today's business environments are characterized by high uncertainty (Teece et al. 2016) and global competition (Sambamurthy et al. 2003b). Especially the diffusion of digital infrastructures and digital technologies has caused fundamental changes (Fichman et al. 2014). As a result, many firms "operate in a world that is increasingly permeated with digital technology" (Yoo et al. 2012, p. 1398). The usage of digital technologies for innovation purposes has led to digital innovation which is a new class of innovation (Fichman et al. 2014; Nambisan et al. 2017; Yoo et al. 2010; Yoo et al. 2012) and encompasses both "the use of digital technology during the process of innovating" (Nambisan et al. 2017, p. 223) as

well as the result of such a process (Nambisan et al. 2017). Closely linked is the concept of agility as it is crucial for preparing for digital innovation (Goncalves et al. 2019). Moreover, firms need agility in uncertain environments in order to perceive, understand, and respond quickly to changes (Chan et al. 2019). To manifest agility and digital innovation throughout the organization, a separate digital innovation unit (DIU) is often established in which employees work together in an interdisciplinary manner and according to agile principles (Fuchs et al. 2019; Holotiuk 2020; Hund et al. 2019; Raabe et al. 2020a). DIUs face a multitude of challenges in supporting digital innovations, as new capabilities need to be developed without endangering existing product innovation practices or new skills and relationships have to be built within organizations while external cooperation is also relevant (Svahn et al. 2017). This leads to the concept of dynamic capabilities (DynCaps), which are considered to be necessary for firm success and for the creation of competitive advantages (Teece et al. 1997; Teece 2007; Teece et al. 2016). They are strongly intertwined with agility and innovation, e.g. they can be used in order to build agility, and are relevant for the ability of a firm to create innovations (Overby et al. 2006; Sambamurthy et al. 2003b; Teece 2007, 2014; Teece et al. 2016). Although the goals and types of DIUs are already discussed in research, little or no attention has been paid to a DynCap perspective. More broadly, while research has studied the development of DynCaps for digital transformation and DynCaps have been applied to innovation and digital strategy contexts (Lawson and Samson 2001; Rothaermel and Hess 2007; Schilke et al. 2018; Warner and Wäger 2019; Yeow et al. 2018), there is no overview of DynCaps that are relevant for agility and digital innovation. The above-mentioned relationship between DynCaps and the concepts of agility and digital innovation as well as the crucial role of these two concepts in contemporary businesses (Fichman et al. 2014; Sambamurthy et al. 2003b) indicate the relevance of such an overview. Consequently, we aim to close this research gap by attempting to answer the following two research questions (RQs):

RQ1: Which dynamic capabilities are relevant in relation to agility and digital innovation?

RQ2: How are the identified dynamic capabilities related to each other and connected with the stages of digital innovation and setups of digital innovation units?

Since we assume that DynCap research is already in a mature state with a large number of high-quality research articles, we conducted a structured literature review (1) to understand relevant DynCaps in relation to agility and digital innovation as well as (2) to link DynCap research with the nascent DIU research stream. The remainder of this paper is structured

as follows: The next section provides an overview of related research on digital innovation, agility, DIUs, and DynCaps. Subsequently, we describe our research methodology. After we introduce the synthesized DynCaps and their relevance within DIUs, we discuss our results. We conclude with limitations and an outlook for future research.

14.2 Related Research

14.2.1 Digital Innovation, Agility, and Digital Innovation Units

The number of possibilities that can be developed with the help of IT has increased dramatically (Fichman et al. 2014). In recent years, digital innovation has been defined quite broadly from the perspective of different types (product, process, business model) (Fichman et al. 2014), the impact and change on the market (Nambisan et al. 2017), and/or the opportunities of combining digital and physical components (Yoo et al. 2010). Fichman et al. (2014) introduce four stages of the general innovation process: discovery, development, (internal/external) diffusion, and impact. Since digital innovation differs significantly from prior non-digital innovation due to unique characteristics of digital technology, e. g. digitalization or network effects (Fichman et al. 2014), it represents a key factor for success and causes a radical shift in business models, organizational designs, and structures, which poses new challenges for firms (Arikan and Borgman 2020; Bharadwaj et al. 2013; Nambisan 2013; Nambisan et al. 2017; Yoo et al. 2010). The current inflexible structures and processes in firms pose a threat to possible disruption, as customer needs may not be addressed sufficiently. Thus, incumbent firms need new and faster ways of (1) satisfying customers' needs and (2) fostering digital innovation. To address this, the concept of (organizational) agility is often discussed in research. It is necessary to participate in a digital competition (Vial 2019). Due to a digital innovation's potential disruptive nature, which often leads to drastic changes, agility is needed to sense and respond to these changes (Chan et al. 2019). "Agility is the ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise" (Sambamurthy et al. 2003b, p. 245). This includes (1) the ability of involving customers in innovation activities ('customer agility'), (2) the ability of leveraging partner assets and knowledge ('partnering agility'), and (3) the ability of achieving speed, accuracy, and cost savings in the exploitation of innovation opportunities ('operational agility') (Sambamurthy et al. 2003b). Incumbents therefore often take the step of addressing these challenges by creating structurally separated agile (innovation) units with a high degree of freedom that are detached from the

main organization. We call these agile units DIUs. The number of publications on DIUs has grown continuously in recent years. In research and in practice various other terms for DIUs exist, e. g. innovation hub (Svahn et al. 2017), digital unit (Fuchs et al. 2019), digital innovation lab (Göbeler et al. 2020; Holotiuk 2020; Holotiuk and Beimborn 2019; Hund et al. 2019), or digital transformation initiative (Jöhnk et al. 2020). Especially within the information systems (IS) community, DIUs have been analyzed under consideration of ambidexterity (e.g. Holotiuk and Beimborn 2019; Jöhnk et al. 2020) or bimodal IT (Raabe et al. 2020a). All of them either describe objectives, ideal types, or practices that foster and strengthen the digital transformation within incumbent firms. Among discovering and implementing digital innovations, DIUs must enable their integration into incumbent firms. In IS research, DIUs are differentiated between various setups with different foci (e.g. Barthel et al. 2020a; Göbeler et al. 2020; Raabe et al. 2020a) that may coexist as concurrent initiatives (Jöhnk et al. 2020). "[W]hile DIUs enforce an intraorganizational cultural and overarching organizational design change, they also impose an interorganizational perspective with customer-oriented digital expertise and innovation, as well as cultivation of digital innovation ecosystems" (Raabe et al. 2021a, p. 5902). We differentiate between four different DIU setups which were identified in prior research. Table 14.1 contains descriptions of the DIU setups and a mapping of them to the digital innovation stages (Fichman et al. 2014), which was performed based on the descriptions of the DIUs in prior research. These different setups of DIUs enforce –despite their strong similarities about their organizational setting– different objectives. Their main difference is whether the innovation activities happen within (Coaching & Screening (C&S) and Center of Excellence (CoE)) or outside of the main organization like in External Creators (ExCs) or Incubators (Incs) (Fuchs et al. 2019). Although the objectives, types, and setups are addressed in-depth, little attention has been given to the DynCaps that must be present to enable a DIU to achieve its objectives. A DynCap perspective is crucial to addressing and enforcing the objectives identified in prior research.

Table 14.1: DIU Setups

Source: Own Representation

DIU Setup	Description	Stages*			
		1	2	3	4
Coaching & Screening (C&S) (Raabe et al. 2020a)	"C&S units mainly address innovation discovery" (Raabe et al. 2020a, p. 7). "[S]creening [digital innovation] trends, coaching and the use of agile methods […] enable the creation and processing of minimum viable products (MVPs)" (Raabe et al. 2020a, p. 7).	x	(x)		
Center of Excellence (CoE) (Raabe et al. 2020a)	„A CoE passes through all [digital innovation] stages, with the particular focus on implementation and integration into the main organization" (Raabe et al. 2020a, p. 8). CoE units focus on digital products and services (Raabe et al. 2020a, p. 8).	(x)	x	x	x
External Creator (ExC) (Barthel et al. 2020a)	ExC units "deal with new products, services, and business models and are therefore externally oriented" (Barthel et al. 2020a, p. 9). "[T]he ties to the core organization still play an important role" (Barthel et al. 2020a, p. 11).	x	x	x	x
Incubator (Inc) (Jöhnk et al. 2020)	Inc units are a "completely self-sufficient legal entity to build entirely new business models and services in an agile way with a strong focus on customer demands and velocity" (Jöhnk et al. 2020, p. 7). Due to the focus on external diffusion, they have little to no touchpoints to the main organization.	x	x	x	x

* Digital Innovation Stages: 1 = Discovery; 2 = Development; 3 = Internal/External Diffusion; 4 = Impact

14.2.2 Dynamic Capabilities

Being focused explicitly on fast-changing as well as technology-intensive environments (Teece et al. 1997; Teece 2007), DynCaps describe "how firms achieve and sustain competitive advantage" (Teece et al. 1997, p. 509). They are defined "as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997, p. 516). While a variety of other –sometimes competing– definitions exists (Barreto 2010; Eisenhardt and Martin 2000; Peteraf et al. 2013), DynCaps have to be distinguished from ordinary (or operational) capabilities, which ensure short-term success of a firm (Winter 2003) and can be easily imitated and acquired (Teece 2014). DynCaps are needed in order to sustain competitive advantages (Teece et al. 1997; Teece 2007) and are responsible for creating as well as altering ordinary capabilities (Winter 2003). In a hierarchy of capabilities, ordinary capabilities are referred to as zero-order capabilities, DynCaps as first-order capabilities, and further higher-order capabilities exist that are responsible for the modification of the respective lower-order capability (Collis 1994; Schilke et al. 2018; Winter 2003). In general, DynCaps have to be built by a firm itself, cannot be acquired or easily replicated by competitors (Teece et al. 1997). They

are based on "organizational processes, shaped by the firm's asset positions and molded by its evolutionary and co-evolutionary paths" (Teece et al. 1997, p. 518). Thus, a firm is dependent on its past and the paths taken (Teece et al. 1997). In addition, DynCaps are also present in the management (Teece 2007, 2014), in non-routine actions (Teece 2014), and can be developed through learning mechanisms (Eisenhardt and Martin 2000; Zollo and Winter 2002). While the management of resources is a constituent of DynCaps, these capabilities have to be used in combination with an adequate strategy as well as valuable, rare, imperfectly imitable, and non-substitutable resources in order to create a competitive advantage and to ensure long-term business success (Teece 2014). DynCaps can be divided into three areas: (1) sensing, (2) seizing and (3) transforming/reconfiguration (Teece 2007). Firms need to *sense* opportunities and threats in the environment, *seize* those opportunities by providing resources, and *transform/reconfigure* by changing and adjusting its assets and structures in order to stay competitive (Teece 2007; Teece et al. 2016). In addition to the above-mentioned plethora of DynCap definitions, a variety of other capabilities and concepts is based on DynCaps. While the term 'capabilities' is frequently used (Nguyen et al. 2019a; Teece et al. 1997; Teece et al. 2016; Törmer and Henningsson 2019), other concepts refer to 'capacities' (Cohen and Levinthal 1990; Yang et al. 2019; Zahra and George 2002), or 'abilities' (Yang et al. 2019). Although DynCaps originally refer to the firm level (Teece et al. 1997), they have also been analyzed at the individual, team, organizational unit, or interorganizational level (Schilke et al. 2018). DynCaps are, as already mentioned, relevant for agility as well as innovation, and have recently been identified in the context of DIUs (Göbeler et al. 2020). However, the role of DIUs in the context of DynCaps is still unclear. In order to link DynCaps to the nascent phenomenon of DIUs, we see the need for an approach which emphasizes the different DynCaps that are relevant for agility and digital innovation as well as their relationships.

14.3 Research Methodology

Following Okoli (2015), we conducted a structured literature review. For our purpose, we chose the following databases to be searched: ABI/INFORM Collection, ACM Digital Library, AIS Electronic Library, IEEE Xplore / Electronic Library Online, JSTOR, and Web of Science. To ensure a high quality of results and to maintain a manageable number of articles, we limited the search in the ABI/INFORM Collection to peer-reviewed articles. This limitation was not applied in the other databases. The goal of our research is to explore the relationship between DynCaps and DIUs. Due to the fact that agility is closely related

to DynCaps, digital innovation, and DIUs (Goncalves et al. 2019; Overby et al. 2006; Raabe et al. 2020b; Raabe et al. 2020a; Sambamurthy et al. 2003b; Teece et al. 2016), we used the following search query to perform an all fields search: *"(agility OR agile) AND ("digital innovation" OR "digital innovations") AND ("capability" OR "capabilities")"*. Aiming to prevent our results from being limited to DynCaps in general, we widened the scope of our search to include other forms of capabilities (e.g., capabilities that are based on DynCaps) as well. The final searches were performed in the databases in June 2020 and led to an initial number of 558 articles. This initial pool included full papers as well as research-in-progress papers. We defined criteria for inclusion and exclusion to identify the relevant articles for addressing our RQs. Articles were considered to be relevant if they deal with at least one of the three central topics of *capabilities*, *agility,* and *digital innovation* or are focused on related topics such as *digital transformation* or *organizational culture*. Criteria for exclusion were a missing focus on firms, on digital technologies, or on the RQs in general. Also, articles addressing ordinary capabilities were excluded. Since the aim of this paper is to provide an initial outlook on a capability perspective on digital innovation and DIUs, we do not focus on interorganizational innovation activities of firms (collaboration between firms) and not on specific digital innovation types. Hence, articles dealing with digital platforms, ecosystems, open innovation, or service innovation were not considered to be relevant. After a review of the title and of the abstract of each article, 391 articles were excluded. For the remaining 167 articles the research questions, the results, and the discussion were analyzed. This resulted in 121 additional excluded articles. After the full text for the remaining 46 articles was read, the number of relevant articles was reduced to 19. Of these 19 articles, 6 were identified to be dealing with IT capabilities or capabilities and concepts that are based on IT capabilities. Due to the important role of IT in contemporary businesses, and the fact that digital innovations are "embodied in or enabled by IT" (Fichman et al. 2014, p. 330), we assume that adequate IT capabilities are a prerequisite for digital innovation and DIUs. Hence, these 6 articles were excluded, and IT capabilities will not be examined below. A backward search in the resulting pool of 13 articles led to the identification of 11 additional articles which met our inclusion criteria. We did not exclude any articles due to quality deficits. All in all, we identified 24 relevant articles. Due to the nascent nature of DIUs and the related novelty in IS research, only a limited number of articles is dealing with this concept. Analogous to the approach presented above, we searched for articles describing DIUs in December 2020. Queries included *"(digital innovation unit*) OR (digital innovation lab*) OR (digital unit*) OR (digital transformation initiative*)"*. Amongst our reviews, we found additional DIU-

related articles through our personal network. As a result, we used the following 12 DIU-related articles: Barthel et al. (2020a), Fuchs et al. (2019), Göbeler et al. (2020), Holotiuk (2020), Holotiuk and Beimborn (2018; 2019), Hund et al. (2019), Jöhnk et al. (2020), Raabe et al. (2020a; 2020b; 2021), and Svahn et al. (2017).

14.4 Results

14.4.1 The Dynamic Capability Jungle for Agility and Digital Innovation

We identified a variety of DynCaps that influence the agility and digital innovation of a firm. Some authors argue that agility is a DynCap (Lee et al. 2015; Sambamurthy et al. 2003b), while others claim that DynCaps represent a broader concept and that agility can be facilitated by certain DynCaps (Overby et al. 2006). The latter fits Teece et al.'s (2016) statement, that "[s]trong dynamic capabilities are necessary for fostering the organizational agility necessary to address deep uncertainty" (p.13). Thus, we interpret DynCaps as a broader concept that can facilitate agility. We consider the DynCaps and the areas (or as we call them, dimensions) (1) sensing, (2) seizing and (3) transforming described by Teece (2007) (see Related Research section) as a 'foundation'. In each of the **DynCap** dimensions sensing, seizing, and transforming, there are possibilities to achieve agility (Teece et al. 2016). This DynCap 'foundation' is deeply intertwined with what we call 'extensions' of DynCaps which are capabilities and concepts that are based on the foundational DynCaps. Figure 14.1 contains an overview of the identified DynCaps, their dimensions, and illustrates their relationships.

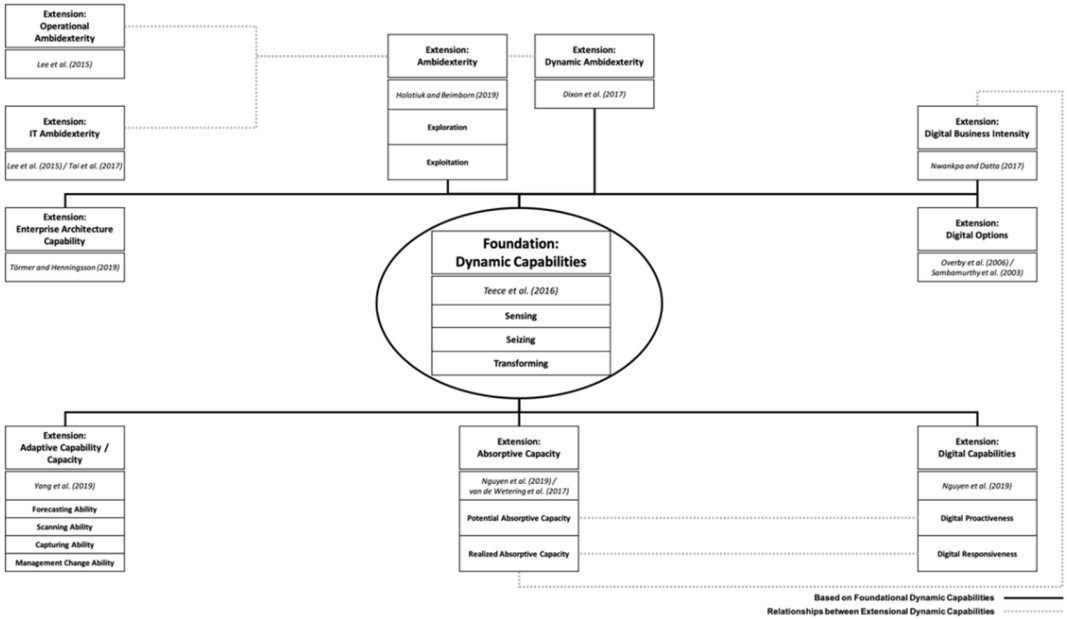

Figure 14.1: The Dynamic Capability Jungle for Agility and Digital Innovation
Source: Own Representation

Due to the multitude of capabilities and relationships which are however presented in a structured manner, we label it as the *Dynamic Capability Jungle*. The researchers mentioned in the *Dynamic Capability Jungle* refer to those in whose studies the effect of capabilities on agility or digital innovation was mentioned. For the sake of clarity, the exploration and exploitation dimensions of IT, dynamic, and operational ambidexterity are not shown. **Organizational Ambidexterity** can be seen as a DynCap (O'Reilly and Tushman 2008). It is defined as the ability of an organization to engage in both, exploration of new possibilities and exploitation of old certainties (March 1991; O'Reilly and Tushman 2013) and thus, has a strong impact on firms' agility and digital innovation procedures. Common forms realized are structural, sequential, contextual, or temporal ambidexterity (Holotiuk and Beimborn 2019; O'Reilly and Tushman 2013). Dixon et al. (2017) describe **Dynamic Ambidexterity** as a DynCap that "enables a dual strategy of resource exploration and resource exploitation to be maintained through the ongoing rebalancing of resources and capabilities" (p.12). **IT Ambidexterity** enables digital innovation (Tai et al. 2017). The influence on the agility of an organization is based on its positive effect on ambidexterity at the operational level (**Operational Ambidexterity**) (Lee et al. 2015). **Absorptive Capacity** can be regarded as a DynCap (Roberts et al. 2012; Zahra and George 2002) and is defined as the "ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal 1990, p. 128). Absorptive capacity consists of potential absorptive capacity, which makes incumbent firms susceptible to acquiring and assimilating external knowledge, and realized absorptive capacity, which describes a firm's ability to transform and exploit the absorbed knowledge (Zahra and George 2002). The relevance of absorptive capacity (besides IT and dynamic capabilities) in relation to innovation in general has been confirmed by van de Wetering et al. (2017). **Digital Capabilities**, which can be seen "as the contextualization of [DynCaps] in digital transformation context" (Nguyen et al. 2019a, p. 5), are relevant for digital transformation. This context includes digital innovation (Vial 2019). Thus, digital capabilities are considered as relevant. Digital capabilities consist of digital proactiveness, which refers to the use of and experimentation with digital technologies and creates a supportive climate for the intake and spreading of digital technologies in the organization (Nguyen et al. 2019a). Digital responsiveness refers to the reconfiguration and coordination of internal and external assets, includes revising the internal environment for the introduction of digital technologies, and the use and mobilization of assets (Nguyen et al. 2019a). Digital proactiveness is related to potential absorptive capacity and digital responsiveness is related to realized absorptive capacity (Nguyen et al. 2019a). **Digital Business Intensity** refers to a

firm's investments in emergent and innovative digital technologies and represents the extent of its investments in digital innovations (Nwankpa and Datta 2017). This concept has strong references to DynCaps and is an extension of absorptive capacity (Nwankpa und Datta 2017), which, as already mentioned, can be regarded as a DynCap. Therefore, we also consider Digital Business Intensity as a DynCap. It also helps organizations to identify digital opportunities and leverage digital innovation in the business strategy (Nwankpa and Datta 2017). **Adaptive Capability or Capacity** is crucial for making adjustments within digital innovation projects. It is defined as the ability to adapt to changes in markets, technologies, or to emerging opportunities and consists of the dimensions forecasting, scanning, capturing, and management change ability (Yang et al. 2019). Forecasting ability refers to forecasting future developments of the environment before implementation, while scanning ability refers to perceiving changes in the environment during implementation. Capturing ability refers to the capturing of opportunities resulting from market changes and management change ability refers to the adjustment of the management system to respond to changes in the environment. These last two abilities include the reconfiguration of assets, thus being closely related to the foundational DynCaps (Yang et al. 2019). The absence or weak expression of the latter dimension may prevent adjustments during digital innovation projects (Yang et al. 2019). **Enterprise Architecture Capability** is described as a DynCap that refers to the enterprise architecture and includes continuous sensing, seizing, and transforming (Törmer and Henningsson 2019). "[T]he [enterprise architecture] capability will be a central element for explaining and prescribing how companies adapt their resources and capabilities to changing customer demands and opportunities in quest for competitive advantage" (Törmer and Henningsson 2019, p. 13). **Digital Options** are defined as DynCaps in the shape of knowledge systems as well as digitized corporate processes (digital process innovations) and enable as well as effect firms to become agile (Overby et al. 2006; Sambamurthy et al. 2003b).

