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HOW INCUMBENT ORGANISATIONS INITIATE DIGITAL INNOVATION WITH NON-IT EMPLOYEES

Krejci Désirée Nina

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FACULTÉ DES HAUTES ÉTUDES COMMERCIALES

DÉPARTEMENT DES SYSTÈMES D'INFORMATION

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THÈSE DE DOCTORAT

présentée à la

Faculté des Hautes Études Commerciales
de l'Université de Lausanne

pour l'obtention du grade de
Docteure en systèmes d'information

par

Désirée Nina KREJCI

Directrice de thèse
Prof. Stéphanie Missonier

Jury

Prof. Rafael Lalive, Président
Prof. Mauro Cherubini, expert interne
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I M P R I M A T U R

Sans se prononcer sur les opinions de l'autrice, la Faculté des Hautes Etudes Commerciales de l'Université de Lausanne autorise l'impression de la thèse de Madame Désirée Nina KREJCI, titulaire d'un bachelor en management de l'Université de Lausanne, titulaire d'un master en systèmes d'information de l'Université de Lausanne, en vue de l'obtention du grade de docteure en systèmes d'information.

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HOW INCUMBENT ORGANISATIONS INITIATE DIGITAL INNOVATION WITH NON-IT EMPLOYEES

Lausanne, le 13 septembre 2022

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All revisions that I or committee members
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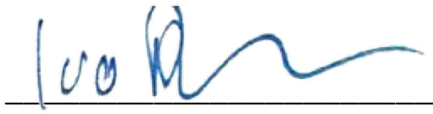
Signature:  Date: 19.08.2022

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ABSTRACT

This thesis explores a particularly underdeveloped aspect of digital innovation management, namely the **initiation** activity. Initiation is currently undergoing substantial transformation, as the creation of innovative digital products, services, processes, and business models "is increasingly being conducted by non-IT professionals, by deploying cheap and easy-to-use IT" (Bygstad, 2017, p.181). This questions classic conceptualisations of innovation management (Nambisan et al., 2017), yet our knowledge of how organisations can transform to better seize the opportunities brought by digital technology is still limited (Oberländer et al., 2021). In particular, we lack an understanding of how organisations can successfully initiate digital innovation with **non-IT employees**, i.e. employees outside the IT unit (Opland et al., 2022). Our overarching research question accordingly reads:

How can incumbent organisations initiate digital innovation with non-IT employees?

We take an **exploratory empirical qualitative research approach** to answer our research question. We perform a longitudinal single case study, in-depth expert interviews, and secondary data collection (Wynn & Williams, 2012; Yin, 2014). We analyse the collected data with different conceptual lenses in four published research papers.

We find that incumbents can initiate digital innovation with non-IT employees in three types of **internal open calls** for ideas: we coin these (1) explicit, (2) implicit, and (3) mixed. *Explicit open calls* refer to formal tenders for ideas via open programmes (e.g. idea management programmes). *Implicit open calls* refer to informal tenders for ideas via open technologies (e.g. low-code development platforms). Finally, *mixed open calls* combine open programmes and open technologies in enterprise-wide initiatives for digital innovation.

Our **process models** of open calls show that non-IT employees contribute to the initiation of digital innovation far beyond idea generation. Their participation during idea development overlaps with roles typically assigned to IT staff. In so-called incumbent organisations, characterised by rigid structures and resource-strapped IT units, we find these blurred role boundaries to cause inefficiencies in the allocation of IT resources because of economic and political resistance to change. To mitigate organisational inertia towards non-IT employees' participation, we find that incumbents must learn to efficiently coordinate and integrate IT and non-IT employees' contributions to initiation.

We conceptualise **three novel organisational competences** to help them do so: orchestration, self-orchestration, and choreography. These competences rely on the multiple uses of digital innovation artefacts throughout the initiation activity. In this regard, we find that mixed open calls most efficiently support the use of digital innovation artefacts by non-IT employees and are therefore best suited to building the three competences. Moreover, we argue that initiating digital innovation with mixed open

calls can enable organisations to harness the ideas of non-IT employees to build a successful digital business strategy. To answer our overarching research question, our recommendation to incumbents is therefore *to* ***deploy mixed open calls and leverage digital innovation artefacts to build orchestration, self-orchestration, and choreography competences***.

Overall, this thesis contributes to the digital innovation management literature with an **understanding of the processes, practices, and competences** that underlie the initiation activity, and a discussion of their impact on IS strategy. Moreover, it provides concrete guidance (especially to mid-level business managers in incumbent organisations) for digital innovation initiation with a set of process models, challenges, and success factors. With this thesis, we aim to pave the way to future research on organisational processes and individual practices that support digital innovation within organisations.

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RÉSUMÉ

Cette thèse explore un aspect particulièrement sous-développé de la gestion de l'innovation numérique, à savoir l'activité d'**initiation**. L'initiation subit actuellement des transformations substantielles, car la création de produits, services, processus et modèles d'affaires numériques innovants " est de plus en plus menée par des non professionnels de l'informatique, en déployant des technologies de l'information bon marché et faciles à utiliser " (Bygstad, 2017, p.181). Ces évolutions remettent en cause les conceptualisations classiques de la gestion de l'innovation (Nambisan et al., 2017), or nos connaissances sur la manière dont les organisations peuvent se transformer pour mieux saisir les opportunités liées à la technologie numérique sont encore limitées (Oberländer et al., 2021). En particulier, nous manquons d'une compréhension approfondie de la façon dont les organisations peuvent initier avec succès l'innovation numérique avec leurs **employés non-IT**, c'est-à-dire les employés qui ne font pas partie de l'unité informatique (Opland et al., 2022). Notre question de recherche principale est donc la suivante :

Comment les organisations dites traditionnelles peuvent-elles initier l'innovation digitale avec des employés qui ne sont pas informaticiens ?

Nous adoptons une **approche de recherche exploratoire empirique et qualitative** pour répondre à notre question de recherche. Nous réalisons une étude de cas unique longitudinale, des entretiens approfondis avec des experts, ainsi qu'une collection de données secondaires (Wynn & Williams, 2012 ; Yin, 2014). Dans nos quatre articles de recherche, nous appliquons différentes perspectives conceptuelles à notre analyse pour une compréhension holistique de notre question de recherche.

Nous constatons que les entreprises peuvent initier l'innovations digitale avec des employés non-IT dans le cadre de **trois types d'appels à idées ouverts à l'interne**. Nous les nommons : appels ouverts (1) explicites, (2) implicites et (3) mixtes. Les *appels ouverts explicites* font référence aux appels à idées formels qui sont lancés dans le cadre de programmes ouverts (par exemple, les programmes de gestion des idées). Les *appels ouverts implicites* font référence à des appels à idées informels qui sont lancés sur des technologies ouvertes (par exemple, les plateformes de développement low-code). Enfin, les *appels ouverts mixtes* combinent des programmes ouverts et des technologies ouvertes dans des initiatives d'innovation digitale.

Nos **modèles des processus** d'appels ouverts montrent que les employés non-IT contribuent à l'initiation de l'innovation digitale bien au-delà de la génération d'idées. Leur participation chevauche souvent avec des rôles généralement attribués au personnel IT. Dans les organisations dites traditionnelles, caractérisées par des structures rigides et des ressources informatiques limitées, ces limites de rôles floues peuvent entraînent des inefficacités dans l'allocation des ressources informatiques et conduire à une résistance économique et politique. Afin d'atténuer l'inertie organisationnelle à l'égard de la

participation des employés non-IT, nous constatons que les entreprises en place doivent apprendre à coordonner et à intégrer efficacement les contributions des employés IT et non-IT durant l'activité d'initiation.

Nous conceptualisons **trois nouvelles compétences organisationnelles** pour les aider à accomplir ceci : la compétence d'orchestration, d'auto-orchestration et de chorégraphie. Ces compétences reposent sur l'usage d'artefacts d'innovation digitale tout au long de l'activité d'initiation. A ce propos, nous constatons que les appels ouverts mixtes soutiennent le plus efficacement l'utilisation d'artefacts d'innovation digitale par les employés non-IT et sont donc les mieux adaptés au développement des trois compétences. De plus, nous soutenons que le fait d'initier l'innovation digitale par des appels ouverts mixtes peut permettre aux organisations d'exploiter les idées des employés non-IT pour construire une *digital business strategy* réussie. En **réponse** à notre question de recherche, nous recommandons donc aux organisations ***d'utiliser des appels ouverts mixtes et des artefacts d'innovation digitale pour développer des compétences d'orchestration, d'auto-orchestration et de chorégraphie*** pour initier l'innovation digitale avec leurs employés non-IT.

Dans l'ensemble, cette thèse contribue à la littérature sur la gestion de l'innovation digitale par une meilleure **compréhension des processus, des pratiques et des compétences** qui sous-tendent l'activité d'initiation, et par une discussion de leur impact sur la stratégie des SI. En outre, nous fournissons des recommandations concrètes (en particulier aux *mid-level business managers* d'organisations traditionnelles) quant aux modèles de processus et aux facteurs clés de succès qui permettent d'améliorer la création de l'innovation digitale avec les employés non-IT. Notre thèse vise à ouvrir la voie à de futures recherches sur les processus organisationnels et les pratiques individuelles qui soutiennent l'innovation digitale au sein des organisations.

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CHAPTER 1. INTRODUCTION

Alice is having a great day. She just met with Bob, one of her organisation's key customers, and their discussion revealed an interesting problem. Alice thinks the problem can be solved with a digital solution, one that her long-standing organisation had never thought of before.

Back at her desk, Alice realises that many more customers face the same problem as Bob. Alice is excited about the potential of her idea, but she feels she lacks some essential technical skills to kickstart the development of a prototype that could convince her boss to let her work on the project.

Later the same day, Alice meets her friend Eve from the IT department at the coffee machine. Alice enthusiastically explains her idea, but Eve seems hesitant: "Your idea sounds interesting, but I am not sure what it implies IT-wise. We could schedule a meeting with the team to flesh it out, but in a few months at best… We get so many requests for system changes; our backlog is crazy right now!"

By the time the IT unit gets back to Alice about her idea, the organisation has lost its leadership to a competitor who now widely markets the digital solution Alice had imagined.

Alice's organisation is not alone in losing ground. Recent figures show that only a handful of Forbes 500 companies born in the last century still exist today (*Fortune 500*, n.d.; Perry, 2019). Those ones which are still around have been losing speed under the growing pressure for innovation (Oberländer et al., 2021). Over the last decade, forerunner companies such as Apple, Microsoft, Alphabet, Amazon, and Meta have been redefining the competitive landscape by spreading the innovative use of social, mobile, analytics, and cloud (SMAC) technologies far beyond the IT sector (Legner et al., 2017). Digital technology, more broadly, has become a driving force for innovation across virtually all industries (Fichman et al., 2014; Nambisan et al., 2017; Yoo et al., 2010). As a result, markets that have long remained sheltered are disrupted at unprecedented pace and scale — between January and March 2022 alone, 83 start-ups worldwide reached $1 billion in market valuation with digital use cases that are predicted to displace existing offerings in a broad range of industries (CB Insights, n.d.). Recognising the far-reaching implications of digitalisation, more and more organisations have appointed digital innovation as a strategic imperative (Teubner & Stockhinger, 2020). Still, many large and established organisations (i.e. incumbents) fail to successfully seize digital innovation opportunities (Rimol, 2021). Despite superior levels of resources and extensive market insights, incumbents' efforts are undermined by processes and structures that were not designed to support the levels of exploration required for digital innovation (Svahn et al., 2017). As evidenced by the latest MIT Sloan Management Review, rethinking innovation management "from ideation through implementation" (Heichler, 2022, p.1) is critical for incumbents in today's digital age. Overall, these topical developments call for special attention to the management of digital innovation in incumbent organisations.