14.4.2 Considered Dynamic Capabilities in Digital Innovation Units

In research, there have been a few initial tries to link DynCaps to DIUs. It is suggested that besides the interaction with entities inside as well as outside the main organization, the typical workflow of a DIU consists of a sequence of the three DynCaps sensing, seizing, and reconfiguring (Göbeler et al. 2020). Further DynCaps can be identified in DIUs and in the main organizations' management depending on whether the DIU directly executes digital transformation and digital innovation activities or is indirectly involved in these activities by supporting the main organization (Göbeler et al. 2020). In addition, it is proposed that

the establishment of DIUs and the resulting (temporal) ambidexterity can lead to the creation of DynCaps (Holotiuk and Beimborn 2019). This proposal has not been addressed yet. Among our presented extensional DynCaps, ambidexterity is the only one that has been related to DIUs (Göbeler et al. 2020; Holotiuk 2020; Holotiuk and Beimborn 2018, 2019; Jöhnk et al. 2020). There is a consensus that DIUs support the establishment of ambidexterity (Fuchs et al. 2019; Göbeler et al. 2020; Holotiuk 2020; Holotiuk and Beimborn 2018, 2019; Jöhnk et al. 2020; Raabe et al. 2020b; Raabe et al. 2020a) as well as that DIUs and the resulting ambidexterity exhibit peculiarities with regard to the established forms of contextual, sequential, and structural ambidexterity (Göbeler et al. 2020; Holotiuk 2020; Holotiuk and Beimborn 2018, 2019). While some conclude that this fact indicates the need of a new form of ambidexterity (Holotiuk 2020) or define such a new form as 'temporal ambidexterity' (Holotiuk and Beimborn 2018, 2019), others disagree by stating that DIUs "are hybrid forms, combining elements of the three [established] forms of ambidexterity […] and utilizing resulting synergies among them" (Göbeler et al. 2020, p. 11). In terms of IT ambidexterity, different types of DIUs have been identified as a representation of either structural or contextual ambidexterity approaches (Jöhnk et al. 2020). The simultaneous presence of these types leads to 'hybrid ambidexterity', describing the co-occurrence of contextual and structural ambidexterity (Jöhnk et al. 2020).

14.4.3 The Linkage between Dynamic Capabilities, Digital Innovation, and DIUs

During the process of developing digital innovations DIUs pass through the digital innovation stages (Raabe et al. 2020a; Raabe et al. 2021a). Hence, in Table 14.2 we map the identified DynCaps and capability dimensions to these stages of digital innovation based on the descriptions of the stages by Fichman et al. (2014) and of the DynCaps in the identified relevant articles. Even though we see exploration and exploitation as relevant in all digital innovation stages, it should be kept in mind that DIUs perform explorative activities, while the exploitation is carried out by the main organization (Fuchs et al. 2019; Holotiuk 2020; Holotiuk and Beimborn 2019; Hund et al. 2019). Since the scope of a DIU and thus the stages of digital innovation carried out by the DIU itself can vary (Barthel et al. 2020a; Raabe et al. 2020a), it is also possible to derive DynCaps that are needed for different setups of DIUs. On the one hand, it is possible to handover the responsibility for an innovation after an initial development inside a DIU (Barthel et al. 2020a; Raabe et al. 2020a). These DIU setups may especially need the capabilities and capability dimensions that are mapped to the first stage of digital innovation ('discovery'). Since C&S units

operate especially within the first stage (and sometimes within the second stage), they have a need for or realize the DynCaps and capability dimensions Sensing, Potential Absorptive Capacity, Forecasting Ability, Exploration, Digital Proactiveness, Digital Options, and Enterprise Architecture Capability. On the other hand, it is also possible that DIUs operate in the other digital innovation stages (Barthel et al. 2020a; Raabe et al. 2020a). CoE, ExC, and Inc units operate in all mentioned stages, thus, it can be deduced that all DynCaps and capability dimensions are needed or realized, except for exploitation (see Table 14.2).

Table 14.2: Dynamic Capabilities in Digital Innovation Stages.
Source: Own Representation

Dynamic Capabilities	Capability dimensions	Stages*			
		1	2	3	4
Foundation: Dynamic Capabilities	Sensing	x	x		
	Seizing		x	x	
	Transforming			(x)	x
Extension: Absorptive Capacity	Potential Absorptive Capacity	x	(x)		
	Realized Absorptive Capacity		x	x	x
Extension: Adaptive Capability/Capacity	Forecasting Ability	x			
	Scanning Ability		x		
	Capturing Ability		x	x	
	Management Change Ability			x	x
Extension: (IT, Dynamic, and Operational) Ambidexterity	Exploration	x	x	x	x
	Exploitation	x	x	x	x
Extension: Digital Business Intensity	-	x	x	x	x
Extension: Digital Capabilities	Digital Proactiveness	x	(x)		
	Digital Responsiveness		x	x	x
Extension: Digital Options	-	x	x	x	x
Extension: Enterprise Architecture Capability	-	x	x	x	x
		C&S			
		CoE, ExC, Inc			

*Digital Innovation Stages: 1 = Discovery; 2 = Development; 3 = Internal/External Diffusion; 4 = Impact

14.5 Discussion and Conclusion

We identified several DynCaps that are relevant in relation to agility and digital innovation. Besides the foundational DynCaps, we found other extensional capabilities and concepts. This classification of 'foundational' and 'extensional' DynCaps should not be confused with

the classification of 'ordinary' and 'dynamic' or 'higher-order' and 'lower-order' DynCaps (Collis 1994; Schilke et al. 2018; Winter 2003), as we did not analyze hierarchies of capabilities. We took capability dimensions into account and discovered relationships between different DynCaps. The *Dynamic Capability Jungle* provides a structured overview of these capabilities and their dimensions as well as their interrelationships and assists in classifying the plethora of different DynCaps articles in research. Furthermore, we strived to investigate how the identified DynCaps are connected with DIUs. Research on DynCaps and DIUs can be characterized as rather scarce. So far, it is mainly limited to the identification of DynCaps in DIUs and in the management of the main organization. In addition, the DynCap ambidexterity has been investigated in relation to DIUs. The multitude of other identified DynCaps that are relevant for agility and digital innovation indicates that they are also worth considering in a DIU context. Hence, we took a different approach in exploring the linkage between DynCaps and DIUs by stating that several DynCaps are needed in or realized within DIUs to support the (successful) development of digital innovations. This is based on a mapping of the foundational and extensional DynCaps to the digital innovation stages. This is the first time that research on DIUs analyzes and acknowledges the relevance of DynCaps and includes capabilities and concepts that are based on them. We confirm the perspective of Göbeler et al. (2020) that DIUs generally implement the dimensions of sensing, seizing, and transforming. However, we believe that this 'sensing, seizing, transforming' workflow needs to be differentiated depending on the setup of the DIUs. DIUs sometimes perform a wide variety of tasks. We show this exemplary with the presented setups of DIUs. Although the CoE, ExC, and Inc units mostly address all stages and should include all DynCaps shown in Table 14.2, C&S units explicitly deal with the first and second stage and thus must entail a different portfolio of DynCaps. However, there may be sub-setups that do not explicitly vary by stage but by the type of digital innovation or its domain they are operating in. Thus, other constellations of DynCaps may be needed. DIUs are not static but dynamic entities and should be able to vary their setting depending on their tasks. We contribute to IS research by initially connecting DynCap research to the nascent DIU research stream. In the past, the embedding of DIUs in the main organization was addressed, but hardly any attention was paid to the unit and its capabilities. Our findings may assist in establishing specific DIU setups as well as in overcoming multifaceted concerns of DIUs (Raabe et al. 2020b; Svahn et al. 2017). Our results are not without limitations. The *Dynamic Capability Jungle* as well as the mapping of DynCaps to the digital innovation stages must be evaluated for validation purposes. The rather scarce research on DynCaps in DIUs represents a further limitation.

Thus, more unidentified foundational or extensional DynCaps may exist that are relevant for agility or digital innovation. Further, we pointed out the importance of other factors in the context of DynCaps such as resources or strategy. These factors may have an influence on the relationship between DynCaps, agility, and digital innovation. In addition, we did not consider the cooperation between different firms. As innovation becomes more complex and distributed (Nambisan 2013; Nambisan et al. 2017; Svahn et al. 2017; Yoo et al. 2012), there is the possibility that further 'interorganizational' DynCaps have an influence. At the same time, it is conceivable that the decentralized nature of innovation activities supersedes several of the identified DynCaps. Additionally, we do not distinguish between the different types of digital innovation. These may influence DynCaps. Our results provide a foundation for future research streams. The *Dynamic Capability Jungle* as well as the mapping of DynCaps to the digital innovation stages need to be evaluated. Even though we investigate DynCaps in DIUs, DynCaps usually refer to firms holistically. Thus, it can be examined in more detail to what extent DynCaps and DIUs are related and belong together. Additionally, future research can also identify further relevant DynCaps or analyze how the required DynCaps change considering the decentralized nature of innovation and its type. As we do not make any statements about how a DIU can build the required DynCaps, this can be subject of future research. The scope of responsibility of a DIU may also change over time (Raabe et al. 2020a). Thus, a longitudinal analysis may be promising to e. g. identify lifecycles of DIUs.

14.6 References

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15 Towards Phenomenon-driven Design Science Research

Raabe, J.-P., Horlach, B., and Drechsler, A. 2021b. "Towards Phenomenon-driven Design Science Research," *Australasian Conference on Information Systems (ACIS)*.

Abstract: We propose a research approach that extends phenomenon-driven research – which is primarily aimed at producing descriptive and explanatory knowledge about novel phenomena – with a design-oriented focus. The resulting approach aims to develop not only explanatory knowledge about novel phenomena but also prescriptive knowledge about how to face corresponding novel challenges and does so in conjunction and in a mutually reinforcing way. We illustrate our approach with two examples to understand and produce design principles for the novel phenomena of organizing the IT setups in Scaled Agile organizations and Digital Innovation Units, respectively. Researchers can draw on our approach to understand novel phenomena and simultaneously produce knowledge that is also relevant to practitioners facing novel practical challenges resulting from these novel phenomena.

Keywords: Phenomenon-driven Research, Design Science Research.

15.1 Introduction

VUCA (Volatility, Uncertainty, Complexity, Ambiguity) is a commonly applied moniker to the current state of the world (Bennett and Lemoine 2014) to characterize the situation that 1) novel phenomena continuously and unpredictably appear in the world, and that consequently, 2) organizations and individuals face novel and complex challenges arising from these phenomena. These novel phenomena require further investigations to understand, explain, and predict them, contributing to descriptive and explanatory knowledge or Ω-knowledge. There is also the potential to develop subsequent prescriptive or Λ-knowledge on how to respond to or even prevent the corresponding novel challenges (Gregor and Hevner 2013; Seidel and Watson 2020). Moreover, as "most management practices create their own nemesis" (Clegg et al. 2002, p. 491), new ways of coping with challenges in a VUCA world may also constitute novel phenomena themselves, potentially

creating a continuous circle of trading one set of practical challenges for another, all while creating novel organizational and technological phenomena.

Phenomenon-driven research (PDR) is a well-established research approach that focuses on understanding unexpected regularities that first challenges extant knowledge and theories, and only engages in theory-building afterward (Schwarz and Stensaker 2014). PDR eschews drawing on established theories at the start of the research, as theories may serve as blinders (Holmström and Truex 2011), which may prevent a true understanding of the novel phenomenon. Surprisingly, an explicit PDR perspective – despite having a long tradition in management research (Schwarz and Stensaker 2016) – can hardly be found in IS research papers, despite IS research papers often being concerned with either understanding novel phenomena in the digital space or – in case of design science research (DSR) papers – providing solutions or other prescriptive knowledge for coping with novel challenges.

However, traditional PDR's strong focus on merely understanding novel phenomena provides little guidance on how to integrate the production of prescriptive knowledge for related challenges in an extensive research programme on a particular novel phenomenon in a VUCA world. In contrast, extant DSR literature often assumes knowledge about particular real-world challenges and underlying phenomena to start a DSR process. To address these two shortcomings, the need arises to integrate PDR and DSR into a coherent and encompassing integrated methodological approach.

To develop such an approach in this paper, we draw on extant methodological guidance in the IS DSR literature about utilizing and producing both knowledge types in a mutually reinforcing way (Drechsler and Hevner 2018; Gregor and Hevner 2013; Seidel and Watson 2020). The resulting approach retains PDR's placement of novel phenomena at the center of research interest but expands its sole focus on explanatory knowledge by integrating the production of prescriptive knowledge as one of two knowledge contribution paths. We also illustrate how this additional angle on the challenges accompanying novel phenomena can lead not only to initial solutions to those challenges but also to even deeper insights.

15.2 Foundations

We first introduce the two research approaches that we later integrate, PDR and DSR.

15.2.1 Phenomenon-driven Research

Phenomenon-based or phenomenon-driven research is a research approach dedicated to contribute new knowledge about novel organizational as well as managerial phenomena (Schwarz and Stensaker 2016). Unlike a traditional theory-driven research path, which primarily focuses on the development, implementation, evaluation, and analysis of theoretical models, PDR starts before that by distinguishing a phenomenon from other facts and occurrences (Krogh et al. 2012). Its main aim is to capture, describe, and document a phenomenon and to conceptualize it so that appropriate research design development and subsequent theory building can take place. PDR classifies a phenomenon within three phases based on the significance and state of prior research (Edmondson and McManus 2007; Krogh et al. 2012):

1. Embryonic (nascent) phase: Novel phenomena must be delineated from other already known phenomena within the scientific field. As (digital) technologies motivate abrupt changes, processes, structures, and even individuals in organizations and society are also changing to counteract these external influences. These changes might become themselves novel phenomena worth studying.
2. Growth (emergent) phase: As a phenomenon spreads and becomes noticeably accepted as a subject for study in a research community, the emerging features and concepts of a phenomenon are captured and compared to new and extant theories.
3. Mature phase: In a mature state, the research on a phenomenon reaches a level of consistency where the regularities found in the previous phases become predictable, which leads to a variety of characteristics revealing the richness of a volatile phenomenon.

Table 15.1 summarizes the five PDR activities and their corresponding knowledge contribution. Note that we changed the name of the third step (originally just 'Design') to highlight that this step is about designing research approaches for studying a novel phenomenon more in-depth, and not about designing in the DSR sense. In a nutshell, PDR provides an approach to grasp a novel phenomenon by understanding the "regularit[y] that [is] unexpected, that challenge[s] existing knowledge (including the extant theory), and that [is] relevant to scientific discourse" (Krogh et al. 2012, p. 278) first and only proceeds to theorizing at a later stage (Schwarz and Stensaker 2014). Such a phenomenon-driven angle is useful, as theories may serve as blinders (Holmström and Truex 2011) preventing a true understanding of a phenomenon. In other words, focusing on theories first may

"prevent the reporting of rich details about interesting phenomena for which no theory yet exists" (Hambrick 2007, p. 1346).

Table 15.1: PDR Activities

Source: Own Representation (based on Krogh et al. 2012; Schwarz and Stensaker 2016)

Activity	Description
1. Distinguish	• demarcate the phenomenon by emphasizing peculiarities and other distinctive characteristics • define a phenomenon in terms of what it is not • identify initial instances or types of the phenomenon
2. Explore	• intensify data-gathering (through primary and secondary data) within or outside the initial conceptualizations in order to further describe and explore the boundaries of the phenomenon • produce concepts that serve as filters in further data gathering
3. Design Research Approaches	• strive to answer broad questions like "What is the nature of the phenomenon?" or "How can this phenomenon best be researched?" by following alternate research approaches • report on the phenomenon by validating observations or improving/replacing prior concepts and provide unprecedented and opportunistic insights
4. Theorize	• compare and/or demarcate the phenomenon from extant theories in the research field • utilize extant theories and refine or contribute new theories
5. Synthesize	• review and synthesize existing studies and research designs • ponder whether and how the new refined or contributed knowledge on the phenomenon connects to the extant knowledge bases • begin generalizing to and contrasting with extant organization and management theories

Moreover, knowledge resulting from applying theory is often not helpful to practitioners, as it does not necessarily help them to make sense of the novel phenomena they encounter or even provide prescriptive knowledge on how to deal with the corresponding novel challenges they face. Here, PDR can provide a deeper understanding of the issues and thus aid practitioners' sensemaking. Simultaneously, PDR's extant focus on describing and explaining regularities does not address the need for solutions for the novel challenges associated with the novel phenomena. Such knowledge production falls traditionally into the DSR realm, which we are going to introduce next.

15.2.2 Design Science Research

In the past 20 years, DSR has evolved to become a central paradigm in IS research. In a nutshell, DSR's primary goal is to contribute prescriptive or Λ-knowledge about solutions to real-world problems – in the form of design artefacts with social and/or technical components – and corresponding solution-related design knowledge (e.g., design

principles or features) to the human knowledge base (Drechsler and Hevner 2018; Gregor and Hevner 2013; Hevner et al. 2004; vom Brocke et al. 2020).

The solution design is grounded in the human knowledge base containing descriptive and explanatory knowledge (Ω-knowledge). Ω-knowledge provides knowledge about the problem space and potential regularities that may comprise suitable means to bring forth the desired ends (= the goals for the solution). Extant Λ-knowledge is a second source for knowledge informing the solution design, providing means and artefacts that previously have been evaluated to be effective in different contexts. Design efforts can draw on extant Λ-knowledge but has to adapt (or project) the knowledge into the new application context (vom Brocke et al. 2020). Beyond Ω and Λ-knowledge, the design researchers' creativity, experience, and insights are further sources to inform the solution design.

Over the course of a DSR project, numerous contributions can be made to both knowledge bases (Ω and Λ) and the interplay between both knowledge types in the DSR process is a crucial factor in designing a solution that is not only fit-for-purpose but also advances both types of human knowledge about the context, the problem, and the solution spaces (Drechsler and Hevner 2018; Seidel and Watson 2020; vom Brocke et al. 2020).

Thus, DSR requires and builds upon a solid understanding about the key phenomena in the problem space and key regularities associated with these phenomena (Hevner et al. 2019). However, common DSR literature often assumes that such knowledge already exists. If it does not, such knowledge gaps need to be identified and then filled first through explanatory-oriented research (Avdiji and Winter 2019). Moreover, DSR presupposes knowledge of particular problems and challenges. When facing novel phenomena, it is often unclear, however, what the nature of these problems and challenges actually is. It is at this intersection that we see a fruitful way of integrating DSR and PDR.

15.3 Phenomenon-driven Design Science Research

In this section, we first outline the crucial role of phenomenon-related knowledge in DSR and then propose an integration of PDR and DSR approaches for the purpose of producing explanatory (Ω) in conjunction with prescriptive (Λ) knowledge about novel phenomena and corresponding challenges.Phenomenon-related knowledge as inputs for DSR

15.3.1 Phenomenon-related knowledge as inputs for DSR

Commonly, DSR and related literature states that Ω-knowledge first provides the means to observe, describe, classify, catalogue, and conceptualize real-world phenomena (Gregor and Hevner 2013; Seidel and Watson 2020). This means in particular that novel phenomena need to be observed first, then defined and described, and also distinguished from other similar phenomena. There may also be different sub-types of a phenomenon to distinguish. Armed with terminology to describe and distinguish a phenomenon, explanatory research then can start investigating regularities in order to develop pre-theoretical knowledge and ultimately, fully fledged theories.

Design science researchers can then draw on such a body of descriptive and explanatory knowledge to describe the phenomena of their interest (i.e., the problem and context) and develop suitable prescriptions (e.g., design features, artefacts) to address the problem. However, the descriptive and prescriptive constructs they use have to be compatible and coherent so that there can ideally be full traceability from the underlying descriptions over the selected documented regularities up to the chosen means or prescriptions to address the problem in its context (vom Brocke et al. 2020). In other words, without suitable and coherent bodies of descriptive, explanatory, and predictive knowledge (in form of pre-theoretical knowledge or fully developed theories) a DSR project would lack a necessary scientific foundation available in order to diagnose the problem further and ground the corresponding prescriptions that are to be developed.

15.3.2 Phenomenon-related knowledge as outputs from DSR

The role of phenomenon-related knowledge in DSR is not limited to inputs to the DSR process, however. Any DSR project – and any research project in general – can, and often does, generate Ω and Λ-knowledge about novel phenomena in conjunction (Gregor and Hevner 2013; Seidel and Watson 2020).

In a knowledge production perspective, a DSR project utilizes a set of knowledge from Ω and Λ in order to contribute new, refined or refutations of knowledge back to Λ (as a primary objective – e.g., artefacts or other forms of design knowledge) and Ω (as a secondary objective – e.g., new insights about individual or organizational behavioral regularities) (Drechsler and Hevner 2018). In other words, even though addressing a real-world problem on a sufficient level of fitness-for-purpose (or utility) may be the primary goal of a DSR project, learning about behavioral regularities (e.g., extending or refuting

existing theories or pre-theoretical Ω-knowledge) or even uncovering new challenges that need to be addressed subsequently may well happen alongside.

Since one can assume a positive relationship between the extent of the understanding of the phenomenon itself and the related challenge on the one hand and the effectiveness of the solution on the other hand, there is a high motivation especially in the early phases of a DSR project to emphasize understanding over design, in case there is scarce Ω-knowledge available. Simultaneously, the changes resulting from implementing or instantiating a design in a real-world context may provide a trigger to learn even more from the – perhaps unexpected – changed behavior of the real-world context. Moreover, designing for challenges related to novel phenomena may provide opportunities to further develop the conceptual or methodological foundations of DSR. Taken even further, the output of a DSR project itself (e.g., an artefact in form of a new technology or a new management approach) that addresses a real-world problem may constitute a novel phenomenon on its own where scant knowledge exists beyond the outcomes of the initial evaluation, thus warranting further investigations.

Consequently, a DSR project aiming to address a real-world problem directly related to a novel phenomenon may contribute to all forms of Ω and Λ-knowledge the literature distinguishes (Drechsler and Hevner 2018; Gregor and Hevner 2013): 1) knowledge about the phenomenon itself, its context, and related novel challenges, 2) regularities about the phenomenon (e.g., theories or pre-theoretical knowledge), 3) design knowledge about suitable research designs, 4) design knowledge to address (parts of) the problem (e.g., design principles or features), and 5) design entities such as artefacts to address the problem in its entirety. Thus, any integration between PDR and DSR has to take into account the dual role of phenomenon-related knowledge as inputs to as well as outputs of DSR.

15.3.3 Integrating Phenomenon-driven and Design Science Research

The previous sections made in-depth cases for the important role of phenomenon-related knowledge as inputs for and outputs of DSR processes. In this section, we propose a research approach that integrates DSR and PDR for the purpose of providing a unified view of knowledge utilization and contribution over the course of a research process that starts with the initial observation of a novel phenomenon.

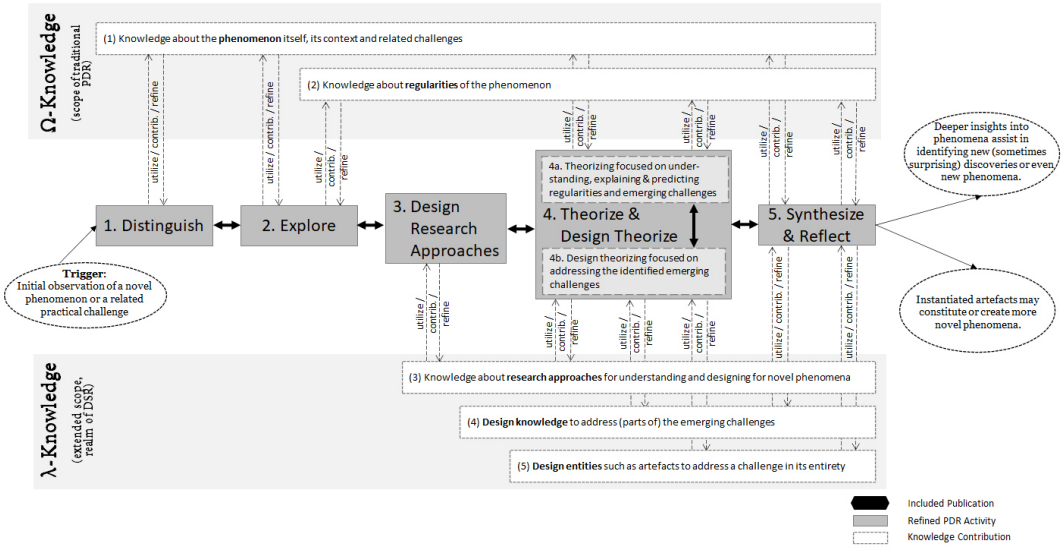

Figure 15.1: Integrating PDR Activities with DSR Knowledge Types and Contributions
Source: Own Representation

Figure 15.1 contains the five enhanced activities of PDR (based on Table 15.1) as well as the five knowledge types a DSR project can draw on and contribute to (as summarized at the very end of the previous section). The activities are not to be understood as a waterfall-like procedure and should rather be seen as iterative blocks, as indicated by the two-sided arrows. In the following, we will introduce each activity and describe the utilized, contributed, or refined knowledge chunks (indicated by the dotted arrows) within each activity. The arrows towards each activity indicate when existing knowledge is utilized to produce further knowledge. The arrows towards the knowledge types indicate either a substantial novel knowledge contribution or a refinement (or refutation) of extant knowledge.

First, we extend the initial trigger of the PDR research process by adding a new trigger for the entire process in the form of the observation of novel practical challenges related to a novel phenomenon. The core of the "1. Distinguish" activity is unchanged from PDR as this phase still entails the need for differentiating a phenomenon's identity in its context from others as well as demarcating the phenomena by emphasizing peculiarities or defining what a phenomenon is not. A key extension to this first activity, however, is the explicit call to identify novel practical challenges related to the novel phenomenon. These challenges are candidates for a subsequent validation and a refinement into problems suitable to start DSR efforts to develop prescriptions as solutions. These challenges thus are further contributions to Ω-knowledge in addition to the contributions or refinements made by improving the understanding of the phenomenon in its context. All these contributions can

be made, for instance, through observations, classifications, measurements, or cataloguing (Gregor and Hevner 2013).

Likewise, the "2. Explore" activity is still about intensifying the process of understanding the phenomenon by questioning "whether the concepts being used allow insight into the phenomenon by distinguishing relevant data from non-relevant data" (Krogh et al. 2012, p. 287). By excluding non-relevant data, the phenomenon can be narrowed down further, and thus additional Ω-knowledge can be generated, which may improve our understanding about the phenomenon and the related challenges. This first sense-making step may be achieved through identifying regularities, natural laws, principles, or patterns (Gregor and Hevner 2013). Phenomenon-driven DSR projects may later iterate through the first and second activity, until a sufficient understanding about its problem, the related phenomena and their context is reached in order to be able to develop well-grounded prescriptive (design) knowledge.

The idea behind the "3. Design Research Approaches" activity is also still the same: the experimentation with alternative research approaches (Krogh et al. 2012), which may lead to new knowledge about research approaches for understanding a phenomenon. As with the previous two activities, we extend this phase to cover design-oriented research as well. Such an integrated perspective on understanding and designing tends to increase a research project's overall contribution and impact potential (Seidel and Watson 2020), and is also well in-line with the more journey-like nature of DSR (vom Brocke et al. 2020). As knowledge about suitable research methodologies and methods is part of Λ-knowledge (Drechsler and Hevner 2018), the arrow towards that knowledge base indicates the standalone contribution potential of this third activity, beyond its purpose to set the stage for activity 4.

The most substantial change to traditional PDR that we propose takes place in the "4. Theorize and Design Theorize" activity, which is now split into two sub-activities. 4a corresponds to the established recommendations in PDR to theorize focused on understanding, explaining & predicting regularities (Krogh et al. 2012), but extended to include emerging challenges (cf. "1. Distinguish" above) of the novel phenomenon. The new sub-activity 4b is the DSR counterpart to 4a and focuses on design theorizing focused on addressing the previously identified emerging challenges. While 4a's primary focus is on utilization, contribution, and refinement of Ω-knowledge, 4b utilizes, contributes, or refines Λ-knowledge. In both cases, pre-theoretical knowledge is equally valued as (and will almost always be a necessary prerequisite for the development of) fully-fledged theories or

artefacts. Pre-theoretical Ω- knowledge allows to gain a better understanding of the phenomenon and its challenges whereas pre-theoretical Λ-knowledge can provide building blocks (e.g., design principles) for future more coherent approaches (e.g. artefacts) to solve parts of or even entire emerging challenges. Note that 4a and 4b are not to be seen as clearly distinguishable research activities or even an either/or choice. Most research will be conducive to produce both types of knowledge to varying extents, and it will be mostly down to the researchers' mindset about their primary direction of inquiry. Moreover, claiming fitness (or utility) for produced Λ-knowledge depends on a solid foundation of Ω-knowledge that meets certain standards of truth (Gregor and Hevner 2013; Seidel and Watson 2020).

As with the previous activity, we also extended the scope of the final activity "5. Synthesize & Reflect". The fifth activity still entails reconciling the newly generated knowledge with established wisdom, assessing the extent of the contribution, and identifying potential future research avenues, or future iterations on the same research questions. Synthesizing also lowers the risk of knowledge being scattered, and thus avoids isolated contributions to the human knowledge bases (Krogh et al. 2012). However, especially contributed Λ-knowledge requires a more nuanced reflection on the nature and extent of contribution made beyond its fitness-for-purpose (or utility) to address a given problem (vom Brocke et al. 2020). As contexts in DSR can be quite specific in nature, design knowledge that was assessed as fit-for-purpose usually can only claim fitness for the respective application context. Applying this design knowledge to other contexts means projecting this knowledge into those contexts, and – unlike as for Ω-knowledge – it is not just about generalizability, but more nuanced considerations of projectability. A third criterion – and one that is applicable to both Ω and Λ-knowledge – is the confidence with which the claims to truth / fitness and generalizability / projectability can be made. For research in the space of novel phenomena, we would expect it to be natural to start with claims of low confidence for one's initial knowledge contributions and then use these claims for subsequent cycles through the PDR (and DSR) activities to refine the previously contributed knowledge and thus improve the level of confidence.

Lastly, deeper insights into a phenomenon may assist in identifying other (and sometimes surprising) new phenomena and related challenges. Moreover, instantiated artefacts may constitute or even create novel phenomena on their own – thus highlighting the cyclical nature of the integrated PDR/DSR approach. In the interest of parsimony, we omitted the cyclical arrows from Figure 15.1, however.

15.4 Example 1: Meta-requirements and Design Principles for Organizing the IT setups in Scaled Agile Organizations

In this section, we illustrate the application of the research approach shown in Figure 15.1 in the context of a research programme on the novel phenomenon of Scaled Agile organizations (Horlach 2021). In a nutshell, Scaled Agile organizations either have split the IT function (and parts of the business organization) into agile and traditional service delivery following a bi-modal approach, or have 'agilized' the IT function or even the whole enterprise. Scaled Agile organizations apply Agile principles and methods beyond software development in order to meet the needs of strategic agility – comprising speed to market, customer centricity, and continuous innovativeness – for their (mostly digital) products and services. Often, the result is a formation of semi-autonomous product / service teams (SAP/ST) – which blur or even eliminate the traditional distinction between 'business' and 'IT' – in these organizations.

The broad challenge that initially guided this research programme was the question of how to effectively organize the IT set-up in Scaled Agile organizations, as many well-known challenges arising from gaps between business and IT do not apply in these organizational set-ups anymore. The same applies to corresponding management approaches to address these challenges such as IT governance, IT project portfolio management, business-IT alignment, or enterprise architecture. Instead, new management challenges arise within and between the SAP/ST.

Since there was very little knowledge at the start of the research programme about the Scaled Agile phenomenon and the corresponding more specific challenges of organizing the IT set-up, an overall research approach was needed that could give sufficient guidance to develop suitable research designs to investigate both angles further. The approach shown in Figure 15.1 proved suitable to give this guidance and led to the insights and contributions summarized below in Tables 4 and 5. The tables are sorted by Figure 15.1's five phases and the five knowledge contribution types (2 in Ω and 3 in Λ). We further distinguish where we drew on (= utilized) extant knowledge, refined extant knowledge, and contributed novel knowledge without clear precursors in the knowledge bases.

Table 15.2: Sample Phenomenon-driven Contributions in PDR Phases 1 and 2 for Scaled Agile Organizations

Source: Own Representation

PDR activity	Selected Ω-knowledge contributions & type
1. Distinguish	*Phenomena (utilized & refined)*: Scaled Agile organizations (bi-modal agile and traditional as well as uni-modal agile), Scaled Agile management frameworks Phenomena (*contributed*): business organizations partially or solely comprised of SAP/ST teams instead of a functional organization with traditional hierarchies, Scaled Agile governance and business-IT alignment mechanisms
	Context (utilized & refined): organizations with digital products / services, strategic agility, business-IT alignment, IT governance
	Challenges (contributed): internal coordination within and between SAP/ST, coordination between SAP/ST and traditional IT / business units, strategic coordination between the SAP/ST and the organizational leadership
2. Explore	*Regularities (contributed)*: bi-modal IT as one instance of co-existence between SAP/ST and a traditional IT function, main areas of action for establishing a bi-modal IT organization, five archetypes of bi-modal IT organizations
	Context (utilized & refined): organizations with digital products / services in business / service / digital platform ecosystems, enterprise architecture
	Challenges (refined / contributed): integrating an ecosystem perspective to SAP/ST management and the whole organization, resource allocation to SAP/ST by the organizational leadership, measuring the business value contribution of SAP/ST and their products / services, handling architectural dependencies

Table 15.2 and 15.3 show an evolution from general phenomena (e.g., Scaled Agile organizations and frameworks) and challenges to additional phenomena (e.g., bi-modal IT) and challenges (e.g., value and ecosystem concerns) which were discovered across the first two steps. Afterwards, a research approach was configured that proved to be suitable to produce descriptive as well as prescriptive knowledge through appropriate coding of interview and focus group data. Subsequently, integrated and mutual reinforcing theorizing and design theorizing about descriptive and prescriptive knowledge about the main topics raised in the interviews and focus groups (portfolio management, enterprise architecture, organizational set-up, alignment & governance) took place. In the end, an overarching regularity (or pattern) of organizing for fluidity and change instead of organizing for stability was uncovered in the context of organizations with digital products and services in their business ecosystems who were striving for strategic agility. Moreover,

a set of seven paradoxes emerged that are specific to Scaled Agile environments with SAP/STs and supplant management challenges and paradoxes in traditional functional organizations. We assess the level of confidence for the resulting prescriptive knowledge as medium to high. The main limitation here is that in the scope of the research programme no re-application of the contributed design knowledge in the design of actual artefacts (i.e., solutions to challenges in specific organizations) had taken place.

Table 15.3: Sample Phenomenon-driven Contributions in PDR Phases 3 to 5 for Scaled Agile Organizations

Source: Own Representation

PDR activity	Selected Ω knowledge contributions & type	Selected Λ knowledge contributions & type
3. Design Research Approaches	N/A	Explorative qualitative interviews & focus groups with organizational stakeholders, additional interviews with external consultants, field visits of selected case organizations, grounded theory-inspired coding to develop descriptive as well as prescriptive knowledge.
4. Theorize & Design Theorize	*Regularities (contributed / refined):* three types of SAP/STs in organizations, IT governance in Scaled Agile frameworks, reconceptualization of enterprise architecture, business-IT alignment, and IT governance for organizations with SAP/STs *Context* (*refined*): Scaled Agile organizations in digital business ecosystems	*Design knowledge (contributed):* meta-requirements and design principles for portfolio management, enterprise architecture management, alignment, and governance in organizations with SAP/STs
5. Synthesize & Reflect	*Regularities (contributed)*: adopting strategic agility leads to organizing for fluidity and change instead of organizing for stability *Emerging challenges (contributed)*: seven paradoxes (four on the team level, three on the organizational level) that Scaled Agile organizations with SAP/STs may have to cope with	*Patterns across the contributed design knowledge:* organizations shall strive for external continuous value and customer-orientation as well as internal continuous adaptability, innovation and synergies *Design knowledge fitness*: ascertained through expert interviews, focus groups and field visits *Design knowledge projectability*: limited to organizations with SAP/STs in digital business ecosystems *Design knowledge confidence*: medium to high based on # of interviews, extent of regularities, and theoretical saturation achieved

Among these contributions, we would like to highlight the seven paradoxes for Scaled Agile organizations (Horlach and Drechsler 2020) which arose towards the end of the research programme out of a deeper problematization of the previously identified challenges. A sole focus on the Scaled Agile organizations phenomenon in the original PDR spirit – i.e., without an explicit attention on understanding and addressing the corresponding emergent challenges – would likely not have enabled us to achieve the necessary level of insight to outline the paradoxes.