Digital innovation refers to the use of digital technology in the process of innovating and in innovation outcomes (Nambisan et al., 2017). An innovation outcome with digital underpinnings essentially differs from a traditional innovation outcome in that it leverages digital components that are more readily re-combinable, editable, and distributable than their physical counterparts (von Briel et al., 2018). These characteristics offer increased potential for openness, affordances, and generativity in innovation processes (Nambisan et al., 2019). Put differently, digital technology transforms the nature of uncertainty and how it is handled by innovation actors (Nambisan et al., 2019). With regards to digital innovation management, the initiation activity is particularly affected by these changes because it aims at reducing the uncertainty of innovative ideas (Vassilakopoulou & Grisot, 2020). More specifically, initiation sets the stage for large-scale implementation and diffusion by developing inherently ambiguous ideas into implementable concepts (Jha & Bose, 2016). Idea development is increasingly performed by heterogenous and distributed stakeholders in today's digital world (Berente et al., 2011; Hsieh et al., 2011). Initiating digital innovation with distributed innovation agencies causes the boundaries between innovation phases and among innovation actors to fade (Nambisan et al., 2017). These changes upend traditional conceptualisations of innovation (Yoo et al., 2010) and call into question existing innovation management theories (Nambisan et al., 2017). In particular, they most critically affect our understanding of the initiation activity (Oberländer et al., 2021) and call for new theories on how innovative ideas are developed in a digital world (Nambisan et al., 2017).

Within organisations, the trend towards distributed innovation agencies manifests in the increased involvement of employees from different functional departments (Opland et al., 2022). Despite growing interest for outside innovators (Bogers et al., 2017), the majority of digital innovations are still initiated within organisational boundaries (Mamonov & Peterson, 2021), supporting the argument that employee participation in organisational innovation remains as relevant as ever (Opland et al., 2020). We adapt the terminology proposed by Neyer et al. (2009) to distinguish two types of employees that may contribute to the initiation of digital innovation within organisations. On the one hand, "core inside digital innovators" are employees who are traditionally held responsible for digital innovation activities within organisations. Since digital innovation is generally framed as a strategic initiative organized and effected within the IT department (Kohli & Melville, 2019), IT employees are thus considered core digital innovators. On the other hand, "peripheral inside digital innovators" are employees who are not responsible for digital innovation as by their job description, but may still contribute to it (Neyer et al., 2009). Employees from outside of the IT department can be valuable to the initiation of digital innovation by providing a different perspective on needs and solutions (Kesting & Ulhøi, 2010). Despite their potential, however, "peripheral inside innovators are often taken for granted and are assumed to innovate without being supported by well-designed innovation practices" (Neyer et al., 2009, p.415). More specifically, Opland et al.'s (2020) literature review on the topic reveals that organisations generally lag behind in supporting their peripheral innovators beyond idea generation. Failing to support

peripheral innovators in idea development limits the organisation's overall digital innovation potential. To enhance the readability of this thesis, we will from now on refer to core inside digital innovators as IT employees, and peripheral inside digital innovators as non-IT employees.

Involving non-IT employees in the initiation of digital innovation can have both beneficial and detrimental effects. On the one hand, their exclusive and highly contextualised knowledge (Kesting & Ulhøi, 2010), their entrepreneurial skills (Arvidsson & Mønsted, 2018; Vassilakopoulou & Grisot, 2020), and their digital creativity (Shao et al., 2021) allow for fresh insights to flow into the initiation activity (Simula & Vuori, 2012). On the other hand, their lack of technological skills lead to diverse, emergent, and ill-defined contributions that IT employees may struggle to act upon (Ciriello et al., 2019). As Opland et al. (2022) put it, "the main problem for organizations trying to increase innovation is not a lack of ideas, but rather an inability to [act upon] the good ideas that are already there" (p.264). This problem is exacerbated in contexts of scarce IT resources, where few IT employees are available to deal with the high levels of ambiguity and malleability that are characteristic of digital innovation (von Briel et al., 2018). This is a scenario typically encountered in incumbent organisations (Rimol, 2021; Sebastian et al., 2020). On the other hand, more and more organisations grant non-IT employees "direct unmediated access to IT resources to convert their deep understanding of customer needs into personalized solutions" (Gregory et al., 2018, p.1240), thus enabling them to bypass the IT department and IT-related supervision in their initiation activities.

Research on digital innovation initiation is currently scarce and the above-mentioned changes in initiation processes and actors have hardly been conceptualised (Oberländer et al., 2021). In particular, we have little insights into the processes and actors at play when digital innovation is initiated within organisations (Mamonov & Peterson, 2021). As a result, we do not fully understand how organisations can support non-IT employees when they create digital innovation (Ciriello & Richter, 2019; Opland et al., 2022). Ultimately, these limitations impede our ability to theorise on digital innovation management and to provide guidance to innovation practitioners in today's digital world. This thesis sheds light on the topic of digital innovation management in incumbent organisations. Specifically, we add to the existing body of knowledge by exploring how employees who are not typically responsible for digital innovation, i.e. non-IT actors, can contribute to the front-end of digital innovation. From a practitioner perspective, we wish to understand how Alice's organisation can leverage Alice's ideas more successfully, and win back lost ground from digital-savvy competitors. Accordingly, we ask the following overarching research question:

How can incumbent organisations initiate digital innovation with non-IT employees?

Four research articles are presented in this thesis, which we published and presented in peer-reviewed IS conferences between 2020 and 2022. Across our papers, we took a qualitative research

approach to explore our emergent phenomenon of interest (Yin, 2014). More specifically, we performed a longitudinal single case study, in-depth expert interviews, and secondary data collection (Wynn & Williams, 2012). For our case study, we selected a revelatory case, namely an incumbent who was at that time experimenting with initiatives, programmes, and technology to initiate digital innovation across the entire organisation. Moreover, we performed expert interviews at an organisation that provides a digital technology meant to support the development of ideas into implementable solutions by individuals with limited technological know-how. We applied several conceptual lenses (e.g. open innovation, idea management, orchestration) to our data on different levels of analysis (i.e. department, organisation, individual) to better appreciate the multiple facets of our phenomenon of interest.

The remainder of this thesis is structured as follows. In Chapter 2, we describe the background and theoretical underpinnings for our work. In Chapter 3, we explain the research opportunity and research gaps. In Chapter 4, we present the thesis structure and research streams, and Chapter 5 describes our research philosophy and methodological approach. In Chapter 6, we detail our research streams and constitutive papers. We conclude in Chapter 7 by discussing the theoretical and practical implications of this thesis for the digital innovation community, and by presenting its limitations.

CHAPTER 2. BACKGROUND

This chapter synthesises prior research into the initiation of digital innovation with non-IT employees. Specifically, it acknowledges previous work on digital innovation, the initiation activity, and non-IT employee participation. It concludes with an overview of key concepts.

2.1 DIGITAL INNOVATION

An interesting new phenomenon. Digital innovation is a relatively young research field that has experienced a massive surge in interest over the past decade, particularly in Information Systems (Kohli & Melville, 2019). The ubiquity of digital technology and its transformative effects on business and society has sparked research interest among a broad range of social and computer scientists (Hund et al., 2021). Leading journals across disciplines have published roughly 300 articles on the topic to date, of which two thirds have been published during our doctoral studies, i.e. between 2018 and 2022 alone (ibid). As illustrated in Figure 1 below, the Information Systems (IS) discipline has been at the forefront of these research efforts since the early 2000s. Thus far, the AIS basket of eight journals have published a total of 78 articles on digital innovation, including eight new research articles since the beginning of 2022. In fact, the close entanglement of people and technology in digital innovation speaks directly to the sociotechnical core of the IS discipline (Fichman et al., 2014), and leading researchers have called it "a golden opportunity to be seized upon by information systems scholars" (Nambisan et al., 2017, p.224). Although the IS community has been making sense of digitalisation and its impacts on business and society for many decades already, the field generally agrees that digital innovation entails new theorisation (Maruping & Matook, 2020). As Markus and Nan (2020) put it, "digital innovations represent an important emerging phenomenon that differs in fundamental ways from the information systems traditionally studied" (p.64). Digital innovation thus constitutes an interesting new phenomenon that IS scholars are uniquely positioned to theorise about (Nambisan et al., 2017).

A critical management issue. Digital innovation management (DIM) is broadly concerned with the initiation, development, implementation, and exploitation of digital innovation in organisations (Kohli & Melville, 2019). In their seminal research note on the topic, Nambisan et al. (2017) define DIM as "the practices, processes, and principles that underlie the effective orchestration of digital innovation" (p.224). Svahn et al. (2017) note that DIM is particularly critical to incumbent organisations because the use of digital technology in innovation activities requires them to shift their innovation logic and to manage a new set of competing concerns that result from changes in innovation capability, focus, collaboration, and governance. Several other studies have uncovered contradicting forces in digital innovation activities as well (see Hund et al. (2021) for an overview), and highlighted their

profound implications for traditional innovation management (e.g. Kohli & Melville, 2019). DIM is thus central to addressing the organisational challenges that arise from using digital technology in innovation processes and outcomes.

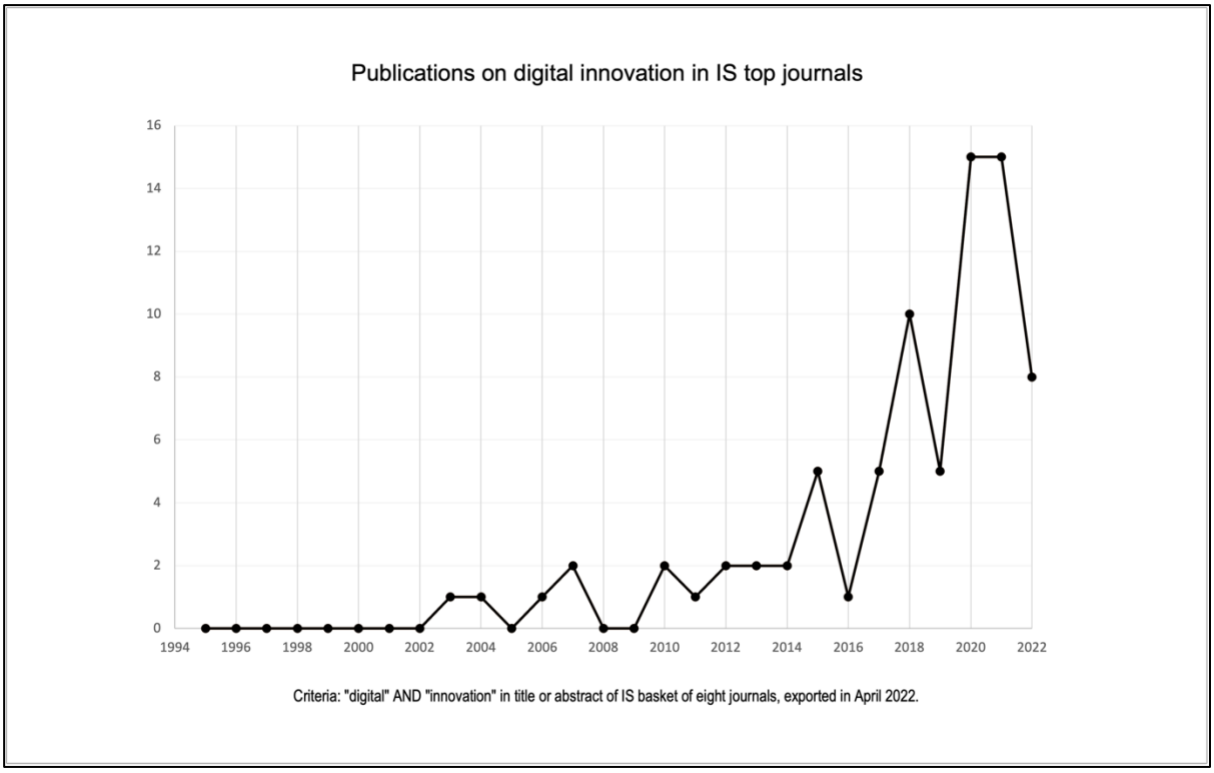

Figure 1. Publications on digital innovation in the IS basket of eight

A fragmented research area. Research on digital innovation is particularly rich, broad, and deep (Kohli & Melville, 2019). This has been acknowledged in several recent reviews of the literature in IS (Hund et al., 2021; Jha & Bose, 2016; Kohli & Melville, 2019; Mamonov & Peterson, 2021) and is further evidenced by an impressive 3.3 million hits on Google Scholar for the search query "digital innovation". Digital innovation research has indeed been taking place across various disciplines simultaneously, driven by fast-paced technological developments and the growing interest in the variability, materiality, emergence, and richness it brings to our lives (Nambisan et al., 2017). Next to IS, the field of innovation, strategy, economics, organisational studies, marketing, entrepreneurship, and operations have shown predominant interest in diverse facets of the digital innovation phenomenon (Hund et al., 2021). This wide range of perspectives has resulted in a fragmented state of the field. In a thorough review of the accumulated scholarly knowledge, Hund et al. (2021) find no less than 29 explicit definitions of "digital innovation" scattered across eight disciplines. While these definitions share some commonalities, they significatively differ on most of their key features. This is even when comparing highly-cited definitions within a single discipline (e.g. Nambisan et al., 2017 vs. Yoo et al., 2010 in IS research). Despite several reviews directed towards consolidating the field (e.g. Hund et al.,

2021; Jha & Bose, 2016; Kohli & Melville, 2019; Mamonov & Peterson, 2021), digital innovation remains a fragmented research area marked by a multiplicity of research perspectives.