15.5 Example 2: Meta-requirements and Design Principles for Positioning Digital Innovation Units in Incumbent Firms

Analogous to the example discussed in the previous section, we now demonstrate the proposed research approach in another research programme in the context of the phenomenon of positioning DIUs in firms for fostering their (digital) innovation capacity (Raabe et al. 2020b; Raabe et al. 2020a; Raabe et al. 2021a). Again, little was known about the phenomenon of DIUs and specifics of related challenges for organizations at the start of the research programme, and the research approach shown in Figure 15.1 proved again suitable to guide subsequent investigations, leading to the insights summarized in Table 15.4 and 15.5 below.

In short, DIUs represent dedicated organizational agile units that work across firm boundaries and strive to foster digital innovation activities in incumbent firms. Many DIUs are currently established or in the process of being established in numerous firms, but (design) knowledge about these agile units and their integration is still scarce. In addition, the large number of established DIUs is accompanied by many multifaceted challenges described in press that need to be tackled. With this in mind, the researchers in this project analyzed DIUs in-depth and defined generic meta-requirements as well as design principles for DIUs to address a firm's (digital) innovation capacity. The meta-requirements and design principles are considered a kind of abstract blueprint for establishing DIUs in firms in the long term. Table 15.4 and 15.5 summarize key findings from this research programme, again sorted by the five phases and five knowledge contribution types of Figure 15.1.

Table 15.4: Sample Phenomenon-driven Contributions in PDR Phases 1 and 2 for DIUs

Source: Own Representation

PDR activity	Selected Ω knowledge contributions & type
1. Distinguish	*Phenomena (utilized & refined)*: Agile innovation units, (digital) innovation management approaches and frameworks *Phenomena* (*contributed*): definition and differentiation of DIU archetypes and their embedding in incumbent firms
	Context (utilized): digital products and service innovations, agility
	Challenges (contributed): rejection of digital innovations in firms, tensions between DIUs and other business units, complex handover scenarios of digital innovations
2. Explore	*Regularities (refined & contributed)*: status quo of addressed digital trends and types within DIUs
	Context (utilized & refined): digital innovation management (including digital products, services, processes, and business models), DIUs as an instance of a bimodal IT archetype
	Challenges (refined / contributed): visualizing a shift from an intra-organizational towards an inter-organizational ecosystem perspective, different terms or labels for DIUs with various tasks & activities

Table 15.5: Sample Phenomenon-driven Contributions in PDR Phases 3 to 5 for DIUs
Source: Own Representation

PDR activity	Selected Ω knowledge contributions & type	Selected Λ knowledge contributions & type
3. Design Research Approaches	N/A	Explorative qualitative interviews with organizational stakeholders, additional interviews with external consultants; social media submission analysis, qualitative meta-analysis with inductive/deductive coding techniques to create descriptive as well as prescriptive knowledge
4. Theorize & Design Theorize	*Regularities (refined):* Prerequisites for a successful DIU foundation *Context (refined*): digital innovation management, digital innovation ecosystems, DIUs as an extension of a bimodal IT archetype, focused on exploration (ambidexterity)	*Design knowledge (contributed)*: Meta-requirements and design principles for DIUs, best/good practices for setting up DIUs focused on digital product innovations, taxonomy for digital accelerators/incubators, dynamic capabilities needed or realized in DIUs
5. Synthesize & Reflect	*Regularities (contributed)*: Various objectives and tasks lead to a two-fold approach for DIUs to focus on: a firm's problem-based selection of digital innovations vs. a digital innovation-driven change of the firm	*Patterns across the contributed design knowledge:* pathways/blueprint for establishing and positioning DIUs in firms *Design knowledge fitness:* ascertained through expert interviews *Design knowledge projectability:* industry-independent but limited to large incumbent firms with legacy IT functions / information systems *Design knowledge confidence:* medium based on # of interviews, the understanding of the phenomenon, and the extent of regularities

Table 15.4 and 15.5 show the emergence of the embryonic phenomenon of DIUs in incumbent firms. In the first two steps, the researchers distinguished various archetypes of DIUs (e.g., incubators or trend screening units) as well as multifaceted challenges that may lead to failure of DIUs (e.g., conflicts between Chief Information Officers and Chief Digital Officers). Subsequently, a research approach was configured and refined to produce Ω and Λ-knowledge through appropriate coding of interview data. Analogous to example 1,

integrated and mutual reinforcing (design) theorizing about the main aspects raised in the interviews (digital innovation management, business-IT alignment, bimodal IT function, and organizational design) took place afterwards. Subsequently, overarching pathways and principles for establishing and positioning DIUs in incumbent firms were uncovered. These can assist firms to innovate by fast-integrating digital products, services, processes, and business models. We assess the level of confidence for the resulting prescriptive knowledge as medium, mainly because in the scope of the research programme, equivalent to example 1, no re-application of the contributed design knowledge in the design of actual artefacts (i.e., establishing DIUs in a real scenario setting) had taken place.

15.6 Discussion and Conclusion

In this paper, we extend phenomenon-driven research (PDR) by integrating it with design science research (DSR). While the main five PDR activities stayed the same, each activity gained an additional perspective on 1) either understanding novel practical challenges associated with the novel phenomena PDR is concerned with or 2) contribute prescriptive or design knowledge about how to address these challenges. Such knowledge can encompass entire solutions or just design requirements and corresponding principles that are already effective in specific practical contexts and are now codified in an abstracted way to be potentially applicable to other contexts. Other ways of deriving prescriptive knowledge can be more traditional DSR work that draws on the gained understanding of regularities and potential other extant design knowledge for other contexts and produces novel artefacts to address the identified challenges.

The integrated nature of our proposed extension to traditional PDR thus opens up the potential for PDR to contribute prescriptive knowledge to the human knowledge bases in addition to 'just' descriptive, explanatory, and predictive knowledge. Our extension thus enhances the knowledge contribution potential of any PDR endeavor following our integrated approach. On the DSR side, our research approach starts before one might be even aware of specific problems and challenges associated with a novel phenomenon and allows a seamless pivoting towards design-oriented research once such challenges are identified. In the terms of Figure 15.1, a traditional DSR approach would start with step 3.

Researchers undertaking PDR or DSR will most likely be already aware that increasing knowledge about emerging phenomena and solution to extant challenges will almost always be a knowledge journey, and we recommend taking an even more open mind

throughout and actively searching for additional unplanned research opportunities for either research mode, even if it means switching the primary directions of inquiry from explanatory to design-oriented directions or vice versa. Ultimately, an integrative perspective on the production of descriptive as well as prescriptive knowledge about novel phenomena promises to have synergies that result in higher overall contribution potential than a sole focus on either knowledge type (Seidel and Watson 2020). For instance, such deeper insights in our first example enabled us to derive seven potential paradoxes that Scaled Agile organizations face.

A second benefit of our approach goes beyond knowledge contribution and concerns the practical impact of research. Practitioners in a VUCA world face many unprecedented challenges. Sometimes these challenges are created by forces outside their control, but sometimes they are created by the practitioners themselves when experimenting with novel management approaches (such as applying Scaled Agile approaches or establishing DIUs) – especially as "most management practices create their own nemesis" (Clegg et al. 2002, p. 491). Simultaneously, if effective, these novel approaches may be the source of competitive advantages and the practitioners on their own may be reluctant to widely share their unique solutions. In contrast, neutral researchers are uniquely positioned to capture these first-movers' deeds and experiences (effective and ineffective). Researchers can further – and potentially across several organizations – distil the essence of effective and ineffective approaches and disseminate this practical knowledge in aggregated form back to interested practitioners, along with a refined understanding of the phenomena and challenges themselves. The promise of anonymity and otherwise lack of traceability, combined with the potential to receive useful insights and recommendations about latent or extant novel challenges may be a powerful motivation for practitioners to take part in PDR studies, especially those studies that can advertise to develop both descriptive and prescriptive knowledge right from the start. By following our proposed approach, researchers can thus achieve both relevant and interesting academic knowledge contributions as well as a notable impact in practice. Researchers also may have an easier time recruiting first-mover practitioners as participants in their research studies in the process.

Future research on our proposed approach can shed additional light on the interplay between descriptive and prescriptive knowledge when (design) theorizing novel phenomena, or on other potential synergies between understanding and design-oriented research activities in such a context. Moreover, analyzing published IS papers on novel phenomena and related challenges through the lens of our approach can shed light on gaps

that extant research has left unexplored, or problematize the result of an (oftentimes) single focus on either explanatory or prescriptive knowledge contributions. Furthermore, there are other design, action, or impact-oriented research approaches such as Canonical Action Research or Action Design Research. Since these also have an integrated perspective on understanding and designing, it appears promising to explore their connections to our extended PDR approach as well. Lastly, future research is more than welcome to apply and refine the approach themselves while contributing all forms of knowledge about novel phenomena to the knowledge bases.

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A Appendix

A.1 Meta-Requirements and Design Principles for Digital Innovation Units: A Longitudinal Investigation

Under Review: Raabe, J.-P., Horlach, B., and Schirmer, I. 2022a. "Meta-Requirements and Design Principles for Digital Innovation Units: A Longitudinal Investigation," *European Conference on Information Systems (ECIS)*.

Abstract: Many incumbent firms establish so-called Digital Innovation Units (DIUs), which represent – despite ambivalent views on their success – novel, dedicated organizational units aimed at fostering digital innovation. Utilizing a pluralistic research approach, we draw on empirical data from a longitudinal single-case study as well as on extant DIU literature to develop meta-requirements and design principles for DIUs. By identifying five distinct phases, in which DIUs are used strategically in different ways, we connect the principles with these phases. Hence, we contribute DIU design knowledge, which may assist researchers and practitioners in establishing and positioning DIUs in the long term. Further, differentiating between digital innovation types, our long-term investigation reveals an ambidextrous trend concerning "exploration/exploitation" oscillation: While digital business model innovation tends to be managed structurally separated with no touchpoints to the main organization, digital product/process innovation seems contextually integrated being in the responsibility of all employees.

Keywords: Digital Innovation Unit, Meta-requirements, Design Principles.

A.1.1 Introduction

"Successful companies in the digital economy will be digital (to provide customer value) and digitized (to provide for scale and efficiency)." (Ross 2017)

High uncertainties, global competition, or complexity are just a few challenges that compromise a firm's success (Sambamurthy et al. 2003a; Teece et al. 2016). Today, becoming "digital" and "digitized" seems to be a necessity to withstand potential disruption. Digital transformation – "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing,

communication, and connectivity technologies" (Vial 2019, p. 118) – has emerged as a nascent, but crucial phenomenon for practitioners as well as for information systems (IS) researchers (Bharadwaj et al. 2013; Vial 2019). As many firms "operate in a world that is increasingly permeated with digital technology" (Yoo et al. 2012, p. 1398), digital transformation induces digital technologies to define or redefine a firm's value proposition (Wessel et al. 2021). Especially the diffusion of digital technologies has caused and is causing fundamental changes in incumbent firms (Fichman et al. 2014). The usage of digital technologies for innovation purposes has led to a new class of innovation: digital innovation (e. g., Fichman et al. 2014; Nambisan et al. 2017; Yoo et al. 2010; Yoo et al. 2012). Digital innovation encompasses, amongst using digital technologies during the innovating process, the result of such a process (Nambisan et al. 2017). Managing digital innovation, however, poses a crucial task with high opportunities that confront incumbent firms with a variety of ways to address. The dilemma lies in reacting quickly to market changes and unpredictable situations while improving their existing day-to-day business. Firms need "the ability to pursue both efficiency and flexibility while balancing exploitation and exploration" (Park et al. 2020, p. 1376). "[B]eing ambidextrous is imperative to companies' short-term performance and long-term survival" (Wang and Rafiq 2014, p. 72). However, despite being the subject of diverse discussions in IS research, achieving organizational ambidexterity is a difficult task and firms struggle to realize such a setting, especially due to the competing tensions between exploitative and explorative modes (Park et al. 2020). It can be accomplished (1) *structurally*, by establishing dedicated units for exploration and exploitation (O'Reilly and Tushman 2013; Tushman and O'Reilly 1996), (2) *sequentially,* by shifting these modes over time (Duncan 1976; O'Reilly and Tushman 2013), (3) *contextually*, by letting individuals decide how they allocate their available time between modes (Birkinshaw and Gibson 2004; O'Reilly and Tushman 2013), or (4) *temporally,* by connecting structurally separated modes with a temporary transfer of individuals (Holotiuk and Beimborn 2019). Interpreting this temporary transfer of individuals as a contextual activity for individuals, the latter intimates a combination between the structural and contextual mode, which induces hybrid ambidexterity for firms (Göbeler et al. 2020; Jöhnk et al. 2020) and shows a firm's necessity of rebalancing resources, capabilities, or ambidextrous settings as a whole dynamically over time (Dixon et al. 2017).

For realizing hybrid ambidextrous settings, "[d]ifferent forms of organizational entities are conceivable and partially implemented in practice: the options commence with cross-functional IT-related project teams to work on a temporally limited task, continue with

distinct organizational units such as digital innovation labs and departments named 'digital transformation', and end with predominantly externally organized digital incubators and accelerators" (Alt et al. 2020, p. 619). We refer to all these nascent phenomena as Digital Innovation Units (DIUs). They represent dedicated organizational units that work across firm boundaries and strive to foster digital innovation activities in incumbent firms. Not exploitation but exploration is the central responsibility of a DIU (Fuchs et al. 2019; Hund et al. 2019). In IS research, DIUs have been analyzed for example under consideration of loose-tight-coupling (Barthel et al. 2020a), knowledge recombination (Hund et al. 2019; Iho and Missonier 2021), performance (Haskamp et al. 2021c; Mayer et al. 2021), bimodal or multimodal IT (Raabe et al. 2020a), or (IT) ambidexterity (Göbeler et al. 2020; Holotiuk 2020; Holotiuk and Beimborn 2019; Jöhnk et al. 2020). Authors analyzed their characteristics, their value contributions within firms, or defined different setups that focus on different types and degrees of digital innovations (e.g., Barthel et al. 2020a; Göbeler et al. 2020; Jöhnk et al. 2020; Raabe et al. 2021a). These perspectives help to understand existing DIUs in their current state. Despite all this, we suppose that one crucial aspect has not been analyzed and is lacking so far. DIUs usually have strong ties to their main organizations. If, for example, the strategy of the main organization changed, it would significantly influence DIUs and their settings. Current research on DIUs is rather static and neither shows their evolution nor their dynamic interactions with the main organization. The evolutionary strategies described by Raabe et al. (2020a) provide insightful mechanisms about the dynamics of DIUs, but longitudinal analyses are still lacking to understand how DIUs evolve. Further, to analyze the dynamics and evolution of DIUs, we believe that the transformation of the entire firm as a whole must be considered.

In general, research on DIUs remains scarce, both regarding knowledge describing practices as well as prescriptive design knowledge (Chandra et al. 2015) assisting in establishing and positioning DIUs to strengthen an entire firm's innovation capacity in the long term. We strive to address this research gap by providing conceptually and empirically validated (design) knowledge using a pluralistic research approach utilizing Iivari's (2015) "Strategy 2". We highlight phases, in which DIUs are used strategically, define generic meta-requirements, as well as phase-dependent DIU design principles (Chandra Kruse et al. 2016). Thus, we define the following research question (RQ):

RQ: What are meta-requirements and design principles for Digital Innovation Units?

We answer the RQ by defining eleven design principles for DIUs based on four meta-requirements. Further, we illustrate five phases of a single case, in which DIUs participate

in. We contribute to research on DIUs by providing nascent (design) knowledge (Gregor and Hevner 2013) to address the crucial real-world issue of improving a firm's innovation capacity with DIUs. The remainder of this paper is structured as follows: Section A.1.2 provides an overview of related research on DIUs. Section A.1.3 describes our research methodology. Section A.1.4 contains the description of our case "RetailCo". Section 5 covers the identified phases, in which DIUs are used strategically, and our defined meta-requirements for DIUs. We connect the design principles and meta-requirements in Section A.1.6. We discuss the results of our research, its contributions, and conclude with limitations and an outlook in Section A.1.7.

A.1.2 Related Research on Digital Innovation Units

For incumbent firms, innovation, in general, has always been a challenging task. But, in today's business environment, becoming "digital" (amongst being "digitized") is a key factor for success (Ross 2017), as digital innovations differ significantly from non-digital innovations (Yoo 2010). Digital innovations show specific characteristics, for example referring to Moore's law or network effects (Fichman et al. 2014), that require full attention, time, and budget (Barthel et al. 2020a). To fulfill these conditions, firms tend to establish units that explicitly focus on digital innovations. DIUs, sometimes referred to as digital innovation labs (Holotiuk and Beimborn 2019), digital units (Fuchs et al. 2019), or digital transformation initiatives (Jöhnk et al. 2020), offer a promising way to fulfill these conditions. These dedicated units provide space for creative, interdisciplinary work, and collaboration, as well as for cooperation between incumbent firms, start-ups, and academia to successfully deal with digital innovations (Barthel et al. 2020a; Mayer et al. 2021; Raabe et al. 2020b). DIUs operate autarchic in terms of location, thinking, collaboration, or communication (Holotiuk and Beimborn 2019). They consist of a group of employees separated from the main organization (Raabe et al. 2020a) concentrating resources on digital innovation, managing the digital transformation agenda (Jöhnk et al. 2020), or taking responsibility for the (re-)integration of digital innovations into the main organization (Barthel et al. 2020a; Haffke et al. 2016; Raabe et al. 2021a). In general, DIUs are differentiated between various archetypes and may coexist within incumbent firms (Jöhnk et al. 2020). DIUs are differentiated by various characteristics: the type of digital innovation, their market focus, the degree of change, or the importance of internal as well as external stakeholders (Fuchs et al. 2019; Raabe et al. 2021a). Table A.1 lists our identified archetypes of DIUs by Barthel et al. (2020a), Göbeler et al. (2020), Jöhnk et al. (2020), and Raabe et al. (2020a) based on the named characteristics. Digital innovation types may vary

between digital products, digital processes, and digital business models (Fichman et al. 2014). The degree of change can be distinguished between incremental (Christensen 1997) and radical innovations (Dahlin and Behrens 2005). The market focus is differentiated between already existing business areas that are close to the current business model of an incumbent firm (C-BM) and a completely new business model (N-BM). The importance of partners and internal ties are specified by none, low, mid, or high.

Table A.1: Archetypes of DIUs and Their Characteristics

Source: Own Representation

		Characteristics				
Authors	Archetypes	Digital Innovation Type	Degree of Change	Market Focus	Imp. of External Partners	Imp. of Internal Ties
Barthel et al. 2020a	Internal Facilitator (IntFac)	Processes	Not defined	C-BM	None to Low	High
	External Enhancer (ExEnh)	Business Models	Radical	C-BM	Not defined	Mid to High
	External Creator (ExC)	Business Models, Products	Radical	N-BM	Not defined	Low to Mid
Göbeler et al. 2020	Active Engagement (ActEng)	Processes, Products	Radical	Both	Not defined	High
	Passive Enablement (PasEna)	Not defined	Incremental	Both	High	High
Jöhnk et al. 2020	Digital Unit (DigU)	Business Models, Products	Radical	Both	Not defined	Mid to High
	Digital Incubator (Inc)	Business Models	Radical	N-BM	High	None
	Cultural Change Program (CulChaP)	Not defined	Not defined	Not defined	High	High
Raabe et al. 2020a	Coaching & Screening (C&S)	Products	Radical	Both	Mid to High	High
	Center of Excellence (CoE)	Business Model, Products	Radical	Both	High	High

Further, current archetypes have one crucial point they do not address: Although the authors imply a connection between the archetypes and highlight possible concurrent

appearances, evolutionary pathways have not been stated. These studies were static and miss a dynamic viewpoint. Such a dynamic view is particularly important as challenges are increasingly described (e.g., Raabe et al. 2020b) that affect the realization of DIUs and their ties to the main organization. Although measures are already mentioned that may circumvent and overcome these challenges (e. g., Svahn et al. 2017), the focus is on the DIUs and their problems, not on those of the DIU and the incumbent firm as a whole. Metaphorically speaking, it is not the individual puzzle piece that should be considered, but the entire jigsaw puzzle as well as puzzling it. By analyzing realized concurrent DIU settings over time, we see great potentials that may assist researchers and practitioners in strengthening an entire firm's innovation capacity in the long term.

A.1.3 Research Methodology

Novel emerging phenomena require explanation-oriented research to understand, explain, and predict their nature. However, these phenomena also lead to emerging challenges, for which no (prescriptive) knowledge is currently available. These challenges might be addressed through design-oriented research made to contribute and refine novel design theories and entities (Drechsler and Hevner 2018). Thus, it is at this intersection that we see a fruitful way of applying a pluralistic research approach "oscillating" between behavioral and design science research (Seidel and Watson 2020). While the longitudinal investigation maps onto behavioral, phenomenon-driven research (Krogh et al. 2012; Schwarz and Stensaker 2016), prescribing design knowledge (meta-requirements, design principles) maps to the traditional realm of design science research. Therefore, our research is oriented to Iivari's (2015) "Strategy 2"-approach striving to generalize a real system implementation into meta-requirements and design principles. To fulfill Iivari's (2015) "Strategy 2", we applied the six-step design research methodology proposed by Peffers et al. (2007), as it seemed promising to address RetailCo's challenge of orchestrating its DIUs since they have been established rather arbitrarily and not positioned according to any pattern. Figure A.1 shows the research phases, our conducted activities, and outcomes within each phase.

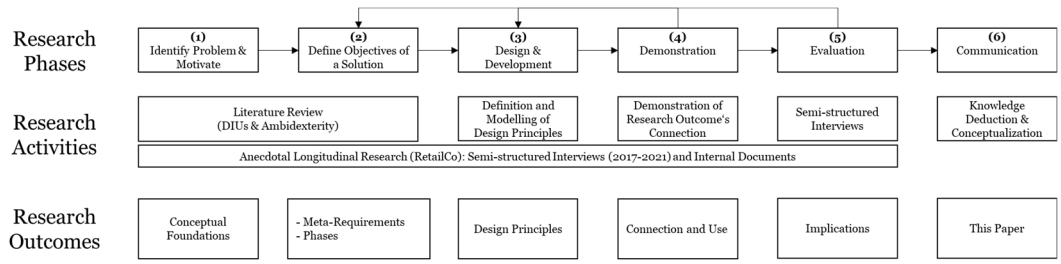

Figure A.1: Research Phases, Activities, and Outcomes
Source: Own Representation (Based on Peffers et al. 2007).

For the **(1) Identify Problem & Motivate** and **(2) Define Objectives of a Solution** phase, our activities include a rigor literature review on DIUs as well as an anecdotal longitudinal research approach that gives us great insights into organizational changes and an (occasional) base for new theory (Miller and Friesen 1982). We followed RetailCo's journey towards a stronger platform-based e-commerce strategy and obtained strong ties to RetailsCo's managers to conduct interviews with experts as well as to access internal records. We supplemented these data sources with lecture presentations, news articles, blog entries, and press releases to reconstruct and understand RetailCo's DIU strategy within the last 10 years. The anecdotal longitudinal approach allows us to utilize "real insights into *how* organizations make decisions, adapt to their environments, enact new environments, and restructure themselves" (Miller and Friesen 1982, p. 1016). Two authors conducted multiple interviews with 15 RetailCo employees in the period of 2017 to 2021. Subjects included CEOs, CIOs, CDOs, Strategic Business Developers, Innovation Management Leads, an Enterprise Architecture Management (EAM) Lead as well as DIU Leads of RetailCo and its subsidiary firms (S1 to S15). In the following chapters, we will provide some exemplary quotes from the interview participants, which further support our findings. We refer to and cite these as follows: (*Interviewee Position, RetailCo or Subsidiary Sx, Year of Interview*). Each interview followed a predefined semi-structured interview guide, which included the current state of explorative and exploitative activities (referring to structural, sequential, and contextual ambidexterity), collaboration with DIUs (referring to temporal ambidexterity), feedback on DIUs in general (success stories and challenges) as well as future objectives for fostering the innovation capacity (referring to achieving and realizing ambidexterity in general). In total, our utilized 23 interviews lasted 55 to 122 minutes. We transcribed the material and used a qualitative content analysis approach (Schreier 2014). Following Flick (2018), we conducted an iterative open coding approach, in which we derived codes out of our interview material deductively and inductively. Our coding scheme consists of 16 codes covering e.g., foci and objectives of DIUs, the

collaboration of DIUs and their incumbent firm, collaboration challenges, or explorative or exploitative tasks of DIUs within digital innovation stages. Utilizing the results of the extant literature review and our anecdotal longitudinal research approach, we define five distinct phases of RetailCo, as well as four generic, phase-independent meta-requirements of DIUs that represent the predominant objectives of our solution. "The first component of a design theory dealing with the product of design is a set of meta-requirements which describe the class of goals to which the theory applies" (Walls et al. 1992, p. 42). Meta-requirements are especially suitable since a requirement (without "meta") "does not address a single problem but a class of problems" (Walls et al. 1992, p. 42). In our case, one specific single problem suits to and can be seen as one specific phase of RetailCo, in which DIUs participate in. Thus, meta-requirements as a core component of an IS design theory apply generic as well as phase-independent and specify the purpose and scope (Jones and Gregor 2007) or boundaries (Dubin 1978).

As part of the **(3) Design & Development** phase, we relied on our gathered data and connected the five phases as well as the four meta-requirements by instantiating eleven phase-dependent design principles. "Design principles […] represent knowledge that is codified, explicit knowledge, readily accessible as prescriptive statements" (Chandra Kruse et al. 2016, p. 39) and depicts "not only innovative artifacts but also knowledge about creating other instances of artifacts that belong to the same class" (Sein et al. 2011, p. 39). Since "[d]esign principles must be understood in relation to the (often novel) contexts in which they are used" (Chandra Kruse et al. 2016, p. 39), they fit our dynamic, longitudinal view including phases, in which DIUs participate in and especially change. We follow Chandra et al.'s (2015) proposition of design principles to ensure consistency, clarity, and concision.

For testing theoretical design propositions (Jones and Gregor 2007), we assess our theoretical design in the **(4) Demonstration** phase by connecting and showing relations between meta-requirements, design principles, and DIU archetypes through deductive logic (Gregg et al. 2001; Hevner and March 2003).

Our **(5) Evaluation** follows the sketched cyclic high-level process incorporating the *design-evaluate-construct-evaluate pattern* for design science research artifacts introduced by Sonnenberg and vom Brocke (2012). This pattern suggests several episodes of *ex-ante* and *ex-post* (*formative* and *summative*) evaluations. Our evaluation consists of three activities (Eval 1 to Eval 3, see Figure A.2). The urge for our research is given in current literature on DIUs, which describes diverse, multifaceted, and sometimes competing challenges of DIUs

that may lead to a DIU's failure (Eval 1). We steadily collected feedback on our defined phases, meta-requirements, and design principles while conducting expert interviews at RetailCo (Eval 2). We showed each participant possible descriptions of these early versions and constructed our final conceptual model(s), which are shown within the next sections. Our validated design specifications have been *ex-post* evaluated (*summative*) with RetailCo's EAM Lead and seven external experts (not employed at RetailCo) to achieve validation for proof of applicability. Following Prat's (2015) evaluation criteria, we strive to gauge the utility, feasibility, generality (*goal*), completeness, simplicity, and understandability (*structure*), scalability as well as adaptability (*evolution*) of our proposed meta-requirements and design principles. The external experts included a CEO and a DIU Lead of a large reinsurance firm, two strategic management principal consultants of a large enterprise software developer, and three individual DIU leads within the insurance, public transport, and health industry.

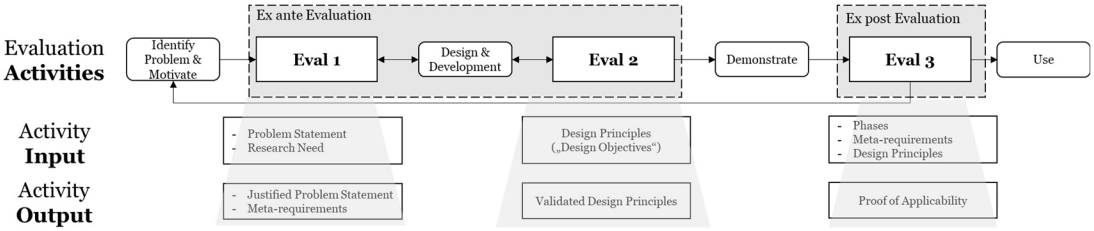

Figure A.2: Performed Evaluation Activities
Source: Own Representation (based on Sonnenberg and vom Brocke 2012).

To fulfill the **(6) Communication** phase, we publish our research through this paper.

A.1.4 Case Description: RetailCo

RetailCo (pseudonymized) is a large incumbent multidivisional retailer with diverse subsidiaries, having its headquarters located in Europe. Figure A.3 depicts the various DIU implementation options RetailCo pursued within the last decades and shows its path of positioning multiple DIUs concurrently. It operates in all G20 (Group of Twenty) countries and employs several thousand people. RetailCo's organizational design is decentralized, which provides all subsidiaries with high autonomy, strong decision-making, and various degrees of freedom. The main field of activity includes the Business2Consumer (B2C) area. In the past, RetailCo struggled to establish an intact and holistically designed digital transformation strategy, which led to a sharp drop in profits that resulted in massive job cuts from 2010-2014. Since 2015, RetailCo is reorganizing its physical and analog retailer model towards a digital platform model (value streams: *"streams of goods"* towards

"information stream"). The success can be seen: Today, RetailCo's business model is flourishing again. Sales have increased by almost a third compared to 2020; the number of customers is constantly increasing. Many arguments point in the direction of the reorganization having caused this success. While becoming "digitized" is part of a subsidiary's task, RetailCo established a big picture with diverse capability foci, including "(Digital) Innovation" as one strategic core capability. This dedicated capability unit is responsible for all strategic concerns related to digital transformation especially in becoming "digital" (Ross 2017). The strategic core capability initiatives consist of expert teams that are available as a point of contact for all subsidiaries. This initiative includes various DIU archetypes that evolved and dissolved over time.

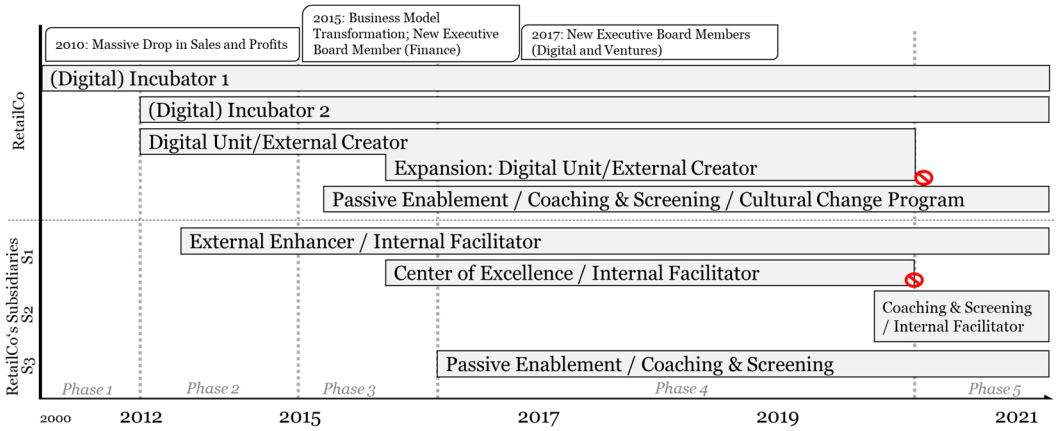

Figure A.3. RetailCo's Path of Positioning and Implementing DIUs
Source: Own Representation

Amongst central digital innovation expert teams, several subsidiaries have also realized their own DIUs with different foci and unique characteristics to achieve organizational ambidextrous settings, particularly hybrid in terms of fostering efforts for structural, contextual, or even temporal ambidexterity. Amongst DIU initiatives pursued by RetailCo itself, its largest and highest turnover subsidiaries S1 to S3 implemented their own dedicated units and are also depicted. Based on the objectives and areas of activity of each DIU, the first and second authors mapped the established DIUs at RetailCo with the archetypes listed in Table A.1. The prohibited signs indicate the dissolution of a DIU. In this figure, we already reveal the phases with dashed lines, which will be further explained in the following section.

A.1.5 Phases and Meta-Requirements for Digital Innovation Units

We identified five phases, in which DIUs had a major role in strengthening RetailCo's way of becoming "digital" and "digitized" and show the efforts for achieving ambidexterity in

each phase. Further, we define generic meta-requirements for setting up DIUs that may be understood as a prerequisite for DIUs, independent of the phases. We describe the five phases and the meta-requirements in detail within the sub-sections.A.1.5.1 RetailCo's Five Digital Innovation Phases, in which DIUs Participate

A.1.5.1 RetailCo's Five Digital Innovation Phases, in which DIUs participate

Around 2000, RetailCo started and founded an early-stage still active investment program, which manages five international funds. This digital incubator's investment amount is up to 10 million €; funds last for a period of up to ten years. We refer to this first phase (< 2012) as "**Business Model Beacon**", since it shows RetailCo's initial DIU implementation and highlights its cornerstone of a DIU strategy. This digital incubator has a strong digital business model focus, operates independently, and has no connections to RetailCo at all, which illustrates RetailCo's efforts of achieving a fully structural ambidextrous setting for digital business models.

Due to a sharp drop in profits that resulted in vast job cuts, RetailCo recognized the importance of transforming its current physical and analog retailer business model (Phase 2: "**Digital Innovation Awareness**" (2012–2014)). Not knowing in which direction RetailCo should be transforming, RetailCo expanded its DIU strategy by implementing two additional DIUs both with a particular business model focus in 2012. Amongst another digital incubator concentrating on the European market, RetailCo started a new DIU, introducing the hybrid Digital Unit/External Creator archetype: *"[RetailCo DigU/ExC] sees itself as an alternative to previous [digital incubator models]: Instead of merely financing startups, we offer founders the opportunity to advance their ideas and generate innovations. The special thing about this is that founders and startup employees are employed by [RetailCo] so that they can concentrate fully on the product and building up the company."* (CEO, RetailCo DigU/ExC, 2014). This business problem-based approach (Raabe et al. 2021a) of a DIU has ties to RetailCo's business units and thus opens the doors for possible intraorganizational as well as interorganizational collaboration mechanisms. "*With its concept, [RetailCo DigU/ExC] promotes collaboration among firms to benefit from shared experiences in direct exchange*" (CEO, RetailCo DigU/ExC, 2017). RetailCo's subsidiary S1 initiated an external/internal facilitator unit: "*At the end of 2012, we set up an innovation management unit together with [S7]: With a truly structured innovation process, innovation roadmap and pipeline. With various methods that we have also tried out over the years, especially for idea development. [...] If it's really about innovation and in the direction of new business models, then we are the appropriate department for that.*

We screen the market for startups, which is a very important area for us." (Strategy and Innovation Management Lead, S1, 2018). Amongst a fully structural ambidextrous setting for digital business models pursued by RetailCo's two digital incubators and its subsidiary's DIU, its DigU/ExC initiative strengthens contextual activities (employees of RetailCo working and assisting within the DIU) as well as enables a structural mode, which initiates a temporal ambidextrous setting for business model innovations at RetailCo.

In 2015, the golden age of dedicated digital innovation activities began, which is why we refer to this phase 3 as "**DIU Appreciation**" (2015). With the kick-off of a holistic corporate-wide business model transformation from a physical and analog retailer model towards a digital platform e-commerce strategy, the power and influence of the DIUs were further expanded. Due to the great expectations of the DigU/ExC unit, it has received a massive infusion of capital in 2015. DigU/ExC became the holding firm for digital retail-related firms and is responsible for all key digital service startups within RetailCo. Further, RetailCo established a new mixture of a PasEna/C&S/CuChaP DIU: "*The mission of our unit is screening, evaluation and, piloting of digital technologies along the e-commerce value chain. We are primarily responsible for business development and consulting […]. After screening, we have a partially self-developed evaluation framework that is simplified a cost-benefit analysis for RetailCo and its subsidiaries. It's about the scope and also to find out what the economic potential is behind the solution.*" (Innovation Management Lead, RetailCo PasEna/C&S/CuChaP, 2018). In addition to the ambidextrous initiatives for business models, the "DIU Appreciation" phase also focuses on the screening and prioritization of digital products and processes within DIUs. This shows the enablement of a structural mode, which initiates a hybrid ambidextrous setting for the digital business model as well as the discovery of product and process innovations at RetailCo.

The many undertakings to promote new digital innovations emphasize RetailCo's and its subsidiaries' "**Urge of Digital Innovation Activities**" (2016–2019; phase 4). *"We made it quite simple and said that every employee has what we call an inspirational responsibility"* (CEO, S4, 2018). *"Who's responsible for digital innovation? Everybody is responsible for it!"* (CEO, S13, 2018). In 2016, Further DIU initiatives were launched that do not only focus on digital business models but also address the development and integration of digital products and processes. Amongst RetailCo's general DIU initiatives that assist all subsidiaries, S1 initiated a center of excellence/internal facilitator unit with a strong focus on digital products and internal processes to improve the current business model in 2016: "*We have a lot of digital expertise and experience at [DIU CoE/IntFac]. We invest a lot of*

time in learning from the people who act and in analyzing the contexts. Finally, there's this: We are all highly motivated to do things better – we don't give up at dead ends but get creative." (Head of DIU, S1, 2019). In phase 4, RetailCo had at least eight DIUs (covering eleven archetypes) implemented. By doing so, RetailCo achieved a strong ambidextrous setting for all digital innovation types. Despite all this, the large number of DIU initiatives also revealed a few side effects. The more DIUs were implemented, the higher the complexity was, which lead to a bunch of challenges that had to be tackled. Especially the collaboration between DIUs and RetailCo's (and its subsidiaries') business units proved to be more difficult than envisaged. Rejection, tensions between units, as well as complex handovers (integration) of digital products and processes accumulated. "*There's always a lot of talk about digital transformation, and it's nice when you can transform things, but the truth is that you can't transform some areas or some units. The New simply replaces the Old as hard as nails. That's true for business models, but it's also true for organizations."* (Head of DIU, S1, 2018). Although these statements may underpin and motivate a stronger contextual ambidextrous setting, hardly any instructions, specifications, or measurements were given on exploring and exploiting digital innovations at RetailCo. *"I think this [everybody's innovation responsibility] strongly suggests that generation of ideas/innovations is done by special functions and/or requires a special process. From my point of view, neither of these is the case in practice."* (CEO, S13, 2018).