An ongoing debate. The fragmented state of the digital innovation research landscape has caused underlying concepts to be inconsistently used in the literature. A sematic decomposition of existing definitions notably reveals inconsistencies not only in the use of "digital innovation", but also in the use of related core concepts such as "digital technology", "digitisation", "digitalisation", and "digital object" (Hund et al., 2021). Regarding "digital innovation" specifically, many definitions were found to suffer from tautology as they conflate the concept of digital innovation with its effects (examples include Nambisan et al., 2020; Schneckenberg et al., 2021). Among others, Avital et al. (2019) and Baskerville et al. (2020) noted that such definitional issues may prompt misgivings and questionings as to the relative novelty of the digital innovation phenomenon. In fact, IS scholars have repeatedly cautioned against using the prefix "digital" to rebrand established concepts and warrant research on otherwise well-known phenomena (e.g. Baskerville, 2012; Grover & Lyytinen, 2015; Orlikowski & Iacono, 2001). In particular, concerns have been raised that it may obscure the differences, or worse mask the similarities with traditional innovation (Wessel et al., 2021). While scholars generally contend that the "growing trend in which the term digital is affixed to other management concepts impl[ies] that there is something different with 'digital'" (Avital et al., 2019, p.2), the conceptual ambiguity surrounding its distinctive properties remains high. Overall, the IS community is still much engaged in discussions to determine the distinctive character of digital innovation.

A revised definition of digital innovation. Hund et al. (2021) propose to address the fragmented state of the literature and the ongoing debate on digital innovation with a revised definition. Based on their review of the literature, digital innovation is defined as:

"The creation or adoption, and exploitation of an inherently unbounded, value-adding novelty (e.g. product, service, process, or business model) through the incorporation of digital technology." (p.6)

We concur with this definition because: (1) it builds on the definitions stated in prior work across several disciplines, (2) it considers the six key features of digital innovation, and (3) it addresses the main weaknesses of existing definitions in a (4) parsimonious way. To illustrate these points, we decompose the revised definition into its key features and compare them to existing definitions in Table 1 below (see Hund et al. (2021) for full definitions and references). By resorting to an existing definition, we position our work within the current research landscape and contribute to the consolidation of the field.

KEY FEATURES OF EXTANT DEFINITIONS OF DIGITAL INNOVATION (based on Hund et al., 2021)				
KEY FEATURE	MEANING	IN PRIOR WORK	WEAKNESS	IN REVISED DEFINITION
INPUT	Describes what goes into the creation of DI.	All extant definitions refer to some digital component/ data/ technology/ activity/ capability/ product/ tool/ infrastructure/ artifact/ materiality.	Inconsistent use of core concepts	Replaced by "digital technology" as an umbrella term.
INVOLVEMENT	Describes actors involved in the creation of DI.	Only five definitions specify involvement: three refer to internal and external actors, one to external only, one to internal only.	Fragmented	Addressed by implicitly accounting for both internal and/or external actors in "creation or adoption".
PROPERTIES	Describes factors that distinguish DI from traditional innovation.	Most mention novelty, only two definitions highlight malleability, homogeneity, transferability, and generativity.	Conceptually ambiguous	Refined into "inherently unbounded, value-adding novelty"; DI goes beyond invention and is perpetually incomplete.
SCOPE	Describes the focus of DI.	Most focus on products and services only, some extend to processes and business, a few also mention ideas, sociotechnical structures, industry, and social and economic spheres.	Narrowly focused	Refined into "product, service, process, or business model" as possible outcomes of DI.
IMPLICATIONS	Describes the effects of DI.	Most highlight changes in market offerings, business processes/ models, some mention implications for business management and human action, transformation of sociotechnical structures, and blurred boundaries.	Tautology	Addressed by omitting implications of DI from the definition to avoid circularity.
CREATION	Describes how DI is actually created.	Only 16 definitions specify creation: 13 refer to a creative process of (re)combination, one to meshing, one to design, and one to orchestration.	Vague and/or incomplete	Addressed by leaving open the exact manner of creation (i.e. implicitly including various creative processes).

Table 1. Key features of extant definitions of digital innovation

2.2 INITIATION

Digital innovation management has received uneven coverage in the IS literature, with surprisingly few studies focusing on initiation. In this section, we review existing work with a particular focus on initiation activities and actors. We explain the concepts of digital opportunities, digital ideas, digital innovation artefacts, and non-IT actors, and conclude with our own definition of the initiation activity.

2.2.1 INITIATION ACTIVITIES

Creation. Despite it being an indispensable prerequisite to the development, implementation, and exploitation of digital innovation, the initiation activity has received scant academic attention (Kohli & Melville, 2019). This gap has been highlighted in all four literature reviews in the field (Hund et al., 2021; Jha & Bose, 2016; Kohli & Melville, 2019; Mamonov & Peterson, 2021). The little available research generally agrees that the initiation activity comprises an act of creation, but it leaves open the exact creation process (Hund et al., 2021). The initiation of digital innovation is therefore implicitly assumed to include various creative activities for the (re)combination of digital and physical components (e.g. Markus & Nan, 2020; Yoo et al., 2010), the meshing of digital and physical materiality (Hinings et al., 2018), the design of new digital artifacts (Woodard et al., 2013), and the orchestration of innovative digital offerings (Magnusson et al., 2021). Interestingly, Shao et al. (2021) differentiate creativity from innovation in their study, contending that "creativity occurs at the stage of novel idea generation, while innovation belongs to the next stage of idea implementation" (Shao et al., 2021, p.3). Moreover, they acknowledge that the concept of creativity is primarily applicable to individuals, while idea generation and innovation can be examined also from an organisational perspective (ibid).

Development. Apart from creation, Kohli and Melville (2019) identify three other initiation activities in their review of the digital innovation literature, namely initiation triggering (e.g. Fichman, 2004), opportunity development (e.g. Mishra & Agarwal, 2010), and decision-making (e.g. Swanson & Ramiller, 2004). These activities have notably been investigated in light of isomorphic pressures (e.g. trends and fads), technological opportunism, and entrepreneurial alertness (Mishra & Agarwal, 2010; Sambamurthy et al., 2003; Swanson & Ramiller, 2004). Of the above-mentioned activities, Kohli and Melville (2019) give special emphasis to opportunity development. In fact, they indeed define initiation as the activity during which organisations "identify, assimilate and apply valuable knowledge from inside and outside the firm regarding opportunities for digital innovation" (ibid, p.206). Viewing initiation in terms of opportunity development has received support in Oberländer et al.'s (2021) study on initiation in incumbents. Based on a study of 150 large and established organisations, Oberländer et al. (2021) found that initiation in incumbents entails the development of opportunities into initiatives for digital innovation. Specifically, they define six types of opportunities that can typically be seized by

incumbent organisations, namely internal/ shared/ external exploitation opportunities, and internal/ shared/ external exploration opportunities. Table 2 below provides an overview of these types.

DIGITAL OPPORTUNITY TYPES IN INCUMBENT ORGANISATIONS (based on Oberländer et al., 2021)		
	EXPLOITATIVE i.e. enhancing existing products, services, or business models to address the demands of existing customers	**EXPLORATIVE** i.e. creating new products, services, or business models that serve new customer needs or create new demands
INTERNAL i.e. using incumbent's own assets and capabilities which can be understood, utilized, and controlled via digital technologies	Internal exploitation opportunity *e.g. 3D printing of shoes (Adidas), interactive talking shelf (Unilever)*	Internal exploration opportunity *e.g. 3D imaging for movies (Pixar), crowdworking platform (Amazon)*
SHARED i.e. using incumbent's connected products which are owned by the customers but remain remotely accessible and addressable via digital technologies	Shared exploitation opportunity *e.g. Oral B connected toothbrush (P&G), contactless payment ring (Mastercard)*	Shared exploration opportunity *e.g. Virtual wallet investing spare change (Alibaba), food delivery to cars (Volvo)*
EXTERNAL i.e. using assets and capabilities of customers and communities which can be accessed and integrated via digital technologies	External exploitation opportunity *e.g. Customer-to-customer online resale of used clothes (H&M), customer-to-customer online financing (ING)*	External exploration opportunity e.*g. Mobile parking services (BMW), app-based assembly service (IKEA)*

Table 2. Digital opportunity types in incumbent organisations

Digital (innovation) opportunities. Digital opportunities, as Oberländer et al. (2021) call them, are context-sensitive "possibilities for action enabled by digital technologies which may lead to innovative digital or non-digital outcomes" (p.3). At least two points deserve further clarification. First, digital opportunities can be fuelled by a "broad swath of digital tools and infrastructure" (Nambisan et al., 2017, p.224). These are more generally referred to as digital technology, without strict differentiation between IT and IS (Oberländer et al., 2021). In Oberländer et al.'s (2021) study, digital technologies comprised 3D printers (e.g. Adidas), chatbots (e.g. Santander), virtual reality (e.g. IKEA), IoT (e.g. Unilever), cloud technologies (e.g. Adobe Systems), mobile technologies (e.g. Marriott International), and data analytics (e.g. Kaiser Permanente). Table 3 below provides concrete examples of the digital technologies we refer to in our doctoral research, along with an illustrative use case for each digital technology (i.e. examples of ideas generated and developed by non-IT employees in our studies). Second, digital opportunities imply relative rather than absolute novelty (Oberländer et al., 2021).

Novelty is defined from the organisation's point of view, and it is of little importance if the imagined innovative outcome is "objectively new as measured by the lapse of time" (Rogers, 1962, p.11). Therefore, the routine use of a given digital technology by a specific firm (e.g. mobile technologies at Airbnb) does not impede the same technology from bearing sufficient novelty for another organisation to be considered a digital innovation in their context (e.g. mobile technologies at Marriott International). Table 3 below also specifies the target stakeholders for novel value creation for each digital technology and illustrative use case.

DIGITAL TECHNOLOGY AND DIGITAL INNOVATION IN OUR STUDIES			
DIGITAL TECHNOLOGY		**ASSOCIATED USE CASES**	**DIGITAL INNOVATION FOR**
DEFINITION Digital technology is "a digital object (bitstrings) that is given a socially agreed-upon meaning" (Hund et al. 2021, p.7)	Mobile	E-commerce: "one stop shop" customer mobile application	Existing customers
	Blockchain	Ingredient traceability for fragrances	Existing customers
	Augmented/Virtual Reality (AR/VR)	E-commerce: "virtual fragrance shop" customer experience	Existing customers
	Internet of Things (IoT)	Smart fragrance dispensers	New customers
	Robotics	Miniaturised perfume manufacturing	New customers
	Artificial Intelligence (AI)	AI-driven sales forecasts; AI-generated scents	Employees (sales); Employees (scent creators)
	Cloud	Cloud-based APIs to share selected sales data with external partners	Employees (marketing) and partner companies
	Low-code Application Development (LCDP)	Various back-office, web, or mobile software applications; e.g. web app automating logistics tasks and workflows	Employees (e.g. logistics) and/or customers
→ *Reprogrammable basis for digital innovation*		**From digital technology to digital innovation**: Digital technologies lead to digital innovation when they are applied in novel and value-creating ways. → *Novel and value-creating use cases of digital technologies*	

Table 3. Examples of digital technologies and innovative use cases studied

A note on digital technology vs digital innovation. Digital technology refers to digital objects (or bitstrings at its base) that have been given a socially agreed-upon meaning (Hund et al. 2021). By contrast, digital innovations arise when digital objects are put to use, i.e. applied to specific use cases

that create value in novel ways. Thus, any given digital technology may or may not result in digital innovation depending on the success of the underlying use case in creating value in ways that previous products, services, processes, and business models did not. The resulting value can be of monetary or societal nature, and the stakeholders for whom value is created can include customers, employees, company owners, or society as a whole (Osterwalder et al., 2020). These stakeholders may or may not be known in advance. As an example, ingredient traceability enabled by blockchain technology (see Table 3 above) may turn out to be unwanted by customers, but surprisingly useful to employees. Employees may be able to change their logistic workflows, decrease their workload, and cut costs thanks to the blockchain monitoring of ingredients. In this example, blockchain ingredient traceability was initially meant as a digital innovation for customers, but turned out to be one for logistic employees instead. In sum, digital technology allows for a virtually unlimited amount of applied use cases, i.e. digital opportunities, a fraction of which may lead to digital innovation.

Digital (innovation) ideas. While the concept of opportunity has been extensively explored in entrepreneurship research (Shane & Venkataraman, 2000), it has more recently been criticised for being "conceptually challenging and empirically elusive" (von Briel et al., 2018, p.280) and for glossing over the digital nature of innovation. To address these shortcomings, von Briel et al. (2018) propose the notion of "new venture ideas" as a more workable alternative to "opportunities". New venture ideas are defined as "imagined future ventures that give direction to entrepreneurial agents' efforts" (von Briel et al., 2018, p.281). Accordingly, "digital venture ideas" (or digital ideas for short) are new venture ideas that have a digital artifact at their core (von Briel et al., 2018). This aligns with Nambisan et al.'s (2017) understanding that "in digital innovation, digital technologies […] form an innate part of the new idea and/or its development, diffusion, or assimilation" (p.224). Acknowledging the central role of ideas further agrees with Oberländer's (2020) recommendation to use their taxonomy of digital opportunities as an ideation guide in organisations. We thus argue that a focus on ideas can provide a more fine-grained understanding of initiation and complement prior studies on digital opportunities.

Digital innovation artefacts. As noted by von Briel et al. (2018), "the ideas [digital innovators] pursue are by no means uniform" (p.278). Some ideas result in software with an ephemeral embodiment (e.g. SurveyMonkey, WhatsApp), some lead to technological objects with a perpetual embodiment (e.g. GoPro, Stratasys), and others combine ephemeral and perpetual embodiments (e.g. Fitbit, Square) (ibid). The prospected embodiment may not be immediately evident in early stages of idea development, and more generally "lack the plenitude and stability afforded by traditional items and devices" (Kallinikos et al., 2013, p.357-358). Given the ambiguous nature of future digital solutions, innovators have been found to leverage digital innovation artefacts to communicate and refine their digital ideas (Vassilakopoulou & Grisot, 2020). Ciriello et al. (2019) define digital innovation artefacts as "any underspecified representation of an envisaged new software product" (p.151). These practice-oriented artefacts include clickable mock-ups, application prototypes, and proofs-of-concept. Digital innovation

artefacts are particularly valuable during initiation, where they help build a common understanding of the idea, amplify its perceived readiness and legitimacy, and support the co-development of implementable solutions (Vassilakopoulou & Grisot, 2020). Additionally, Vassilakopoulou and Grisot (2020) have reported on the "evocative character" of digital innovation artefacts, which refers to how their concrete yet malleable nature helps innovators envision future digital solutions, arouse interest, build commitment, and form alliances with stakeholders. Digital innovation artefacts are also considered "disposable" since their functionalities can swiftly be created and discarded through the adjustment of pre-existing templates (ibid). Disposability is ideally supported by a layered and modular technical architecture that is decoupled from the existing IT landscape (Kallinikos et al., 2013). Such an architecture also favours end-user computing and reduces the amount of resources needed for the development of digital ideas, thus helping to maintain "responsiveness" to emerging needs by making experimentation losses more affordable (Vassilakopoulou & Grisot, 2020). In sum, prior research has shown that the initiation activity is critically supported by the use of evocative, disposable, and responsive digital innovation artefacts. In Figure 2 below, we leverage Osterwalder et al.'s (2020) representation of the explore-exploit continuum to visually depict the key concepts that underlie the initiation of digital innovation.

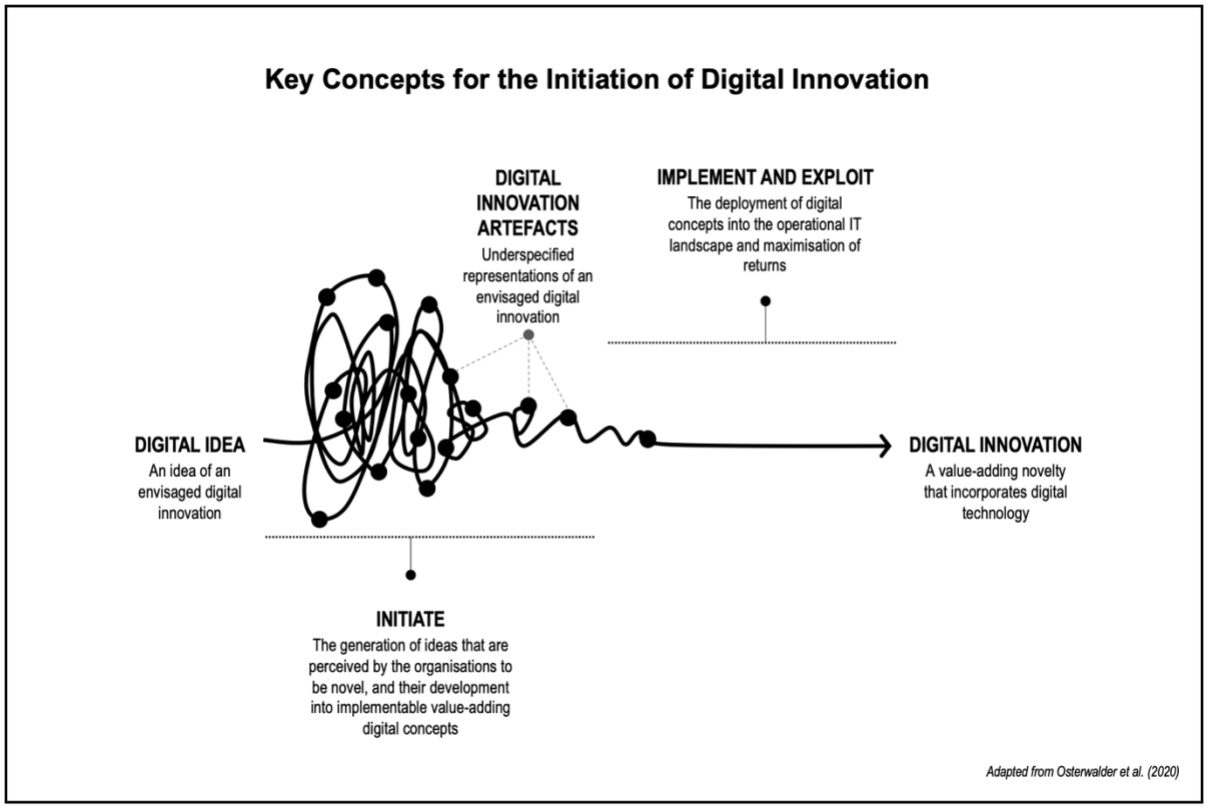

Figure 2. Key concepts for the initiation of digital innovation

2.2.2 INITIATION ACTORS

IT actors. While the initiation activity has not yet been thoroughly investigated, similarly scant attention has been given to the actors who take part in initiation. In their comprehensive review of the innovation-related literature in IS, Mamonov and Peterson (2021) found only four studies that examined the role of specific actors in the initiation of internal digital innovation. Of these, one study focuses on IT personnel (Kim et al., 2011), and three studies examine the role of IT executives, namely Chief Information Officers and Chief Digital Officers (Benlian & Haffke, 2016; Leidner et al., 2010; Tumbas et al., 2018). Kim et al.'s (2011) study on IT personnel shows that deep expertise on complex and specialized IT (i.e. operational systems, programming languages, database management systems, networking) critically contributes to the initiation of digital innovation. However, the enabling role of IT employees greatly depends on the organisation's ability to keep the IT infrastructure in pace with business needs, and the related management capabilities (e.g. business-IT coordination). Thus, IT personnel was found to positively affect a firm's performance mainly by reshaping business processes with digital technology. Overall, Kim et al. (2011) emphasise that digital technology is most valuable when it contributes to the firm's ability to adapt to changing business environments. Therefore, "competent IT staff is a necessary, but not sufficient, condition [for] competitive business processes" (ibid, p.501).

Regarding IT executives, the studies by Benlian and Haffke (2016) and Leidner et al. (2010) show that the Chief Information Officer (CIO) has become a major driver for digital innovation, not only thanks to their strong technical expertise but also to their increasingly deep business knowledge. The overall level of digital innovation in organisations is indeed strongly influenced by the CIO's strategic leadership (i.e. ability to create a vision of IT investment, shape expectations of IT-enabled values, and weave together business and IT strategies) and thought leadership (i.e. ability to make other executives aware of the strategic potential of IT) (Leidner et al., 2010). More specifically, CIOs are expected to act as strategic partners to CEOs who help them understand the business value of IT and reshape traditional business strategies with digital technology (Benlian and Haffke, 2016). To meet these expectations, CIOs must "demonstrat[e] their high level of business understanding and proactively guid[e] business strategy, particularly by bringing in their perspective on emerging technology trends, IT-driven innovation, and digital transformation" (ibid, p.116).

Taking this one step further, Tumbas et al. (2018) find that a number of organisations have created a new executive position to explicitly deal with "initiating new projects triggered by and rooted in digital technologies" (p.12). While digital technologies have historically fallen under the responsibility of CIOs, the emerging role of Chief Digital Officer (CDO) is carving out a space that overlaps and sometimes conflicts with CIO jurisdiction (Tumbas et al., 2018). Specifically, CDOs have been found to depart from established practices and norms of the IT profession to better collaborate with

organisational departments during the initiation of digital innovation. CDOs are especially valuable for dealing with departments that are known to bypass the CIO when developing their digital innovations or require more support than the CIO can give (Tumbas et al., 2018). Overall, these studies highlight a shift towards a greater acknowledgement of the business perspective and non-IT actors in the initiation of digital innovation.

Non-IT actors. The most recent addition to the set of studies on non-IT actors is Shao et al.'s (2021) research on front-line (i.e. non-managerial) employees. Shao et al. (2021) find that the use of digital technologies by frontline employees across functional departments fosters their digital creativity, which in turn enables them to generate new valuable ideas for enhanced job performance. Both exploitative and explorative uses of digital technology (i.e. IoT specifically) have been found to foster employees' digital creativity, where exploitative use involves repetition, refinement, and extension, and explorative use entails experimentation and innovation (ibid). Shao et al. (2021) conclude that "frontline employees serve as critical agents to facilitate the assimilation of the technologies into business processes and creatively utilise them to improve business offerings" (p.2). This echoes slightly earlier work on IT consumerisation and lightweight IT in which Bygstad (2017) and Gregory et al. (2018) describe how various actors, including workers, contribute to the initiation of digital innovation thanks to more democratised access to digital technology and more adaptable use cases. Unexpensive and easy-to-use digital technologies such as apps, business intelligence software, and Robotic Process Automation (Bygstad, 2017) allow for "product ideas to be quickly formed, enacted, modified, and re-enacted through repeated cycles of experimentation and implementation" (Nambisan et al., 2017, p.225). Overall, these studies concur that non-IT actors increasingly participate in the initiation activity.

Two different logics. Both IT and non-IT actors increasingly "look to innovate with digital technologies, but do so according to much different logics" (Tumbas et al., 2018, p.19). While IT actors put more emphasis on the systematic development of fully integrated solutions through software engineering methods, non-IT actors are mostly concerned with the experimentative use of non-invasive digital technologies through iterative innovation practices (Bygstad, 2017). Both logics face significant challenges, with the IT logic being affected by the increasing complexity and rising costs of the IT landscape, and the non-IT logic being at risk of producing isolated gadgets and security loopholes. Concretely, non-IT actors accelerate innovation activities, but their limited IT skills cause inefficiencies that "leave scope for software developers to augment and build upon [their] foundation" (Maruping & Matook, 2020, p.453). Overall, IT and non-IT actors offer valuable complementarities for digital innovation that remain largely untapped. Organisations may unlock these complementarities by bridging the gaps in development culture and discourse, and favouring a tighter integration between IT and non-IT actors in the development of innovative digital solutions (ibid). Table 4 below summarises the digital innovation logics of IT and non-IT actors.