RetailCo's new member of the board, responsible for "digital", recognized the serious challenges caused by the complex handovers between DIUs and business units, which affected and bothered the integration of digital products and processes. Thus, at the end of 2020, RetailCo dissolved its huge DigU/ExC program and strived to emphasize innovation activities within its subsidiaries contextually (Phase 5: "**Decentral Digital Innovation Responsibility**" (2020–Today)): *"In the future, we want to align our great expertise in innovation and new business models even more specifically and very closely to our respective successful business models […]. Our diverse activities in the start-up business [Inc1 & Inc2] remain unaffected […]"* (Member of the Board, RetailCo, 2020). Along with the RetailCo DigU/ExC unit, S1 dissolved its CoE unit due to the rising challenges and insufficient value contribution. *"The dissolution of the [DIUs] can be explained quite simply: the costs were higher than the profit. There were also various problems in the collaboration with RetailCo. This may perhaps be because RetailCo had not really defined a holistic corporate strategy and rather left the individual subsidiaries alone" (Head of EAM, S3, 2021).* Since 2020, shortly after the dissolution of RetailCo's DigU/Exc, S3 is

testing a new "Venture Client" model for its business units. "Venture Client" is seen as a promising concept highlighting a business unit's high responsibility of digital product and process exploration (amongst exploitation) in day-to-day business. "*Venture Client is suitable for working with startups at a very early stage and involving them in a real innovation project. This way, we quickly understand how well the technology fits and the startup understands how they can work with us*" (Business Development Manager, S3, 2020). RetailCo's new DIU strategy shows a bifurcation based on the type of digital innovations. While fostering digital business model innovations is strictly structurally ambidextrous with no links to RetailCo's business units, the responsibility of exploitation and exploration of products and processes is more fervently with the business units without any intermediate DIUs, which strive to settle digital products or processes.

A.1.5.2 Generic and Phase-independent Meta-requirements for DIUs

Any (digital) innovation originates from an idea that is perceived as useful (van de Ven 1986). Thus, DIUs need a way of motivating people to develop ideas. The dynamic interplay of participants, a DIUs environment, its facilitation, and resources highly influence inspiration to develop ideas (Fecher et al. 2018). These ideas may be completely new as well as improvements out of prior digital projects. Thus, our first meta-requirement calls to **enable physical and mental space for ideation** (**MR1**).

As idea generation may lead to large amounts of potential digital innovations that have to be evaluated, defining a systematic approach of idea selection is necessary. "*It is rather that the possibilities of innovations that are tangible around us far exceed what we can realize at all. We don't have a shortage of ideas, we have a shortage of ways to implement them."* (CEO, S13, 2018). *"Discovery is not particularly systematic at [RetailCo], but rather erratic […]. What is much more systematic is an adaptation of ideas that we find on the market. That is definitely our task amongst identifying ideas with a technology focus […]"* (Innovation Management Lead, RetailCo PasEna/C&S/CuChaP, 2018). Further, amongst the adaption of ideas, Raabe et al. (2020a) highlight the importance of monitoring digital innovation projects that have already been integrated into incumbent firms. S2's DIU strives to achieve this in near future: "*In purely theoretical terms, the task of the unit is to challenge the products again and again. In other words, just because you developed an app four years ago doesn't mean that it still has to be the best solution, but that other approaches may make more sense in the meantime. I don't think it's a matter of putting on blinkers […]"* (CDO, S2, 2019). Following the need of prioritizing and monitoring digital

innovation, our second meta-requirement summons DIUs to **ensure and assess the fit of currently available digital innovations in firms** (**MR2**).

Besides assessing current hypes, incumbent firms need to open their boundaries ("closed innovation"), since digital innovation causes a shift towards a stronger collaborative setting ("open innovation") (Nambisan 2013). This also applies to collaboration within a firm, as digital innovations may have an impact across business units or departments. "*It's simply that we try to include someone [from the business units] in the decision-making process […]. We hope to have these guys working full time on the project […]*" (Head of DIU, S1, 2019). For example, S4 and S5 collaborate with RetailCo's PasEna/C&S/CuChaP unit including guidance in digital technology assessment as well as assistance in cultural aspects like new ways of working: *"What I always like to use is the [digital innovation support's name] from [RetailCo's DIU], because it helps me*" (CEO, S6, 2018). In consequence, our third meta-requirement aims to **foster intra- or/and interorganizational collaboration (MR3**).

In addition to the successful implementation of digital innovation projects, the communication of such projects is a crucial component as well. A lack of transparency of these initiatives hinders awareness. Despite the importance of digital transformation projects, there is also resistance that may be solved by advertising or marketing mechanisms: "*That's where I build up pressure quite dully, so to speak. […] we just make a film where the advantages are presented again very nicely, put it on the intranet and so on, and the economic pressure that we have as a company also contributes to this in part. This increases the pressure on people, who say, I don't need it or no, I'll do it later. It's not nice. I don't enjoy it either, but that's how it is sometimes.*" (Head of DIU, S1, 2018). To proactively drive digital change, DIUs should assist in communicating digital innovation endeavors as well as being an information point for those who strive to initiate digital innovation projects. This leads to our final meta-requirement, which seeks to **make digital innovation initiatives transparent** (**MR4**).

A.1.6 Defining and Demonstrating Design Principles

Since we have specified the objectives of the solution by establishing four generic and phase-independent meta-requirements, we define eleven design principles as the principles (Chandra et al. 2015) that provide specific knowledge or guidance in terms of requirements on designing DIUs and demonstrate RetailCo's DIU.

Table A.2 lists design principles, their contribution to the overarching meta-requirements, and DIU archetypes fulfilling these principles. DIUs can have different characteristics, as already indicated by the multitude of described archetypes in research.

Table A.2: Design Principles, Meta-Requirements, and DIU Archetypes
Source: Own Representation

Meta-Requirements	DIU Design Principles (being acted upon)		DIU Archetypes
MR1, MR3, MR4	DP01	Provide an open forum or lab to employees who strive to participate in innovative endeavors	Inc, DigU, PasEna, C&S
MR4	DP02	Trigger communication of "digital" and "digitized" initiatives	IntFac, ExC, PasEna, C&S
MR2, MR3, MR4	DP03	Facilitate discourse with internal business units	ExtEnh, DigU, ActEna, PasEna, C&S, CoE
MR1, MR2, MR3	DP04	Provide collaboration touchpoints with external partners	Inc, PasEna, C&S, CoE
MR1, MR2,	DP05	Identify potential digital technology hypes suitable for current and new business models	C&S, CoE
MR2, MR3	DP06	Invest and participate in digital technologies or firms focusing on them	Inc, CoE
MR3, MR4	DP07	Guide in the context of agile	IntFac, PasEna, CulChaP, C&S
MR1, MR3	DP08	Represent a cultural mindset as a set of new rules	IntFac, PasEna, CulChaP, C&S
MR1	DP09	Enable employees to work with digital technologies	IntFac, PasEna, CulChaP, C&S
MR3, MR4	DP10	Test and produce digital artefacts	ExtEnh, DigU, ActEng, CoE
MR1, MR3, MR4	DP11	Organize and utilize acceleration programs	IntFac, PasEna, CulChaP, C&S

Closely connected to MR1, enabling ideation requires space that assists in getting creative. Providing an open forum or lab to foster participation in innovative endeavors represents a core requirement for DIUs (**DP01**).

Since firms need to understand the importance of digital transformation (Ross 2017), digital innovation initiatives, both "digital" and "digitized", need to be communicated to achieve a strong impact in firms. This involves both intra- as well as interorganizational communication. Amongst intraorganizational communication, interorganizational communication is crucial to enable the recruitment of digital talents, which may be

interested in working within a specialized setting that focuses e.g., on specific digital technology hypes (**DP02**).

Some DIUs work closely with business units to identify potential problems or provide solutions for working more effectively and efficiently. This includes complex handovers or integration mechanisms of digital innovations into an incumbent firm's business units. Thus, DIUs might facilitate discourse with internal business units (**DP03**).

Since "the locus of innovation moves outside of the boundary of a single design hierarchy" (Yoo et al. 2010, p. 732), searching and redeeming for (external) capabilities to develop and diffuse digital innovations (Selander et al. 2013) leads to stronger foci on external partners (and customers). Thus, DIUs may provide additional collaboration touchpoints with external partners, which may include collaboration with technology startups or other early ventures (**DP04**).

Many firms struggle to predict and understand the effects of potential digital technology hypes, which is why a systematic approach for assessing digital innovations is needed (Adomavicius et al. 2008). Subsequently, we highlight the need for DIUs to identify potential digital technology hypes suitable for current and new business models of an incumbent firm, which includes all types of digital innovation (**DP05**).

Recently, IS researchers argued the need to understand digital innovation ecosystems as a new organizational form, since they "can spawn countless innovations of substantial social and economic value, but are complex and prone to often surprising failure" (Wang 2021, p. 397). Following Raabe et al. (2021a), DIUs may invest and participate in digital technologies or in firms focusing on them by identifying and analyzing emerging ecosystems of digital innovation (**DP06**).

Researchers emphasize the high importance of an agile setting in DIUs (e.g. Barthel et al. 2020a; Göbeler et al. 2020; Holotiuk 2020; Raabe et al. 2020a). Since agility is considered a crucial prerequisite to successfully navigating through digital innovation ecosystems (Sambamurthy et al. 2003a; Svahn and Henfridsson 2012), DIUs should guide in the context of agile (**DP07**).

The same applies to further cultural aspects, e.g., new ways of working that include continuous learning approaches to adapt to high dynamic digital innovation malleability (Nylén and Holmström 2015). Therefore, DIUs may represent a cultural mindset as a set of new rules (**DP08**).

Based on and deeply connected to a continuous learning culture, DIUs should foster and qualify employees to acquire new digital capabilities (Nguyen et al. 2019b; Nylén and Holmström 2015), which is why DIUs should enable employees to work with digital technologies by building up digital expertise (**DP09**).

Many established DIUs in practice develop prototypes through design thinking workshops, test them with early user acceptance tests, and develop high fidelity prototypes or even minimum viable products (e.g. Barthel et al. 2020a; Raabe et al. 2020a). Subsequently, DIUs test and produce digital artifacts, which include digital business model, product, or process innovations (**DP10**).

Leading to our final design principle, DIUs are often in charge of motivating individuals to participate in innovation events (Raabe et al. 2020a). Prior research highlighted open innovation approaches to empower innovation ecosystems (e.g. Rehm et al. 2015), which assists in accelerating exploitative and explorative endeavors. Thus, DIUs may organize and utilize acceleration programs, e.g., through hackathons, which also assist in getting in touch with high potentials (**DP11**).

A.1.7 Discussion and Conclusion

Based on our findings, we derive implications for implementing DIU archetypes. We make transparent how firms may use DIUs in the long run to manage digital innovations. This longitudinal investigation also allows us to conclude achieving different modes of ambidexterity oscillating between exploration and exploitation, which we see as paths to navigate through the modes of ambidexterity. Though Smith et al. (2017) already derive alternative pathways, their data relies on extant literature without empirical validation. As there is a unified understanding of DIUs supporting ambidexterity in research (Fuchs et al. 2019; Göbeler et al. 2020; Holotiuk and Beimborn 2018, 2019), we show the pursued modes of structural, contextual, and temporal ambidexterity (sequential efforts could not be identified) in Table A.3. By distinguishing between the types of digital innovation (Fichman et al. 2014), we demonstrate an important disparity between digital business models and digital products/processes, as they are managed differently and differ in terms of the phase, in which DIUs are used strategically. In phase 1, due to RetailCo's urge of transforming its business model, digital business model innovations have been fostered within a structurally separated setting early on. Digital product & process innovations were sparsely incentivized in phase 1; most initiatives were launched contextually but did not follow a structured process, which is why we see this as an undefined contextual behavior. In phase 2, first

collaboration initiatives between DIUs and business units started due to the implementation of a DigU/ExC unit, which searched for business problems at RetailCo and strived to provide solutions wrapped in new business models. RetailCo's dissolved units established temporal ambidexterity by achieving temporal transfers of employees from the main organization to the DIUs for the digital business model as well as for product/process innovations (phases 2, 3, and 4). Despite the large mix of modes that are combined within a DIU setting (Göbeler et al. 2020), a bifurcation differentiating between digital business model and product/process innovations becomes apparent in the current phase 5. In phase 5, there are hardly any handover or integration scenarios resulting in serious challenges that may be hard to overcome. Digital business model exploration takes place completely independently in incubator units; digital product and process innovations have a much stronger contextual ambidextrous setting due to the dissolvement of DigU/ExC and Coe/IntFac units.

Table A.3: RetailCo's Efforts of Realizing Ambidexterity with DIUs

Source: Own Representation

<table>
<tr><td colspan="2">RetailCo's Phases</td><td>(1) Business Model Beacon</td><td>(2) Digital Innovation Awareness</td><td>(3) DIU Appreciation</td><td>(4) Urge of Digital Innovation Activities</td><td>(5) Decentral Digital Innovation Responsibility</td></tr>
<tr><td colspan="7">Efforts for Achieving Organizational Ambidexterity</td></tr>
<tr><td colspan="7">Digital Business Model</td></tr>
<tr><td></td><td>Discovery</td><td rowspan="2">Structurally Separated</td><td>Structurally Separated & Contextual</td><td rowspan="2">Structurally Separated, Contextually Integrated & Temporal</td><td rowspan="2">Structurally Separated</td><td rowspan="2"></td></tr>
<tr><td></td><td>Development, Diffusion, Impact</td><td>Structurally Separated</td></tr>
<tr><td colspan="7">Digital Product & Process</td></tr>
<tr><td></td><td>Discovery</td><td rowspan="2">Undefined Contextually Integrated</td><td rowspan="2">Contextually Integrated & Initially Structural</td><td rowspan="2">Structurally Separated, Contextually Integrated & Temporal</td><td>Structurally Separated & Contextual</td><td rowspan="2"></td></tr>
<tr><td></td><td>Development, Diffusion, Impact</td><td>Contextually Integrated</td></tr>
</table>

RetailCo's journey can be projected and generalized to other firms. In line with Ross (2017), becoming "digital" requires a strong motivation to trigger "digital" change. Different approaches on achieving ambidexterity for digital business model as well as product and process innovations may be suitable and may depend on diverse factors. However, the meta-requirements and the design principles assist in choosing suitable DIU archetypes.

DIUs may be seen as a fast vehicle to prepare incumbent firms for fomenting a stronger responsibility for digital innovation and may raise awareness of the importance of digital innovations. Starting with a structurally divided DIU without any touchpoints to its incumbent firm is fast; initiating touchpoints (through temporal ambidexterity) can be realized relatively simply. Despite the challenges posed by a temporal ambidextrous setting, however, fostering digital innovations within business units is reinforced highlighting an interesting but crucial organizational phenomenon. Due to the speed of new digital technologies rising and their potentially disrupting nature, we see, in parallel to digital products and processes, strong digital business model incubation initiatives as a prerequisite to adapt. Further, business units will have more responsibility for digital product and process innovations. They must absorb the tasks of DIUs, which means that DIUs may not be as important in the future. However, a dissolution of a DIU does not mean that it has failed; it might also be the case that the objectives of the DIU were fulfilled.

Our research has some limitations. Our empirical data is gathered on a single case, in which only a fraction of employees participated. Further, the design principles have not been used in a naturalistic setting. Thus, we recommend e.g., an action design research approach (Sein et al. 2011) for using and evaluating them. The importance of digital innovation may increase significantly in the future, so firms need to be digital and digitized much faster to avoid being disrupted. Ross (2017) emphasizes the importance of data and clear digital responsibilities. However, in nascent DIU research, no specific measurements are given that reflect their value. This is initially pointed out by Haskamp et al. (2021c), but we would like to emphasize the importance of elaborating performance measurements in the future to make the value proposition of DIUs more transparent.

A.1.8 References

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A.2 The Digital Innovation Unit: A Silver Bullet for Managing the Digital Transformation?

Under Review: Raabe, J.-P., Haskamp, T., Barthel, P., Schirmer, I., and Hess, T. 2022b. "The Digital Innovation Unit: A Silver Bullet for Managing the Digital Transformation?," *European Conference on Information Systems (ECIS).*

Abstract: Receiving great attention in research as well as in practice, DIUs are dedicated organizational units whose role is to drive and support digital transformation by promoting diverse facets of digital innovation. Utilizing DIU knowledge from a theoretical literature review on DIUs and their role in digital transformation, we leverage Wetten's building blocks of theory and present a synthesis of knowledge. We further propose a research agenda that assists in structuring the field and connects the partly isolated knowledge chunks with each other. Researchers can draw on our core findings to understand the emerging phenomenon of DIUs and to use them as a stencil for conducting proper future DIU research. It simultaneously may guide practitioners to understand the nature of DIUs and their role in a firm's digital transformation journey.

Keywords: Digital Innovation Unit, Digital Transformation, Literature Review.

A.2.1 Introduction

Today, firms, especially incumbents, face multifaceted challenges arising from novel emerging digital technologies and resulting digital innovations that may disrupt their current, some of them highly lucrative, business models (Legner et al. 2017). As a response, firms strive to engage in a multitude of activities for managing their digital transformation. These activities comprise diverse initiatives on multifaceted levels (e.g., Hartl 2019; Horlacher and Hess 2016; Jöhnk et al. 2017; Jöhnk et al. 2020), as they seem to be a necessity to withstand potential disruption and, conversely, may even help to gain competitive advantages over rivals. One specific initiative that is gaining popularity is the phenomenon of dedicated units established with the aim of creating digital innovations. We refer to these units as digital innovation units (DIUs). DIUs are described as a silver bullet that – by using agile principles – creates a cultural shift, builds digital expertise, and generates new digital innovation (Barthel et al. 2020a; Fuchs et al. 2019; Haskamp et al. 2021c; Holotiuk and Beimborn 2019; Raabe et al. 2020a). Nevertheless, there are also signs that such units do

not always bring the expected success (Mayer et al. 2021; Raabe et al. 2020b). However, the phenomenon is – despite having several contributions within the last years – still in its infancies; implicating a nascent state of prior theory with isolated not synthesized knowledge. Therefore, in this paper, we aim for a comprehensive view on this emerging phenomenon in order to structure the field, synthesize isolated knowledge, and derive an agenda for future research. The research question is as follows: *What is the current body of knowledge on digital innovation units and their role in digital transformation?*

To develop such a comprehensive view on DIUs, we draw on extant information systems (IS) literature about the DIU phenomenon. We included studies that investigate the phenomenon of DIUs directly (what we term DIU core papers) or also indirectly as part of a larger digital transformation journey of a company (what we call DIU periphery papers). From our analysis, we propose resulting attributes of DIUs that retain current knowledge on DIUs but classifies and synthesizes the isolated knowledge chunks by applying Whetten's (1989) approach. This contributes in the endeavor to move towards a better understanding of DIUs and their role in the digital transformation of companies.

The remainder of the paper is as follows. Section A.2.2 comprises the conceptual foundations of DIUs and their role in digital transformation. Section A.2.3 entails the conducted research methodology. In section A.2.4, we describe our results. We introduce the research agenda in section A.2.5. Finally, we conclude with a summary and describe our limitations in section A.2.6.

A.2.2 Digital Transformation and Digital Innovation Units

Digital transformation can be understood as a "process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial 2019, p. 121). Researchers have described a close intertwinement between this transformation process and the concept of digital innovation (Berghaus and Back 2017; Hinings et al. 2018). Digital innovations can be defined "as the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology" (Nambisan et al. 2017, p. 224). Digital transformation can thus be considered as a specific process to initiate, develop, implement, and exploit digital innovation (Kohli and Melville 2019; Wiesböck and Hess 2020). There is an ongoing discussion, on what differentiates digital transformation from other forms of IT-enabled organizational transformation (Wessel et al. 2021). However, there is a broad consensus that digital innovations can radically alter

companies' value creation process (Nambisan et al. 2017). Accordingly, the consequences of digital transformation for organizations can go as far as changing their value proposition and identity (Wessel et al. 2021).

Such a comprehensive transformation is usually not implemented with a single big bang project, but through numerous concurrent activities and initiatives on different organizational levels (Jöhnk et al. 2020; Zimmer 2019). It is however not a trivial task to promote the emergence of these transformation activities, ensure sufficient breathing space for innovative initiatives in established organizations, and strategically steer and align these activities, so not to end up with scattered, unconnected projects, but to realize a sustainable change. Accordingly, dedicated governance is needed for an organization's digital transformation activities (Gimpel et al. 2018a; Wiesböck and Hess 2020).