DIGITAL INNOVATION LOGICS (based on Bygstad, 2017)		
	IT ACTORS	**NON-IT ACTORS**
PROFILE	Back-end: Supporting work documentation	Front-end: Supporting work processes
IT ARCHITECTURE	Fully integrated solutions	Non-invasive solutions
SYSTEMS	Transaction systems (servers, databases)	Apps, Business Intelligence, Robotic Process Automation (RPA) and other process support
DEVELOPMENT CULTURE	Systematics, quality, security	Innovation, experimentation
DISCOURSE	Software engineering	Business and practice innovation
PROBLEMS	Increasing complexity, rising costs	Isolated gadgets, security

Table 4. Digital innovation logic of IT and non-IT actors

2.2.3 DEFINITION AND SYNTHESIS

Our definition of digital innovation initiation. The IS literature does not yet provide a unified perspective of the initiation activity. Based on the above, we propose to define initiation as:

The generation of digital ideas that are perceived by the organisations to be novel, and their development by both IT and non-IT actors into implementable value-adding concepts (i.e. product, service, process, or business model).

We developed this definition with the following points in mind: (1) it builds on Hund et al.'s (2021) definition of digital innovation as the creation of value-adding novelties that necessarily incorporate digital technology, (2) it concurs with Oberländer et al.'s (2021) understanding of relative novelty, (3) it accounts for Kohli and Melville's (2019) understanding of the initiation activity as the development of opportunities, (4) it leverages von Briel et al.'s (2018) concept of digital ideas as a more workable alternative to opportunities, (5) it explicitly considers IT and non-IT actors (and implicitly allows for different logics as per Bygstad, 2017) while (6) remaining as parsimonious as possible.

Synthesis of Section 2.2. Prior research provides an initial understanding of the activities and actors involved in the initiation of digital innovation, and the digital opportunities that are typically initiated in incumbents. However, we have a limited understanding of the processes through which non-IT actors contribute to initiation. This gap is particularly problematic for incumbents, who typically have a large number of non-IT employees. In the following section, we identify three concrete ways in which non-IT employees can participate in digital innovation initiation in incumbents.

2.3 EMPLOYEE PARTICIPATION

This section reviews the literature on employee participation in the initiation of digital innovation. We especially focus on non-IT employees and describe their contributions to the initiation activity in terms of knowledge, skills, and creativity. We also highlight the importance of motivation and describe management- and employee-driven approaches to non-IT employees' participation. We conclude by defining three types of open calls that support the participation of non-IT employee in initiation.

2.3.1 OPEN PARTICIPATION

Heterogenous and distributed innovators. The IS literature increasingly acknowledges that organisations face less bounded innovation processes and outcomes and less predefined innovation agencies because of the pervasive use of digital technology (Nambisan et al., 2017). This applies also to the initiation activity, where the development of digital ideas has been shown to unfold differently than for traditional non-digital ideas (von Briel et al., 2018). Differences in idea development have notably been explained by the fact that digital technology is more easily re-combinable, editable, and distributable than its physical counterparts (Kallinikos et al., 2013; Tiwana et al., 2010; Yoo et al., 2010). These characteristics cause digital innovations "to evolve their identity over time and generate new forms of agency, both within and across processes" (von Briel et al., 2018, p.281). New forms of agencies principally refer to the emergent participation of more heterogenous and distributed innovators in digital innovation activities (Nambisan et al., 2017). Within organisations, this has notably resulted in an increased involvement of non-IT employees during initiation (Opland et al., 2022).

Inbound open participation. The shift towards more heterogenous and distributed innovation actors has most notoriously been explored in the field of open innovation. Since Chesbrough (2003) first coined the term roughly two decades ago, open innovation has experience a strong increase in scholarly attention, notably from the innovation, management, and IS communities (Bogers et al., 2017). Today, open innovation is a voluminous stream of work that explores distributed innovation processes and cross-boundary knowledge flows (Mamonov & Peterson, 2021). From an IS perspective, the open innovation lens has notably proven useful to the study of IT-enabled initiation and specifically how organisations can tap into the collective intelligence of Internet users with online crowdsourcing platforms (Blohm et al., 2013; Schlagwein & Bjorn-Andersen, 2014). Crowdsourcing has become increasingly popular among practitioners for sourcing knowledge from outside the organisation (Urbinati et al., 2021) and generating a large number of ideas with a distributed crowd. However, a number of challenges have been identified, mainly around intellectual property rights (Simula & Vuori, 2012), participant motivation (Kruft & Kock, 2021), and information overload (Blohm et al., 2013). Regarding the latter, organisations often struggle to "cope with the enormous volume and variety of big data acquired via Internet-based crowdsourcing platforms" (Blohm et al., 2013, p.200). As an

alternative to externally open innovation, Laviolette et al. (2016) propose to investigate internal open innovation, or the open nature of innovation activities within organisational boundaries (Opland et al., 2022). They introduce the term "inbound open innovation" (p.1) to refer to how employees act as internal vectors of open innovation by "tapping in external and internal knowledge sources and integrating them in new ways within the scope of their company" (p.1). However, we note that open innovation research does not typically focus on inbound open innovation, nor on innovation with digital artefacts at its core. This stream of work has thus remained fairly independent from the digital innovation literature (Mamonov & Peterson, 2021) and only applies indirectly to our research. In the remaining of this section, we thus review prior work on employees' contributions and participation to the initiation of digital innovation beyond the open innovation stream.

2.3.2 NON-IT EMPLOYEES' CONTRIBUTIONS

Three generic contributions. Research on the type of contributions non-IT employees can make to the initiation of digital innovation is highly fragmented (Opland et al., 2022). We have found relevant insights (i.e. *what* can they contribute?) to be scatted across the fields of digital entrepreneurship (e.g. Arvidsson & Mønsted, 2018; Vassilakopoulou & Grisot, 2020), IS strategy (e.g. Peppard, 2018), digital infrastructures (e.g. Bygstad, 2017; Gregory et al., 2018; Maruping & Matook, 2020), IT ambidexterity (e.g. Oberländer et al., 2021), and digital creativity research (e.g. Shao et al., 2021). Overall, studies on the topic have highlighted that non-IT employees can make three generic contributions to the initiation of digital innovation: (a) knowledge, (b) skills, and (c) creativity.

- **Knowledge.** First, non-IT employees have been shown to acquire highly contextualised knowledge in their daily activities that can be valuable to the identification and enactment of digital opportunities (Oberländer et al., 2021). On the one hand, top and middle managers do not typically possess the same in-depth knowledge about operative routines than non-IT employees, nor do they necessarily have the time or expertise to fully comprehend all underlying processes and activities (Kesting & Ulhøi, 2010). On the other hand, IT employees typically struggle to achieve a similarly deep understanding of user needs than non-IT employees, because they seldomly interact with prospective users directly (Bygstad, 2017). In contrast to external innovators, the knowledge of non-IT employees has the additional benefit of being contractually bound to the organisation. Therefore, intellectual property rights are rarely an issue because potentially conflictual situations are typically regulated in employment contracts (Zuchowski et al., 2016).
- **Skills.** Second, non-employees have been shown to develop and apply entrepreneurial skills that help them leverage the generative potential of digital technology (Arvidsson & Mønsted, 2018) and navigate the uncertainties in digital idea development (Vassilakopoulou & Grisot, 2020). These entrepreneurial skills notably include "concealing" initiation activities by flying under the managerial radar to better manoeuvre the political landscape and avoid the premature termination

of their digital ideas (Arvidsson & Mønsted, 2018). Non-IT employees have also been shown to apply their comparatively limited technical skills during initiation. The pervasiveness of digital technology in everyday life indeed transforms their expectations of digital technology (Karoui & Dudézert, 2016) and influences their IT-related activities (Gregory et al., 2018), encouraging them to increasingly make use of their technical skills to bypass the IT department (Bygstad, 2017).

- **Creativity.** Third, non-IT employees have been shown to leverage their digital creativity in daily work to come up with innovative digital ideas (Shao et al., 2021). As Shao et al. (2021) report in their study of digital creativity, the use of digital technologies in ways that involve repetition, refinement, and extension, or experimentation and innovation, enhances employees' ability to generate innovative ideas. Their creativity can enable organisations to address a broad range of intelligence problems (i.e. accessing specific information and knowledge), design problems (i.e. generating and developing ideas, co-creating strategy), and decision problems (i.e. crowd voting) (Zuchowski et al., 2016). It has been found to be particularly suitable for "problems that are mission critical, strategic, and otherwise non-publishable" (ibid, p.171) and "problems that benefit from knowledge varied across departments" (ibid, p.180), which arguably include digital innovation initiation. Despite their considerable creative potential, however, non-IT employees still represent a largely untapped resource in the front-end of digital innovation (Opland et al., 2020, 2022).

Motivation. Next to their knowledge, skills, and creativity, employees generally demonstrate high levels of intrinsic motivation to innovate (Zuchowski et al., 2016). This seems to remains true in the digital age, as the everyday use of digital technology has been found to drive non-IT employees' motivation to engage in digital innovation (Shao et al., 2021). However, in situations where employees feel expected to participate, motivation and commitment may vary significantly, and additional incentives may become necessary (Zuchowski et al., 2016). In their study on internal ideation platforms, Kruft & Kock (2021) show that the use of digital technology can increase employees' motivation to engage in innovative behaviour. The front-end of innovation can for instance be supported by generic social IT platforms such as wikis or forums, or specific IT such as idea management systems (Zuchowski et al., 2016). Compared with wikis and forms, idea management systems provide a more thorough and more flexible support for the management of ideas from their generation to their deployment (Gerlach & Brem, 2017). These systems typically comprise an online platform where employees can submit ideas, view ideas and their current status, post comments, and vote on ideas, and a backend where the ideas, comments, and votes are gathered, stored, and organised by management (Westerski et al., 2011). Idea management systems, electronic suggestion schemes, online ideation platforms, digital intrapreneurship platforms, and internal crowdsourcing platforms all designate IT software specifically aimed at fostering employee participation in the front-end of innovation (e.g. Kruft & Kock, 2021; Zuchowski et al., 2016).

2.3.3 NON-IT EMPLOYEES' PARTICIPATION

Two extremes on a continuum. Based on our review of the literature, we find two different approaches to involving non-IT employees in the initiation of digital innovation within incumbents (i.e. *how* can they contribute?). Specifically, we define a continuum of non-IT employee participation ranging from management-driven to employee-driven. Figure 3 below illustrates the continuum.

- **Management-driven.** On the one end of the continuum, the management-driven approach refers to hierarchy-based work settings where employees participate in the initiation of digital innovation based on management's decision (Zuchowski et al., 2016). Typically, non-IT employees are allocated to interdisciplinary projects where they help initiate digital innovation by providing business insights in agile rounds of development or DevOps teams (Maruping & Matook, 2020). Digital technologies have indeed "opened up new ways of making sense of user preferences, [leading to] tighter integration of software development and operations" (ibid, p.447) via organisational processes, but also via new organisational structures. Some organisations have notably created separate sub-units dedicated to digital innovation, also called "digital innovation labs" (Goebeler et al., 2020). Generally, IT and non-IT employees are selected in a top-down manner based on formal roles and areas of expertise and join the digital innovation lab to explore digital technologies and use cases (Fuchs et al., 2019). This assumes, however, that the best innovators are known to management, that they are motivated to contribute, and they can easily be allocated to the separate unit (Zuchowski et al., 2016). Overall, the management-driven approach allows for extensive managerial control with formal structures and processes but leaves little room for serendipity during initiation.

- **Employee-driven.** On the other end of the continuum, the employee-driven approach refers to unsolicited innovation activities carried out by employees with an entrepreneurial mindset (Opland et al., 2022). This approach allows for great flexibility since individual practices are not typically embedded in existing organisational structures and processes, providing employees "the freedom to identify opportunities and pursue them" in a bottom-up manner (Arvidsson & Mønsted, 2018, p.369). However, organisations run the risk of losing control of such employee-driven digital innovation. In fact, "intrapreneurial activities may unfold even against the wishes of superiors" (Vassilakopoulou & Grisot, 2020, p.3). Specifically, employees have been found to work against the logic of systematic preplanning with intrapreneurial tactics (e.g. Arvidsson & Mønsted, 2018; Vassilakopoulou & Grisot, 2020). Regarding initiation specifically, digital intrapreneurs have been found to make use of the "concealing" tactic to "develop applications under the radar until investments can be justified" (Arvidsson & Mønsted, 2018, p.371). Moreover, they deal with high levels of uncertainty during initiation by "trialling" with low-code digital technology to postpone the integration of the envisioned digital solution into the broader technological landscape and

circumvent lengthy risk assessments by IT actors (Vassilakopoulou & Grisot, 2020). Overall, the employee-driven approach helps organisations overcome risk-averse managerial decision-makers and resource-strapped IT departments at the cost of reduced control over digital innovation activities.

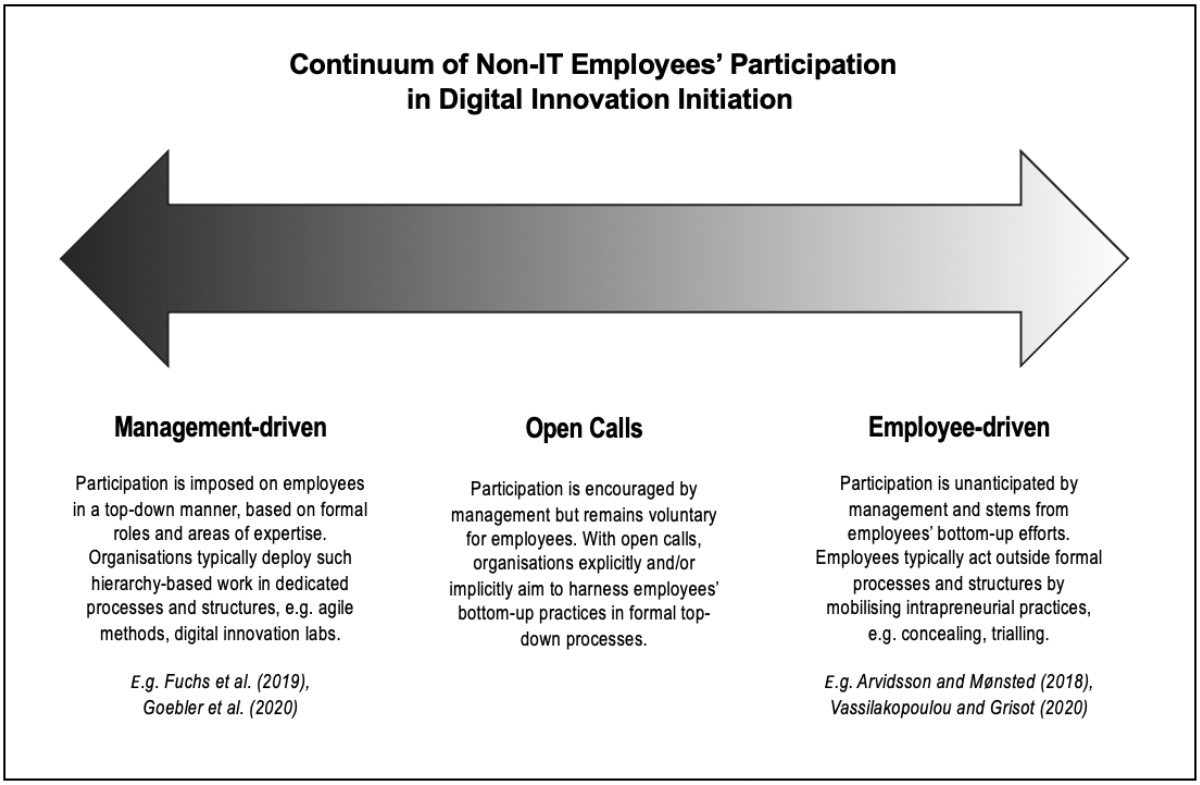

Figure 3. Continuum of non-IT employees' participation in digital innovation initiation

Three types of open calls. Between those two extremes lies a more moderate approach that combines elements of the management-driven and employee-driven approaches: what Zuchowski et al. (2016) call "open calls". Compared to purely management-driven or employee-driven approaches, open calls are in-betweens where management invites non-IT employees to volunteer in the initiation of innovation. Participation in open calls is generally supported by formal processes that harness employees' bottom-up innovation practices (Opland et al., 2022). Based on our review of the literature, we find that incumbents can initiate digital innovation with non-IT employees in three types of **internal open calls**: (1) explicit, (2) implicit, and (3) mixed.

- **Explicit open calls.** Explicit open calls are formal tenders for ideas that are addressed at employees through an enterprise-wide programme, which is typically launched by management. Idea management programmes are a widespread means to encourage employees to share their ideas (Gerlach & Brem, 2017). The underlying idea campaigns are often support by digital tools (e.g.

idea management systems) that enable employees to submit their ideas and managers to track them in dedicated processes (Reibenspiess et al., 2020).

- **Implicit open calls.** Implicit open calls are informal tenders for ideas that are addressed at employees through an inherently open technology, which is typically deployed on behalf of management. Early examples included internal social networking sites and social media applications such as instant messaging and micro blogs (Davison et al., 2018). More recently, incumbent organisations have started to leverage "digital platforms that enable the development of simple applications through the design and configuration of graphical user interfaces" (Maruping & Matook, 2020, p.453), i.e. low-code (or no-code) platforms. These platforms aim to enable individuals who have a basic understanding of modelling principles (e.g. universal modelling diagrams, activity diagrams, etc.) to develop applications without writing programming syntax (Maruping & Matook, 2020). This development is noteworthy because it has the potential to provide a new avenue for implicit open calls, where employees with little coding experience can develop their digital ideas into an implementable concept (e.g. software application) by themselves.
- **Mixed open calls.** Mixed open calls combine key features of explicit and implicit open calls by integrating open programmes and open technologies in enterprise-wide initiatives for digital innovation. Supporting idea management programmes with low-code technologies is for instance becoming increasingly popular among practitioners (Rymer & Seguin, 2019), yet this type of mixed open calls has not yet been explicitly addressed in the literature.

2.3.3 SYNTHESIS

Synthesis of Section 2.3. Prior research provides a fragmented understanding of the ways in which non-IT employees can participate in the initiation of digital innovation. We have synthesised prior knowledge on the topic along two broad approaches (i.e. management-driven, employee-driven) and identified three types of open calls (i.e. explicit, implicit, mixed). Prior research on the topic of open calls generally fails to theorise about non-IT employees' participation in digital innovation initiation beyond IT-enabled idea generation. We therefore lack an understanding of how the digital nature of innovation impacts the initiation activity with employees. This gap is problematic for practitioners who wish to involve non-IT employees in the initiation of digital innovation. In the following section, we help the reader contextualise the phenomenon of open calls by providing some key figures and real-world data on open calls for digital innovation initiation.

2.4 EXTENT AND IMPORTANCE OF OPEN CALLS FOR DIGITAL INNOVATION

Key figures. Digital innovation, employee participation, and open calls are relatively abstract concepts that most readers may not be deeply familiar with. To help them grasp the reality of the field and understand the importance of our phenomenon of interest, this section presents some key figures on digital innovation. Table 5 and **Error! Reference source not found.** provide a visual overview.

- **Digital innovation**. According to a large-scale survey by Couchbase (2017), over 80% of digital decision-makers believe that their industry is being or will be disrupted by digital technology, and are concerned their business could be at risk of being left behind by digital-savvy competitors. Similarly, 80% of digital decision-makers feel under pressure to be constantly improving their organisation's customer experience through digital innovation projects. The average yearly spending on digital innovation projects is $6M, and organisations have realised the following tangible objectives from their investments in digital projects: more efficient work processes (60%), improved customer experience (55%), bringing new services and products to market faster (28%).
- **Innovation maturity**. According to Innovation Leader and KPMG (2020), the majority of organisations are in "emerging" (46%) or "defined" (27%) maturity stages with regards to their innovation programmes, i.e. their innovation initiatives are becoming more organised, systems are put into place, and processes are becoming more consistent. Around 12% are in "integrated" or "optimized" maturity stages, i.e. their innovation initiatives systematically track and realise innovation outcomes, efficiently incentivize employees to innovate, and significantly drive the corporate culture. The final 13% of organisations are in an "ad hoc" maturity stage, i.e. their innovation initiatives lack strategic vision, as well as formal tools, systems, and procedures. The challenge of adopting emerging digital technologies is the biggest obstacle to innovation maturity in 21% of organisations.
- **Employee participation**. Innovation Leader and KPMG (2020) find that a majority of organisations (65%) encourage employees to participate in innovation activities by offering some kind of recognition (i.e. time, funding, rewards, recognition, or bonuses), and about one-third (30%) track employee participation rates in their innovation programmes. Innovation Leader (2015) report that employees typically generate most of the innovation ideas in organisations. According to their survey, around half of organisations (43%) generate between 1-99 ideas per year, one-third (33%) generate 100-999 ideas, some (8%) generate 1'000-9'999 ideas, and a minority (2%) generate more than 10'000 ideas annually.
- **Innovation tools**. Innovation Leader (2015) find that 62% of organisations use idea capture tools for ideation, 71% use rapid prototyping tools for ideation, and 46% use project management tools

for idea development. Forrester (2015) reports an overall 69% usage of innovation management solutions across organisations.

- **Innovation teams**. According to Innovation Leader and KPMG (2020), most innovation teams are small; innovation programmes are typically staffed with 1-9 FTEs, or 10-24 FTEs for innovation top-performers (excluding long-established groups such as R&D teams).
- **Case illustrations**. Finally, several academic and practitioner case studies provide quantitative insights into internal open calls in incumbents. These case studies focus primarily on the use of idea management platforms for idea generation. Table 5 below summarises selected key figures.

KEY FIGURES FROM PRIOR RESEARCH ON INTERNAL OPEN CALLS

	ORGANISATION	PARTICIPANTS	IDEAS GENERATED	OUTCOMES	SOURCE
ACADEMIC CASE STUDIES	**ALLIANZ UK** "IDEAS TO SUCCESS" (AS OF 2014)	NA (employees only)	41'000 ideas	£20M annualised benefit	Benbya & Leidner (2017)
	RENAULT "RENAULT CREATIVE PEOPLE" (AS OF 2011)	NA (employees only)	350 ideas	9 ideas implemented	Elerud-Tryde & Hooge (2014)
	VOLVO CARS "GLOBAL INNOVATION GIG" (AS OF 2011)	NA	278 ideas	0 ideas implemented	Elerud-Tryde & Hooge (2014)
PRACTITIONER CASE STUDIES	**AXA** "START-IN" (AS OF 2016)	23'000 (employees only)	873 ideas; 2'500 comments; 28'000 votes	4 ideas in implementation	Axa.com
	CISCO "INNOVATE EVERYWHERE" (AS OF 2016)	57'000 (employees only; 49% engagement)	5'600 ideas; 20'000 comments; 61'000 votes	86 ideas implemented; $60M tracked outcome; $170M projected outcomes	Brightidea.com; Itonics-innovation.com
	HEWLETT PACKARD "THE GARAGE" (AS OF 2015)	31'000 (employees only)	80 ideas; 750 comments; 700 votes	3 ideas in implementation	Brightidea.com
	GENERAL ELECTRIC "ECOMAGINATION" (AS OF 2015)	70'000 (employees & externals)	3'844 ideas; 80'000 comments; 120'000 votes	12 ideas in implementation	Brightidea.com
	GREAT-WEST LIFE "NAME THE TOOL" (AS OF 2017)	3'350 (employees only; 24% engagement)	2'170 ideas; 3'070 comments; 1'930 votes	11 ideas implemented	Microsoft.com
	NIELSEN "CYCLE TIME" (AS OF 2013)	NA (employees only)	500 ideas	Saved 4M hours of documented work	Brightidea.com
	MERCK "MIND"	1'500 (employees only)	300 ideas	5 ideas in implementation	Strategos.com
	VERIZON	NA	1'300 ideas	$25M outcome	Planbox.com