One specific phenomenon related to this digital transformation governance that has gained considerable attention in research and practice (e.g., Fuchs et al. 2019; Sindemann and Buttlar 2018; Velten et al. 2016) in recent years, is the emergence of dedicated units, that are granted some degree of autonomy from an established main organization, and are tasked with "foster[ing] organizational digital transformation by performing digital innovation activities" (Barthel et al. 2020a, p. 4). Various definitions that address the broader/general phenomenon coexist (see Table A.4).

Furthermore, various terms are in use, such as digital innovation lab (Holotiuk and Beimborn 2019), digital transformation unit (Chanias et al. 2019), or digital unit (Fuchs et al. 2019). In this paper, we aim for a comprehensive view on this emerging phenomenon in order to structure the field and derive an agenda for future research. Accordingly, we do not limit ourselves to a specific manifestation (e.g., a specific type of unit), but following a broad, inclusive definition of the phenomenon. Thus, we consider *any kind of newly created, dedicated organizational units associated with digital transformation and innovation activities* (Barthel et al. 2020a). However, for the sake of readability, we use the term "digital innovation unit" (DIU) (Haskamp et al. 2021c; Raabe et al. 2020a; Toutaoui and Benlian 2020) consistently, regardless of the specific terminology in the literature studied. While the relevance of these units for digital transformation and innovation is apparent, the associated field of research is so far weakly structured and connected.

Table A.4: Definitions of DIUs
Source: Own Representation

Article	Definition
Ciriello and Richter (2015)	"[…] a nexus of collective creativity, where different kinds of employees collectively generate, refine, or extend innovation-ideas online or offline." (p. 5)
Fuchs et al. (2019)	"[…] organizational units with the goal to foster the organizational digital transformation […]." (p. 644)
Hellmich et al. (2021)	"[…] dedicated agile units that focus on digital innovation […]." (p. 1)
Holotiuk and Beimborn (2019)	"[…] bundle the firm's exploration efforts to foster innovation with a primary focus on digital innovation in various types […]." (p. 2)
Holsten et al. (2021)	"[…] provide space for creative, interdisciplinary work and collaboration, as well as for cooperation between firms, start-ups, and academia with the goal of successfully dealing with [digital innovations]." (p. 1)
Jöhnk et al. (2020)	"[…] purposefully create organizational change and foster ambidexterity" (p. 2)
Raabe et al. (2021a)	"[…] dedicated organizational units that work with a high degree of freedom across firm boundaries and serve as enablers for embedding digital technologies into incumbent firms." (p. 5902)

A.2.3 Methodology

The intention of this study is to summarize and assess the current body of knowledge on DIUs. Thus, we conducted a structured literature review following Webster and Watson (2002) which is suitable to gain an overview of an emerging topic. More specifically, we opted for a theoretical review, which "draws on existing conceptual and empirical studies to provide a context for identifying, describing, and transforming into a higher order of theoretical structure and various concepts, constructs or relationships" (Paré et al. 2015, p. 188). Thus, we aim to contribute by providing an overview of what has been done and by identifying knowledge gaps within the field (Paré et al. 2015). Such a review presents a valid choice to "tackle an emerging issue that would benefit from the development of new theoretical foundations" (Paré et al. 2015, p. 188). While the idea of a dedicated lab or unit for driving innovation is not new, the challenges posed by incorporating digital technologies into an organization (Vial 2019) has fueled the emergence of dedicated organizational setups (DIUs) dealing with digital innovation. This view also finds support in considering the development of publications over the past years (see Figure A.4). As such, DIUs are gaining increasing attention as a vehicle for driving digital transformation

efforts of organizations. While publications on DIUs are growing, a structured review of existing literature that summarizes existing knowledge has not yet been conducted to our knowledge, thus synthesizing existing knowledge on the given topic would be beneficial. To structure our findings, we decided to use the building blocks of theory by Whetten (1989), which have been used previously successfully to provide a coherent picture on a phenomenon (Schilke et al. 2018).

A.2.3.1 Process

To capture high quality research in the field of IS, we initially conducted a keyword search in the titles, abstracts, and, where possible, keywords of the eight journals from the AIS Senior Scholars' Basket (AIS 2021). Additionally, as we are interested in a rather contemporary phenomenon, we included the proceedings of six major IS conferences: ICIS, ECIS, PACIS, AMCIS, HICSS, and WI (International Conference on Wirtschaftsinformatik). Building on keywords that have been proven successful within DIU studies (Raabe et al. 2020b; Raabe et al. 2021a), we decided to search all combinations of the keywords ("digital" OR "digital innovation" OR "digital transformation") AND ("unit" OR "lab" OR "hub" OR "office"). As the phenomenon in focus is highly topical, we limited the search to papers published after 2010. The keyword search yielded 179 results, of which 26 were included. Subsequently, 16 additional papers were added after a backward (13) and forward (3) search process. This resulted in a final sample of 42 papers.

In terms of inclusion criteria, the units mentioned within the paper needed to match our rather broad conceptual definition of an organizational unit tasked with the exploration of digital innovations/technologies. Further, we only selected peer-reviewed articles, so consulting reports were not included. Regarding our exclusion criteria, we excluded articles that describe areas of activity of units similar to the regular IT function of firms, e.g., providing and maintaining IT services, such as "Online at Transport For London" (Paletti 2018). We also excluded all articles that only cover a specific executive role, e.g., Chief Digital Officers, without addressing related organizational units.

A.2.3.2 Analysis

In terms of analysis, all papers were read by two members of the author team deeply familiar with the DIU literature. Within the first meeting, papers were discussed and we identified two recognizable streams of DIU literature. A first stream consisting out of 24 papers (that we labelled DIU Core literature) focusing specifically on DIUs and their actual activities, e.g., Holotiuk and Beimborn (2019), Barthel et al. (2020a), or Haskamp et al. (2021c), and a second stream consisting out of 17 papers (that we labelled DIU Periphery papers) that

mention DIUs as part of the digital transformation journey of an organization, e.g., Dremel et al. (2017). We split our paper sample between these groups of papers. Within the first group of papers, we created a concept matrix investigating each DIU (in total 69 DIUs that were investigated as either single or multiple cases) mentioned within the papers. We conducted the analysis based on the dimensions offered by an existing DIU typology (Barthel et al. 2020a; Fuchs et al. 2019). Within the second group of papers, we investigated the role of the DIU within the digital transformation journey of a company. Having prepared all the steps, we conducted a workshop to analyze the results and recognized that the DIU literature seemed rather scattered. Thus, we decided to use Whetten's (1989) proposed questions to investigate a phenomenon, namely the What?, Why?, How?, Who?, Where?, and When? of a phenomenon. Therefore, we used the existing concept matrix from the first group of papers and our analysis from the second group of papers and summarized answers given to the posed questions from Whetten (1989) that were then subject to discussions and further refined and reviewed within the team.

A.2.4 Results

Our findings are structured along with the building blocks of theory (Whetten 1989). Thus, we first provide an answer to the question of what the phenomenon actually is about, how it is related to other concepts, why it is existing and who, where, and when it does appear.

A short descriptive analysis of our paper sample (Figure 1) presents an overview of the development of DIU literature. We start with the year 2014 as in this year the first paper (Blindenbach-Driessen and van den Ende 2014) was published with a clear focus on DIUs. The strong growth of both groups of papers, core DIU papers and DIU periphery papers, reveals growing interest in the topic and provides another rationale for the necessity to review and synthesize current findings.

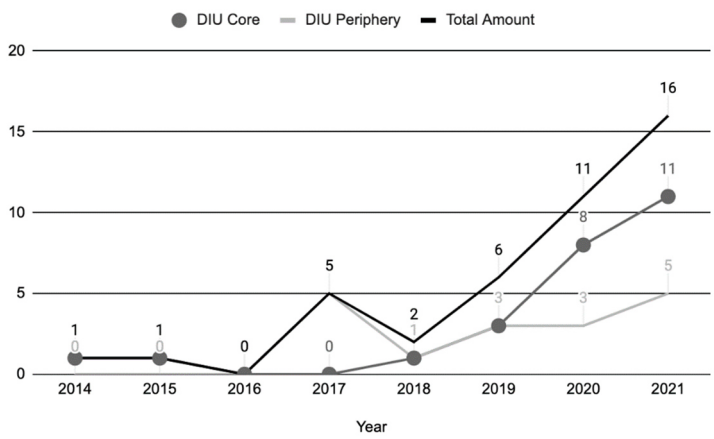

Figure A.4: Publications over Time
Source: Own Representation

In the following subsections we display our findings. We first answer the question what a DIU is currently consisting of, namely current definitions, areas of activity, areas of application and size and also archetypes of DIUs. We answer how DIUs are currently understood by introducing four different perspectives. Afterwards, we display five different motivations why companies' setup a DIU before we talk in the last subchapter about existing knowledge regarding where, when and how DIUs are currently investigated.

A.2.4.1 What? – Defining Digital Innovation Units

Efforts to understand **what** defines DIUs are rooted in the nascent state of the phenomenon and its high appearance within incumbent firms in practice. However, despite using or giving similar definitions, they are sometimes competing (e.g., the inclusion/exclusion of digital accelerators or incubators as DIUs (Raabe et al. 2020a)), and thus, lack a holistic and generally applicable definition. In an attempt to shed some light on this, we provide a definition of DIUs, focusing on the fundamental purpose for initiating them. Therefore, we first give a general definition and address further properties and foundations in the subsequent sections and paragraphs.

Defining DIUs: Utilizing Barthel et al.'s (2020a), Fuchs et al.'s (2019), and Holotiuk and Beimborn's (2019) definitions, we sum up DIUs as *dedicated organizational units whose role is to drive and support digital transformation by promoting diverse facets of digital innovation*. In this definition, we intentionally omit for whom digital transformation should be driven, as some DIUs have a more internal (belonging/referring to an incumbent firm), while others have a strong external focus and are therefore not necessarily tied to a firm (Fuchs et al. 2019; Raabe et al. 2021a), what becomes clearer when looking at the archetypes defined in literature (see Table A.5).

Areas of activity DIUs perform: DIUs are initiated with the aim to (1) discover, select, develop, and diffuse digital technologies (Barthel et al. 2020a; Ciriello and Richter 2015; Holotiuk and Beimborn 2019; Raabe et al. 2021a), (2) trigger a cultural change (Göbeler et al. 2020; Jöhnk et al. 2020; Raabe et al. 2020a), (3) assist in building up capabilities in handling digital technologies and new, especially agile, working methods (Fuchs et al. 2019; Hellmich et al. 2021; Jöhnk et al. 2020; Raabe et al. 2021a), (4) enable intraorganizational or interorganizational ambidextrous settings through adapting mixed or temporal modes (Brauer et al. 2021; Göbeler et al. 2020; Holotiuk and Beimborn 2019; Jöhnk et al. 2020), or (5) act as an integration mechanism for external validation of digital technologies to reduce market/technology uncertainties, for showcasing digital innovations, or ecosystem participation (e.g., Brauer et al. 2021, picking up the mechanisms described by Gassmann et al. 2012). Depending on the size, DIUs address one or more of the described objectives and may occur concurrently, when established in incumbent firms (Jöhnk et al. 2020). Researchers describe the high importance for DIUs of being agile in terms of light governance mechanisms and low hierarchies of authority to enable high degrees of freedom for emphasizing creativity as well as doing agile in adopting agile methods, such as Design Thinking, Scrum, or Kanban (Ciriello and Richter 2015; Fuchs et al. 2019; Holsten et al. 2021; Jöhnk et al. 2020; Raabe et al. 2020a). There is also evidence that the spatial design of DIUs should be creativity-enhancing to boost the innovation process (Ciriello and Richter 2015; Raabe et al. 2020a). Most internally focused DIUs are located close to the main organization, while externally oriented ones are established in large cities in which a high start-up mentality is present.

Areas of application and size: The range of applications for DIUs is wide, as they are used across all industries, even in a university context (Brauer et al. 2021; Holsten et al. 2021). Scientific literature describes cases of DIUs that either (1) operate independently without reference to an existing firm, or (2) are affiliated and connected with large incumbents (or universities). However, evidence on DIUs within small and medium-sized firms is scarce; only Barthel et al. (2020a) describe a case of a DIU within a medium-sized firm. The size based on the number of employees differs depending on the described cases, e.g., Raabe et al. (2020) describe DIU sizes of 1–6, 7–15, and higher, whereas others provide evidence for much higher employee numbers ranging from 5 to 150 (Barthel et al., 2020). In this respect, we consider a classification of small (< 10), medium (10–100), and large (> 100) to be appropriate.

Archetypes of DIUs: Depending on the objectives a DIU must fulfil, researchers describe several archetypes utilizing the dimensions or characteristics described within Fuchs et al.'s (2019) taxonomy of DIUs. These dimensions include the stated internal or external orientation, objectives, the target group (existing vs. new business model), staffing, work coordination, their funding, and its embedding within firms. Further separations or refinements are made based on the digital innovation type, e.g., business model, process, and product innovation (Barthel et al. 2020a; Göbeler et al. 2020; Raabe et al. 2020a), or the intended impact (incremental vs. radical digital innovations) measured by means of an adopting unit (Raabe et al. 2020b). Now that we identified dimensions for distinguishing DIUs, we portray 10 identified archetypes, differentiating archetypes based on an internal or external orientation. We like to point out that an internal focus refers to triggering change within an accompanied incumbent firm, highlighting the digital innovation types of products and processes (intraorganizational), whereas external orientations refer to contributing or producing direct digital offerings to markets emphasizing digital business model innovations (interorganizational). We excluded Jöhnk et al.'s (2020) cultural change program as a DIU archetype, since we interpret "programs" as a temporary establishment without longevity, which is contrary to our definition of dedicated units. Table A.5 lists the identified archetypes differentiated by their orientation and their focused digital innovation type. Although a clear distinction between an internal and external focus can be gleaned from the academic literature, the boundaries are blurry, since hybrid forms also exist in practice having their own raison d'être. This is also rooted by the fact that DIUs are in a constant flux and may evolve and transform to adapt to changing (environmental) conditions (Hellmich et al. 2021; Raabe et al. 2020a).

Table A.5: Identified DIU Archetypes
Source: Own Representation

DIU Archetype	Orientation	Digital Innovation Type	Article
Internal Facilitator	*Internal*	*Processes*	*Barthel et al.(2020a)*
External Enhancer	*External*	*Business Models*	
External Creator	*External*	*Business Models*	
Active Engagement	*Internal*	*Processes, Products*	*Göbeler et al. (2020)*
Passive Enablement	*Internal*	/	
Digital Unit	*Internal*	*Products/Services*	*Jöhnk et al. (2020)*
Incubator	*External*	*Business Models*	
Inhouse Digital Incubator	*External*	*Business Models*	*Hjalmarsson Jordanius et al. (2019)*
Coaching & Screening	*Internal*	*Products/Services*	*Raabe et al. (2020a)*
Center of Excellence	*Internal*	*Products/Services, Processes*	

A.2.4.2 How? – DIUs and their Relationship to the Main Organization

Established by the main organization with a specific purpose, the question of **how** a DIU collaborates with other stakeholders has been very much focused on the relationship between the DIU and its main organization. Thus, eight papers specifically address the relationship between the DIU and the main organization. Surprisingly the DIU's role as a player to establish an ecosystem is mentioned (Brauer et al. 2021), but not yet addressed accordingly within our sample of papers with only one exception (Raabe et al. 2021a).

As priorly suggested, the term DIU is adopted quite widely (see section What?), thus, also the question of how a DIU manages the relationship with the main organization is depending on the autonomy and design of the DIU (Fuchs et al. 2019). The management of the relationship between the DIU and the main organization is currently being investigated taking four different approaches: 1) Dynamic Capabilities including

organizational ambidexterity and IT ambidexterity (Brauer et al. 2021; Göbeler et al. 2020; Holotiuk and Beimborn 2018, 2019), 2) Knowledge Recombination (Hund et al. 2019), 3) the DIU understood as the extension of the IT function (Raabe et al. 2020b; Raabe et al. 2020a) and 4) DIU in the context of digital transformation activities (Barthel et al. 2020a; Fuchs et al. 2019; Jöhnk et al. 2020).

DIUs for enabling/realizing dynamic capabilities: Regarding dynamic capabilities, a lens that was adopted in six of the 24 DIU core papers, there is some evidence (Hellmich et al. 2021) that the workflow practices of the DIU with its different steps follow the initial proposed dynamic capabilities of sensing, seizing and transforming (Teece 2007). Further, considering organizational ambidexterity as a dynamic capability, one can distinguish between DIUs as an expression of organizational ambidexterity and as an expression of IT ambidexterity (Iho and Missonier 2020; Iho and Missonier 2021). Thus, there is evidence that DIUs enable ambidexterity (Brauer et al. 2021; Göbeler et al. 2020; Holotiuk and Beimborn 2019). However, there is much disagreement whether DIUs and for example the exchange of employees between the DIU and the main organization trigger a new form of temporal ambidexterity (Holotiuk and Beimborn 2019) or whether the DIU rather leads to recombination of existing forms of structural or contextual ambidexterity (Göbeler et al. 2020), which induces hybrid ambidexterity as suggested by Jöhnk et al. (2020).

DIUs for fostering knowledge recombination: For the use of knowledge recombination, Hund et al. (2019) have identified the mechanisms of liaison employees, workshops, aggregation of cross-functional knowledge, small teams, rotations, and exploration as key to foster knowledge recombination between the DIU and the main organization.

DIUs extending and refining the IT function: Another stream of research explains the emergence of DIUs as an extension of the IT function. Specifically, two types of DIUs have been identified (Coaching and Screening or Center of Excellence) by Raabe et al. (2020a) and they have also proposed two linking mechanisms of employee exchange and the lack of interest of the DIU to incorporate digital innovation within the main organization. Further, the DIU has been interpreted as an agile mode of bimodal IT (Raabe et al. 2020a).

DIUs as digital transformation initiatives: Lastly, there is a stream of research interpreting and investigating DIUs in the context of digital transformation efforts (Jöhnk et al. 2020). Specifically, a DIU is considered to be an expression of a digital transformation initiative (Jöhnk et al. 2020), or also as a digital transformation strategy enabler (Barthel et al. 2020a;

Fuchs et al. 2019), or even contributing to cultural change and delivering digital expertise to the main organization (Fuchs et al. 2019; Raabe et al. 2021a).

A.2.4.3 Why? – Motivation for Establishing DIUs

The question of **why** DIUs exist can be ultimately boiled down to the reasons of why organizations engage in digital transformation and innovation in the first place. Organizations react to opportunities and threats from outside, or to new demands and requirements from the internal business (Raabe et al. 2021a). Thus, they want to transform their external market offering, as well as their internal processes (Barthel et al. 2020a). However, we can also ask why organizations deem the establishment of DIUs as a fitting approach to master the challenges of digital transformation and innovation. A common theme/narrative in the DIU literature is that companies struggle to realize digital transformation and innovation activities in their established organizational structures, or at least not to the desired extent. DIUs are seen as a counter to that struggle. This central motive/Leitmotiv has different, complementary facets, which are reflected in the existing literature.

Breaking-up silos, cross-departmental cooperation, and combination of competencies: A recurring motive is that the agency of digital innovation and transformation cannot be clearly assigned to a single actor. Instead, a network of different stakeholders who need to (re-)combine their diverse knowledge and competencies in novel ways, working together across departments and in a distributed manner, is necessary (Ciriello and Richter 2015; Hund et al. 2019). In this context, the term "breaking-up silos" is used regularly (Rahrovani and Pinsonneault 2017; Svahn et al. 2017). However, cross-departmental collaboration is not only necessary to combine knowledge from different disciplines. The nature of the developed innovations themselves, for example in the area of smart and connected products, requires rethinking and overcoming departmental boundaries, as interfaces and interdependencies emerge that did not play a role before (Kaiser and Stummer 2020). DIUs are thus considered to be a vehicle for facilitating this breaking-up of silos and the facilitation of innovation networks. They open-up spaces, in which interdepartmental innovation can succeed. Going even further, DIUs can also break-up the borders between companies, by facilitating the establishment of ecosystems (Holotiuk 2020; Raabe et al. 2021a).