Table 5. Key figures for internal open calls in incumbent organisations

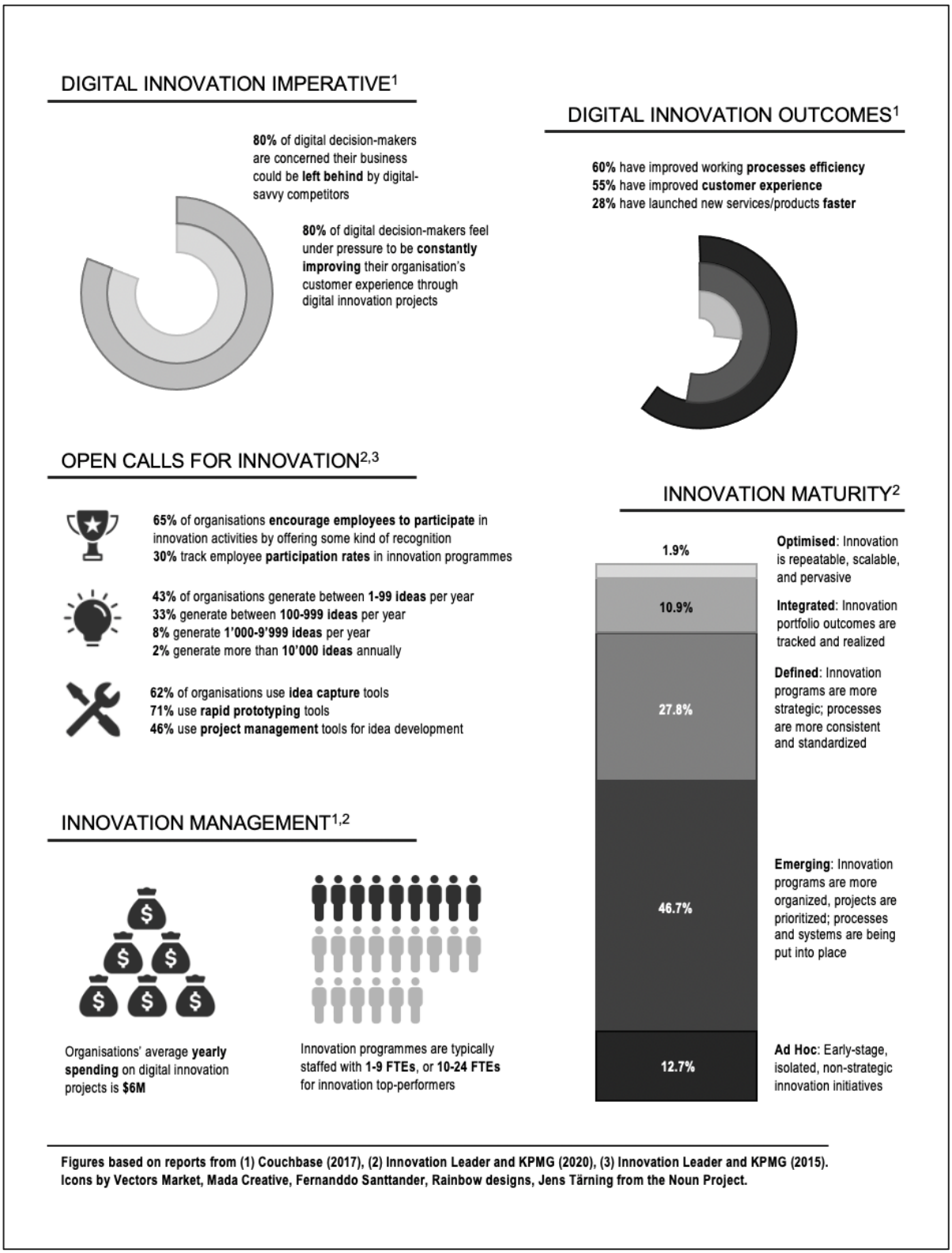

Figure 4. Infographic on digital innovation and internal open calls

2.5 SYNTHESIS OF BACKGROUND

We close our background section by synthesising the main insights of Chapter 2. In Table 6 below, we recapitulate key concepts, provide a definition, and summarise their main characteristics.

KEY CONCEPTS IN DIGITAL INNOVATION INITIATION		
CONCEPT	**DEFINITION**	**CHARACTERISTICS**
DIGITAL INNOVATION	"The creation or adoption, and exploitation of an inherently unbounded, value-adding novelty (e.g., product, service, process, or business model) through the incorporation of digital technology" (Hund et al., 2021, p.6)	Unbounded and generative
DIGITAL INNOVATION INITIATION	The generation of ideas that are perceived by the organisations to be novel, and their development into implementable value-adding concepts (i.e. process, product, or service) that are at least partially enabled by or embedded in digital technology, by both IT and non-IT actors (own definition based on Bygstad, 2017; Oberländer et al., 2021; von Briel et al., 2018)	Classic stage-gate model vs blurred role and phase boundaries
DIGITAL OBJECT	Purely technical object (i.e. "objects whose component parts include one or more bitstrings"; Faulkner & Runde, 2019, p.7), related to digitisation	Homogenised via data bitstrings
DIGITAL TECHNOLOGY	"Digital object with socially agreed upon meaning" (Hund et al., 2021, p.5), related to digitalisation	Editable via component reprogrammability
DIGITAL OPPORTUNIY	Context-sensitive "possibilities for action enabled by digital technologies, which may lead to innovative digital or non-digital outcomes" (Oberländer et al., 2021, p.3)	Explorative or exploitative; internal, external, or shared digital resources
DIGITAL IDEA	An idea of an envisaged digital innovation (based on "a new venture idea that has a digital artifact at the core of the (imagined) market offering"; von Briel et al., 2018, p.292)	Ambiguous, necessarily subjective
DIGITAL ARTEFACT	"Man-made purposeful objects embodied in information and communication technology components of software and hardware" (von Briel et al., 2018, p.292)	Malleable
DIGITAL INNOVATION ARTEFACT	Any underspecified representation of an envisaged digital innovation (based on "any underspecified representation of an envisaged new software product"; Ciriello et al., 2019, p.151); characteristics based on Vassilakopoulou & Grisot (2020))	Practice-oriented; evocative, disposable, and responsive
DIGITAL INNOVATION CONCEPT	An envisaged digital innovation that is sufficiently specified for implementation in the existing IT infrastructure and maximisation of returns (based on Kohli & Melville, 2019)	Implementable and exploitable
IT ACTOR	Individuals who are IT professionals, e.g. IT architects, integration specialist, IT managers (based on Bygstad, 2017; Gregory et al., 2018)	Systematic IT-oriented approach
NON-IT ACTOR	Individuals who are not IT professionals, e.g. employees, users (based on Bygstad, 2017; Gregory et al., 2018)	Experimentative business-oriented approach
EXPLICIT OPEN CALLS	Formal tenders for ideas addressed at employees via an enterprise-wide programme that is typically launched by management (based on Reibenspiess et al., 2020; Zuchowski et al., 2016)	Open, enabled by IT; idea management systems
IMPLICIT OPEN CALLS	Informal tenders for ideas addressed at employees via an inherently open technology that is typically deployed on behalf of management (based on Prinz et al., 2021; Zuchowski et al., 2016)	Open, embedded in IT; low-code platforms
MIXED OPEN CALLS	Tenders for ideas that integrate inherently open technologies with idea management programmes, combining key features of explicit and implicit open calls in enterprise-wide initiatives for digital innovation (based on Rymer & Seguin, 2019)	Open, both enabled by and embedded in IT

Table 6. Synthesis of key concepts

CHAPTER 3. RESEARCH OPPORTUNITY AND GAPS

This chapter describes the research opportunity and research gaps that guided our work.

3.1 RESEARCH OPPORTUNITY

Exploring an understudied phenomenon. Despite growing consensus in the IS community that non-IT employees can significantly contribute to initiation, digital innovation is still primarily framed "as a strategic initiative organized and effected within the IT services function" (Kohli & Melville, 2019, p.202). Employee participation beyond the IT unit is commonly viewed as the "organisational backdrop" (ibid, p.202) rather than the core phenomenon of interest. As a result, non-IT employees remain a rather unexplored topic in digital innovation research (Mamonov & Peterson, 2021). In practice however, organisations increasingly leverage the knowledge, skills, and creativity of non-IT employees to generate and develop ideas for digital innovation, causing notable shifts in innovation agency (Opland et al., 2022). This is especially the case in incumbent organisations, where most employees do not have a technical background (Oberländer et al., 2021). Without a conceptual understanding of their participation in the initiation activity, we are left with an incomplete picture of digital innovation (Opland et al., 2022). This may lead scholars to overlook important differences between traditional and digital innovation and result in distorted conceptualisations of digital innovation management (Nambisan et al., 2017). Moreover, it may hinder our ability to provide guidance on the topic and cause practitioners to miss out on critical digital opportunities (Oberländer et al., 2021). The research opportunity we aim to address thus lies in *the lack of a conceptual understanding of digital innovation initiation with non-IT employees in incumbent organisations.*

3.2 RESEARCH GAPS

Open calls in incumbents. This thesis addresses three research gaps pertaining to the initiation of digital innovation with non-IT employees in incumbents: explicit open calls, implicit open calls, and mixed open calls.

- **GAP 1: Explicit open calls.** Prior research on explicit open calls investigated how the use of idea management platforms (Benbya & Leidner, 2017), internal crowdsourcing platforms (Greineder & Blohm, 2020), idea screening cockpits (Ciriello & Richter, 2019), and digital intrapreneurship platforms (Reibenspiess et al., 2020) enhance employee participation in the front-end of innovation. In their review of the digital innovation literature, Mamonov and Peterson (2021) highlight a generally positive effect on organizational innovation. However, Opland et al.

(2022) note that extant studies have also cautioned against a number of shortcomings, such as the bottleneck that many organisations experience when transferring the ideas generated by employees into marketable solutions. This bottleneck has been found to stem notably from the reliance on managers and experts as idea assessors, who may not always be available or suited to evaluating inherently subjective ideas (von Briel et al., 2018). Interestingly, the digital nature of ideas and how it impacts classic initiation processes has hardly been discussed (Opland et al., 2022). This is although digital ideas are distinctly more ambiguous and malleable than traditional innovation (von Briel et al., 2018). In sum, existing research has neither sufficiently addressed the changes in explicit open calls that result from the digital nature of innovation, nor the corresponding transformation process itself. We therefore lack an understanding of **how the digital nature of ideas transforms traditional innovation processes**. Taking idea management programmes as an instantiation of explicit open calls, we therefore ask:

How is idea management transformed to help seize digital innovation opportunities? (Paper 1a)
How can idea management programmes be conceptualized in light of digital innovation? (1b)

- **GAP 2: Implicit open calls.** Prior work shows that inherently open technologies are prolific avenues for generating and developing ideas with non-IT actors (Bygstad, 2017). In particular, open technologies hold potential for shifting the participation of non-IT actors from that of informants who share their ideas with software developers to actually implementing their ideas in software applications (Maruping & Matook, 2020). Viewed from a different perspective, the use of such digital technology at work can trigger employees' creativity (Shao et al., 2021) and make software development more affordable (Gregory et al., 2018). Practitioner research predicts that the adoption of inherently open technologies will increase with the maturity of digital platforms that reduce technological barriers for non-IT users (Prinz et al., 2021). Maruping and Matook (2020) highlight that "academic research on low-code and its implications are minimal at present [y]et, it has tremendous potential to inform the form and intensity of user participation in software development" (p.453). More generally, investigating **how the use of digital technology in innovation practices transforms traditional innovation agency** is of great interest to digital innovation scholars and the IS field at large (Nambisan et al., 2017). Taking low-code development as an instantiation of implicit open calls, we therefore ask:

  How are innovative ideas developed on low-code development platforms? (Paper 2)

- **GAP 3: Mixed open calls.** Organisations rarely lack ideas, but rather are unable to act upon the good ideas that are already there (Opland et al., 2022). While the probability of finding a good idea statistically increases with the number of ideas generated, so do the resources required to develop them in traditional innovation processes (Blohm et al., 2013; Gerlach & Brem, 2017). To address

the scarcity of IT resources, more and more organisations involve non-IT employees in the rapid development of marketable digital solutions with a mix of implicit and explicit open calls (Opland et al., 2022). To the best of our knowledge, the literature has not yet addressed the emergent phenomenon of mixed open calls for digital innovation. Particularly, we know little about how the problems in the innovation logic of non-IT actors described in Bygstad (2017) play out when non-IT employees are formally encouraged to generate innovative digital ideas and develop them with digital technologies. Tapping into the potential of non-IT employees with open calls may well result in diverse, emergent, and ill-defined contributions that IT units struggle to act upon. As Maruping and Matook (2020) put it, "to be clear, these [low-code] platforms enable those with no coding experience to develop somewhat functional applications, but these are very limited in their capabilities and may possess many security flaws" (p.453). The contributions of IT and non-IT employees should thus be integrated and coordinated, yet this has not received much spotlight so far (Maruping & Matook, 2020). Extant studies on the topic have either focused on the potential of platforms for bringing together different communities of IT developers and reshaping their orchestration (e.g. Daniel et al., 2018; Zhang et al., 2019), or on the orchestration of development and operations domains within organisations (DevOps, e.g. Hemon et al., 2020). We therefore still lack an understanding of **how organisations can develop competences to orchestrate the large-scale participation of non-IT employees in digital innovation** and build an enterprise-wide digital innovation capability. Taking enterprise-wide initiatives for digital innovation as an instantiation of mixed open calls, we ask:

How can incumbent organisations coordinate and integrate their employees' contributions to digital innovation? (Paper 3)

CHAPTER 4. THESIS STRUCTURE AND RESEARCH STREAMS

This chapter describes the structure of this thesis in terms of research streams and constitutive papers.