Building-up new capabilities and fostering new culture: Companies realize that combining the knowledge and competencies that already exist in the organization is often not sufficient to master digital transformation and innovation. It is rather necessary to build

up entirely new capabilities and competencies, e.g., in the area of big data analytics (Dremel et al. 2017). This acquisition of capabilities is difficult and slow within existing structures, which is why DIUs are seen as a vehicle to foster the development of new digital capabilities and competencies (Göbeler et al. 2020; Wulf et al. 2017). Besides the development of "hard" competencies, also the promotion of a new, digital culture throughout the company, can be driven by DIUs (Göbeler et al. 2020).

Developing fundamentally deviating digital innovation: One of the main reasons for establishing DIUs is that, in the course of their digital transformation process, companies are repeatedly faced with the challenge of not being able to develop and drive digital innovations that fundamentally deviate from the type/logic of innovation that traditionally prevails in the company (Barthel et al. 2021; Dremel et al. 2017). Thus, there is not only a lack of space to acquire or to recombine competencies, but also a lack of space for the innovation activities themselves. The problem can be even more pronounced in a case where a manufacturer of physical products, whose entire innovation activities are geared to the further development of physical products, now wants to develop digital services (Smith and Beretta 2021). Especially when digital innovations change the entire business model, or fundamentally different business models emerge, innovation within existing structures is apparently difficult and companies are more likely to rely on a DIU (Holotiuk 2020; Schiffer 2021; Sund et al. 2021). DIUs create spaces for innovation activities that are entirely different from what established R&D departments traditionally do, for example. They prevent such innovation activities from being stifled right away or being paralyzed by the rigidities and inertia of the established organization (Barthel et al. 2020b; Fuchs et al. 2019; Haskamp et al. 2021a; Haskamp et al. 2021b; Jöhnk et al. 2020).

Anchoring digital business: Following on from the challenges of developing new digital business models, companies are also faced with the challenge of where/need to locate/anchor a digital business model once it has been developed. If it is not possible/beneficial/desirable to reintegrate the business model innovation to the core organization, it is also possible to consider the DIU as the nucleus of a new digital business field (Schiffer 2021; Toutaoui and Benlian 2020). This approach also gives a company the opportunity to create an entirely new brand with its own identity for a new digital business model (Hron et al. 2021).

Anchoring of digital transformation strategy: Finally, another strand of literature explains the emergence of DIUs rather from the perspective of digital transformation strategy. Digital transformation requires dedicated governance, which includes a digital

transformation strategy (Chanias 2017). A new digital transformation strategy requires a place in the organization in which it is formulated, implemented, and anchored. This place can be a DIU (Chanias 2017; Chanias et al. 2019; Zimmer and Niemimaa 2019; Zimmer and Niemimaa 2020). DIUs are seen as particularly important in this context for supporting bottom-up strategizing activities, as they give employees a space to contribute their own ideas and initiatives (Chanias 2017; Chanias et al. 2019; Zimmer 2019; Zimmer and Niemimaa 2019; Zimmer and Niemimaa 2020).

A.2.4.4 Where? When? Who? – Contextual Factors Influencing DIUs

Now that we know what motivates organizations to set up DIUs, we conclude with looking at the context of DIUs. Who sets them up in the first place, when and where?

As expected, the **who** question can be answered primarily with "incumbents". This refers to companies that are established players in their market and tend to operate a pre-digital business model, i.e., one that is originally not based on digital technologies. Automotive companies are particularly prominent in the literature (Barthel et al. 2021; Dremel et al. 2017; Jöhnk et al. 2020; Svahn et al. 2017; Wulf et al. 2017; Zimmer 2019; Zimmer and Niemimaa 2019; Zimmer and Niemimaa 2020). This is plausible, as these are usually companies that have existed for a long time and offer a physical product. The challenge of integrating digital transformation and innovation into the existing organization should therefore be particularly pronounced here. However, it would be wrong to limit DIUs primarily to a tool of manufacturing companies. At the same time, there are also many cases from the insurance, financial services, and banking sectors, i.e., industries that do not live on physical products but on abstract services (Chanias 2017; Chanias et al. 2019; Göbeler et al. 2020; Haskamp et al. 2021a; Holotiuk 2020; Rahrovani and Pinsonneault 2017; Schiffer 2021; Sund et al. 2021). In addition, we find evidence from numerous other industries where incumbent firms establish DIUs such as chemicals (Barthel et al. 2020b), water pumps (Smith and Beretta 2021), high tech optics (Gimpel et al. 2018a), household appliances (Kaiser and Stummer 2020) and many more (Barthel et al. 2020a; Fuchs et al. 2019; Haskamp et al. 2021d; Holotiuk and Beimborn 2019; Hund et al. 2019; Toutaoui and Benlian 2020). Interestingly, there are also born-digital firms, respectively companies with a business model building up on digital technologies that are reported to utilize DIUs, e.g., cases from the areas of e-commerce (Raabe et al. 2020a), software engineering (Ciriello and Richter 2015) or an online real estate platform (Hron et al. 2021). Thus, while DIUs might be a phenomenon that is particularly prevalent at incumbents, pre-digital companies, it is not exclusive to those companies.

Talking about **when** DIUs are founded, it is interesting to both look at the phase of digital transformation a DIU is founded in, as well as the financial situation a company finds itself in. In many cases, DIUs are associated with the kick-starting of digital transformation, respectively they are founded at the beginning of a larger digital transformation effort (Chanias et al. 2019; Dremel et al. 2017; Schiffer 2021; Sund et al. 2021; Svahn et al. 2017; Zimmer 2019; Zimmer and Niemimaa 2019). However, we see that DIUs are also founded in more progressed/matured stages of a digital transformation process, e.g., in a phase of digital transformation strategy revision or realignment (Barthel et al. 2021; Chanias 2017; Smith and Beretta 2021). Further, looking at the time companies found DIUs, we see that its often in times of economic success and little urgent pressure to drive digital transformation (Barthel et al. 2021; Chanias et al. 2019; Wulf et al. 2017). In other cases, there is already increasing pressure to digital transformation, while the company still experiences economic success (Chanias 2017; Schiffer 2021). In some cases, however, DIUs are established at a stage where the profitability of the existing business is already declining, and the threat of digital disruption becomes more immediate (Holotiuk 2020; Sund et al. 2021). Overall, however, we see that DIUs are not utilized as a last-ditch effort, when the business is already going down the drain and one tries to save what can be saved. Rather, they are utilized proactively, in times where companies still have scope and free financial resources. They are more of a long-term measure, with the hope of remaining competitive in the long term and mastering digital transformation.

Lastly, it is interesting to address the **where**, in a geographical sense. Looking at published research, we get the impression that DIUs are foremost a European phenomenon (e.g., Hron et al. 2021; Smith and Beretta 2021; Sund et al. 2021; Svahn et al. 2017), and especially a German one (e.g., Barthel et al. 2020a; Dremel et al. 2017; Gimpel et al. 2018a; Göbeler et al. 2020; Haskamp et al. 2021d; Kaiser and Stummer 2020; Schiffer 2021; Zimmer 2019). Strikingly, our set covers only one paper that has a case from a non-European firm, in that case a North-American bank (Rahrovani and Pinsonneault 2017). We are not suggesting that DIUs are inherently a particularly European phenomenon. However, there are definitely many researchers doing research on DIUs in Europe.

A.2.5 Research Agenda

Having answered our research question by adressing every question of Whetten's (1989) building blocks, we synthesized core findings, identified research gaps and potential research questions (Table A.6) that can serve other researchers as a roadmap towards better

understanding the role of a DIU in the digital transformation of organizations. Our summarized core findings are numbered implicating attributes of DIUs. With these nine points, we want to reinforce that future work related to DIUs should include and cover these points to advance rigorous DIU research. Researchers can draw on our synthesized core findings and the identified research gaps to understand the emerging phenomenon of DIUs and to use them as a stencil for conducting proper future DIU research.

Table A.6: Synthesized Core Findings, Research Gaps, and Potential Future Research Avenues

Source: Own Representation

Type	Core Findings	Research Gaps/Future Research
What? (Foundations)	1. **Definition**: DIUs are dedicated organizational units whose role is to drive and support digital transformation by promoting diverse facets of digital innovation. 2. **Areas of Activity**: DIUs might occur concurrently, are used industry-independent within large incumbents, and address at least one of the following tasks: ○ Participation in all kinds of activities around novel digital technologies ○ Triggering a cultural change ○ Fostering digital capabilities ○ Enabling ambidexterity ○ Participation in ecosystems 3. **Archetypes**: DIUs come in various archetypes that differ especially in terms of	• **Dimensions of Classification**: We highlighted the internal vs. external classification of DIUs. However, researchers introduced a variety of other dimensions which may be promising in future research: *Integration vs. Exchange; Active vs. Passive; Explore vs. Exploit; Innovate vs. Transform* • **Biased Data**: Researchers primarily conducted qualitative-empirical studies with DIU employees. Other stakeholders (CIOs, external partners) should be considered for a thorough data base. • **"Silver Bullets"**: Are DIUs a suitable vehicle for all kind of firms? What kind of value can DIUs generate in specific settings? • **Design Knowledge**: Within a design science lens, current knowledge is primary descriptive and misses further prescriptive design theories and design entities of DIUs that might assist in establishing and positioning DIUs in the long run. • **DIU Lifecycles**: In terms of longevity (programs vs. dedicated units), it is not clear, if and how DIUs (co-)evolve, as their main organizations might be in a constant flux as well.

	their internal vs. external focus, their aimed digital innovation type, or their target group(s).	
How? (Relationship)	4. **Relationship to the Main Organization:** DIUs play a role in building dynamic capabilities, specifically contribute to building different forms of organizational ambidexterity. 5. **Knowledge**: DIUs facilitate knowledge recombination. 6. **IT Function**: DIUs may refine an agile mode of a bimodal IT setup. 7. **Strategic Partner**: DIUs might support business model exploration by being connected to a firm's business development or innovation management unit.	• **The Main Organization:** "How do DIU's create value for the main organization?" as a future research question is deeply intertwined with processes and workflows to embed DIUs into the main organization for e.g., absorbing digital innovations. However, described or even prescribed processes or workflows are scare and need further attention. • **Dynamic Capabilities**: Since DIUs might appear in diverse archetypes with a variety of tasks, different design parameters and configurations of DIUs are needed that might influence the development of dynamic capabilities, e.g., for realizing/enabling organizational ambidexterity. • **DIUs in Ecosystems:** Due to a DIU's participation in innovation networks, other stakeholders are crucial as well. Thus, it is not clear what roles a DIU might have within the orchestration of digital innovation ecosystems and how they are enabling collaborations with external stakeholders.
Why? (Motivations)	8. **DIU Motivation**: DIUs might enable firms to master at least one of the following multifaceted challenges of digital transformation and innovation stated: ○ Breaking-up silos ○ Building-up new capabilities ○ Developing deviant digital innovation ○ Anchoring digital business	• **Measuring Success**: Currently, there is a high level of turmoil about whether DIUs actually solve these challenges. The debate is about whether DIUs even contribute to fostering silos in the form of a "two-tier society". Thus, this raises the question of how DIUs track and measure the fulfillment and, more broadly, their success. • **Isomorphism**: Many DIUs have been established in recent years. We are ambivalent about whether the reasons for this were strictly rational, as it could be that many units were founded only because decision-makers felt a certain

	○ Anchoring digital transformation strategy	pressure to adapt, to imitate their competitors in setting up DIUs. Thus, are the reasons for DIU's existence entirely rational or might it be also explained with institutional isomorphism?
Where? Who? When? (Context)	9. **Context:** DIUs are especially founded in Europe by large pre-digital incumbent firms in times of economic success	• **"Innovative Europe?"**: Obviously, it raises the question, if or why DIUs are a European phenomenon. As most research analyzed DIUs within large incumbents, we like to know why born-digital firms are also utilizing DIUs. We struggle to understand if DIUs founded at the beginning of digital transformation differ from DIUs founded in mature stages.

A.2.5.1 What? – Research Avenues: Towards a Theory of DIUs

Researchers have a very positive attitude towards DIUs, which could create the impression that DIUs are a silver bullet to approach digital transformation with high chances of success and little to none risks of failure. Thus, a bias could arise and downplay serious challenges DIUs as well as incumbent firms are confronted with (Haskamp et al. 2021a; Raabe et al. 2020b). This bias may also be caused by the fact that most qualitative studies were conducted in which members of DIUs were interviewed. Thus, to address this bias and potential research gap, further research should be conducted that includes individuals who (1) need to coordinate their work with DIUs (e.g., employees of the main organization, CEOs, CIOs, CDOs, start-up employees who cooperate with the DIUs, etc.) or (2) are customers of DIUs. Further, regarding the title, the question arises whether DIUs are suitable silver bullets for all kinds of challenges resulting from digital transformation. While Blindenbrach and Drießen (2014) point out that both manufacturing and service firms benefit from establishing exploratory units (such as DIUs), current research addresses mainly large traditional incumbent firms. Thus, an in-depth analysis of DIUs and their fit within small and medium-sized firms as well as their contexts (industry, revenue, firm size, digital-native vs. non-digital-native) may be flourishing. Lastly, DIU research seems to be rather static without any considerations of DIUs evolving or transforming. Despite stating that DIUs are in a constant flux, a dynamic view is missing in research. Therefore, we strive to motivate DIU research depicting several lifecycles or evolutionary pathways, e.g., through longitudinal analyses.

A.2.5.2 How? – Research Avenues: Exploring Digital Innovation Units Role in Digital Transformation

While much research has been dedicated to exploring the relationship between the DIU and the main organization in particular using concepts of organizational ambidexterity, there is still a research gap considering the DIUs interaction with other stakeholders. Digital transformation is largely about building digital innovation ecosystems (Hanelt et al. 2021), the role that DIUs play in building and developing these ecosystems is mentioned (Brauer et al. 2021; Raabe et al. 2021a), but seem not yet explored sufficiently. Thus, a better understanding of how DIUs may enable collaboration and cooperation with external stakeholders (such as universities, competitors, public institutions, start-ups) may help to strengthen our understanding of how DIUs can help organizations accessing new expertise and digital capabilities. Regarding the collaboration between the DIU and the main organization, the question of how DIUs create value has not yet been explored sufficiently. One explanation for this might be related to the still quite diverse and cluttered understanding of what a DIU actually is, how it differs from other organizational setups and units (e.g., R&D), and whether they are just old wine in new bottles. To capture and still analyze the current use and adoption of DIUs, it might be interesting to see how different design parameters of DIUs relate to the development of specific dynamic capabilities of organizations.

A.2.5.3 Why? – Research Avenues: Leitmotifs for Establishing DIUs

Literature covers multiple leitmotifs for companies to establish DIUs. In one way or another, they all have the expectation that DIUs will put firms in a better position to meet the challenges, opportunities and demands emanating from digital innovation and transformation. However, we see a gap when it comes to the question of whether these expectations come true. The question of the success of DIUs often remains unanswered. This is also related to the fact that firms themselves are not always clear about whether and how they can and should measure the degree to which the founding motifs are fulfilled of their DIUs. First literature does address the issue of this measurement of success (Barthel et al. 2021; Haskamp et al. 2021c; Mayer et al. 2021), but beyond describing the challenge affiliated with measuring DIUs efforts (Haskamp et al. 2021a; Haskamp et al. 2021d; Mayer et al. 2021), providing ways and solutions how to assess the DIU activities falls currently short. Research in this area would also help to counter the partly justified criticism of the concept of DIUs, e.g., complaints about lacking value contribution. Further, firms face serious challenges regarding inertia, thus, not being able to absorb digital technnolgies in a

required manner. Further research could be fruitful to analyze how DIUs could serve as a response for incumbents' structural inertia (Haskamp et al. 2021b). Closely related to this is another research opportunity. Prior research often assumes that companies have "rational" reasons for creating DIUs, that is, that they actually expect DIUs to lead to sustained business success. We propose here an alternative lens, that of institutionalism, especially the established concept of isomorphism. Many DIUs were founded in a very similar timespan (2015-2017), one can almost speak of a wave of DIUs. Could it be that many units were founded only because decision-makers felt a certain pressure to adapt, to imitate their competitors in setting up DIUs, even if they themselves do not believe in success? Perhaps the existence of DIUs can sometimes be better explained by isomorphism than by economic rational.

A.2.5.4 Where? When? Who? – Research Avenues: Contextual Factors

Many papers on DIUs follow the narrative of long-established, pre-digital incumbents who want to transform digitally and founded a DIU for this purpose. However, we also see cases where organizations found DIUs that do not fit this pattern, such as comparably young, digital companies (Ciriello and Richter 2015; Hron et al. 2021; Raabe et al. 2020a). In some cases, even universities established DIUs (Brauer et al. 2021). Here, it would be more interesting to delve deeper and look at why DIUs are not only used by the usual suspects and how these units differ from "regular" DIUs. Following on from this, it would also be important to look at DIUs at different stages of digital transformation. Particularly appropriate here would be a comparison of DIUs that emerge in early phases, and DIUs that emerge in late phases of a transformation process. This would also allow us to learn something about the evolution of digital transformation processes as a whole. Finally, future research could critically shed light on why DIUs are such a European phenomenon and why IS research outside Europe does not deal with them much. It is not implausible, since in Europe pre-digital incumbents may still be more important than digital players. It could also be that there is a general bias in IS research towards European cases.

A.2.6 Conclusion

Our research question was raised with the intention to summarize and synthesize the current body of knowledge on DIUs and their role in the digital transformation of organizations. Coming back to the role of DIUs in digital transformation, our findings may imply that DIUs may play a role in terms of the identity-changing properties of digital transformation (Wessel et al., 2021). Thus, DIUs can be seen as spaces in which a new

organizational identity can be created without being burdened by the identity of the established main organization. Having answered the research question based on Whetten's (1989) building blocks, our work contributes on multiple levels. Firstly, we summarize and structure the field of research in the area of DIUs. As we have shown, the field of DIU research is highly fragmented which we addressed by summarizing core findings and connecting single knowledge chunks on the questions what a DIU is, how a DIU is connected to other stakeholders, why DIUs are currently existing, and when, who, and where DIUs are currently adopted. Thus, secondly, building on this we contribute by providing attributes of DIUs on which basis we develop a research agenda which can advance our knowledge on DIUs and their role in the digital transformation of entire organizations. Researchers can follow up on these core findings by using them as a stencil for future DIU research. Furthermore, we provoke a discussion whether DIUs are a silver bullet for digital transformation efforts, as the diversity of manifestations of DIUs is high, including different motifs and setups. Building on our research agenda and further dissecting DIUs, their specific roles in predefined contexts may help us to sharpen our understanding regarding the question of what role they can play in companies endeavors to build digital capabilities. Unfortunately, our study has limitations that future work may address. The terms of innovation labs/units are currently adopted quite broadly and in an ambiguous way, making it hard to provide a sharp overview of the phenomena. Further, our review focused on literature in the area of IS, not saying that the phenomenon of DIUs are not present in other discourses under different terms such as management or entrepreneurship. Including these and working towards a better understanding of what value DIUs can achieve will greatly advance theoretical knowledge and may serve practitioners to design DIUs specifically to the needs of the main organization initiating these new organizational setups.

A.2.7 References

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Declaration on Oath / Eidesstattliche Versicherung

Hiermit versichere ich, **Jun-Patrick Raabe**, geboren am 23. Oktober 1991 in Lüneburg, an Eides statt, dass ich die vorliegende Dissertationsschrift mit dem Titel „Digital Innovation Units as a Vehicle for Innovating Incumbent Firms: A Nexus for Digital Innovation Management“ selbst verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel genutzt habe.

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Ort, Datum Unterschrift