4.1 THESIS STRUCTURE

This thesis comprises four research papers which we have published and presented in peer-reviewed IS conferences between 2020 and 2022. These four papers explore three research streams and jointly provide an answer to our overarching research question. Figure 5 below illustrates the thesis structure.

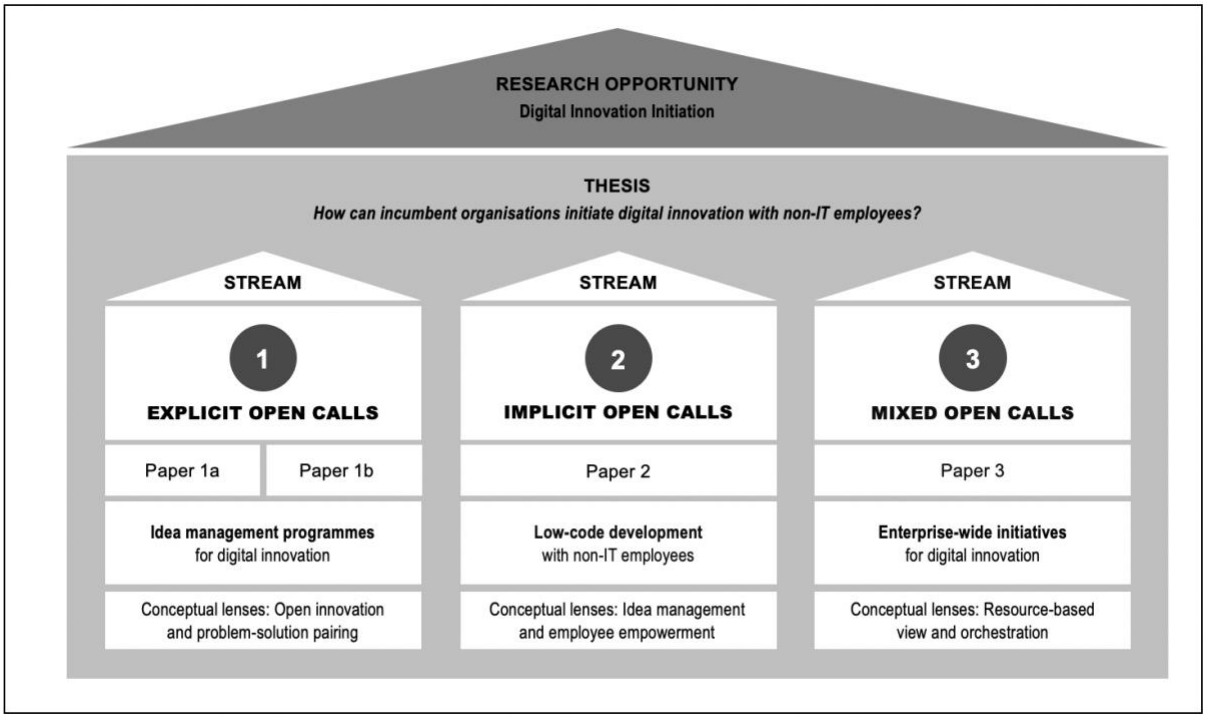

Figure 5. Overview of thesis structure

4.2 RESEARCH STREAMS

Our three research streams focus on (1) explicit, (2) implicit, and (3) mixed internal open calls. Each stream addresses a particular aspect of the larger research opportunity and makes a distinct contribution to our overall research question. We account for the complex and emergent nature of our phenomenon of interest by deploying a mix of qualitative research methods and applying different conceptual lenses. Moreover, we favour a holistic understanding of our research question with different research focuses, notably organisational processes, individual practices, and organisational competences. The insights

from our three research streams combined yield a rich understanding of digital innovation initiation with non-IT employees. The constitutive papers of each research stream are listed in Table 7 below.

4.3 RESEARCH PAPERS

The four papers presented in this thesis are contained in the Appendix (see p.88 for the full list of our publications and an overview of each author's contribution). Alternatively, the papers are available in the following conference proceedings:

1a. Krejci, D. and Missonier S. (2020). Idea Management in the Age of Digital Innovation: An Exploratory Case Study. *Conference of the Association Information and Management (AIM)*. Marrakesh, Morocco| Virtual.

1b. Krejci, D. and Missonier S. (2020). Idea Management in a Digital World: An Adapted Framework. *Hawaii International Conference on System Sciences (HICSS)*. Maui, Hawaii| Virtual.

2. Krejci, D., Iho, S. and Missonier, S. (2021). Innovating with Employees: An Exploratory Study of Idea Development on Low-Code Development Platforms. *Twenty-Ninth European Conference on Information Systems (ECIS)*. Marrakesh, Morocco| Virtual.

3. Krejci, D., Küng, K. and Missonier, S. (2022). A Case Study of Enterprise-wide Digital Innovation: Involving Non-IT Employees. *Thirtieth European Conference on Information Systems (ECIS)*. Timisoara, Romania.

THESIS RESEARCH STREAMS AND PAPERS						
	N°	**PAPER TITLE**	**QUESTION**	**METHOD**	**KEY CONTRIBUTIONS**	**OUTLET**
STREAM 1 – EXPLICIT OPEN CALLS	1a	Idea Management in the Age of Digital Innovation –An Exploratory Case Study	*How is idea management transformed to help seize digital innovation opportunities?*	Longitudinal in-depth case study at Globex (observational, interview, and secondary data).	**To theory**: Validates DIM's core tenets in initiation (i.e. fluid processes and emergent actors). **To practice**: Dimensions of organisational inertia and actions to address it during initiation.	Full paper published in Proceedings of Association Information et Management (AIM) 2020.
	1b	Idea Management in a Digital World –An Adapted Framework	*How can idea management programmes be conceptualized in light of digital innovation?*	Longitudinal in-depth case study at Globex.	**To theory**: Refines DIM with a process perspective on initiation (development of a refined framework). **To practice**: Processes and tools for sense-making and orchestration in the initiation of digital innovation.	Full paper published in Proceedings of 54th Hawaii International Conference on System Sciences (HICSS) 2021.
STREAM 2 – IMPLICIT OPEN CALLS	2	Innovating with Employees –An Exploratory Study of Idea Development on Low-Code Development Platforms	*How are innovative ideas developed on low-code development platforms?*	Expert interviews and secondary data (analyst reports, vendor documentation, user reviews).	**To theory**: Refines DIM with a practice perspective on initiation (development of an initial framework). **To practice**: Initial blueprint for idea development on low-code platforms (including stakeholders, roles, challenges, support factors).	Full paper published in Proceedings of European Conference on Information Systems (ECIS) 2021.
STREAM 3 – MIXED OPEN CALLS	3	A Case Study of Enterprise-wide Digital Innovation –Involving Non-IT Employees	*How can incumbent organisations coordinate and integrate their employees' contributions to digital innovation?*	Longitudinal in-depth case study at Globex.	**To theory**: Refines DIM with a competence perspective on initiation (defines three novel competences: orchestration, self-orchestration, choreography). **To practice**: Managerial actions to enhance digital innovation capability and digital business strategy.	Full paper published in Proceedings of European Conference on Information Systems (ECIS) 2022.
THESIS		How Incumbent Organisations Initiate Digital Innovation with Non-IT Employees	*How can incumbent organisations initiate digital innovation with non-IT employees?*	Analysis of the above.	Synthesis of the above.	Doctoral thesis.

Table 7. Research streams and constitutive papers

CHAPTER 5. RESEACH PHILOSOPHY AND METHODOLOGY

This section describes our research philosophy and research methodology. It provides an overview of critical realism and case study research, introduces the concept of "methodological bricolage" as per Pratt et al. (2022), and explains how we addressed ethical concerns in our research.

5.1 RESEARCH PHILOSOPHY

Philosophy of science. The central questions of ontology (i.e. *what is reality? What is the nature of the world?*) and epistemology (i.e. *how can one know reality? How can one produce reliable knowledge?*) are pivotal to conducting high quality research (Avenier & Thomas, 2015). Philosophical paradigms notably dictate what phenomena are worthy of investigation, what research questions and methods are appropriate, and what findings constitute valuable knowledge (Gorski, 2013). More generally, researchers are well advised to reflect on their ontology and epistemology to avoid seeking a reality that does not exist, or ignoring parts of the full reality that exists (ibid). Given that any form of research is underlain by a philosophy of science, "it is better to choose a philosophy of science than to inherit one by default" (Van de Ven, 2007, p.36).

Critical realism. The research presented in this thesis takes a critical realist perspective. As a research philosophy, critical realism constitutes a middle ground between positivist-oriented philosophies, which advocate that reality is made of universal laws, and interpretivism-oriented philosophies, which view reality as made of meaning and discourse (Collier, 1994; Gorski, 2013). More specifically, critical realism acknowledges that the world is real, but that knowledge production is fallible[1] (Bhaskar, 1975, 1998). In other words, it recognises that science is a social process that aims to conceptualise the real world by building theories upon localised knowledge (Mingers et al., 2013). Therefore, critical realism entails a realist approach to the world (i.e. realist ontology) and a subjectivist approach to knowledge creation (i.e. subjective epistemology). We identify as a critical realist because we fundamentally agree there is a single objective reality that can only ever be known imperfectly.

Critical realism in IS research. Applying the critical realism paradigm to research entails paying special attention to causal mechanisms (i.e. conceptual structures) that act as tendencies in the world (Gorski, 2013). In the field of IS, it involves carefully studying individuals and digital technology as socio-technological actors, exploring their interactions, and conceptualising their role in causal mechanisms (Wynn & Williams, 2012). Critical realism has established itself as a viable philosophical

[1] Critical realism views knowledge production as theory dependent (i.e. knowledge is *influenced* by the theories a researcher adopts, thus all knowledge is fallible) but not theory determined (i.e. knowledge is *determined* by the theories the researcher adopts, thus all knowledge is equally valid).

paradigm in IS (Mueller & Urbach, 2017) notably because it allows researchers to craft usable theories that demonstrate causal power while acknowledging the socio-technical complexity of IS phenomena (Avenier & Thomas, 2015; Wynn & Williams, 2012). Critical realist research is thus particularly suited for research that aims to close the gap between academics and practitioners with deep and useful knowledge (Van de Ven, 2007), such as digital innovation research.

Critical realism and digital innovation research. Critical realism seems particularly suited to digital innovation research because the phenomenon of digital innovation is difficult to observe directly, and we can only observe its underlying processes and practices, which may or may not reflect the full reality of digital innovation. With regards to digital innovation management specifically, critical realism has helped IS scholars uncover a number of generative mechanisms and socio-technical dynamics (Wynn & Williams, 2012). Research that is explicitly positioned in the critical realist paradigm includes Vega and Chiasson's (2019) study on the role of technology in innovation, Bygstad et al.'s (2016) study on the diffusion of innovative technology, and Daniel et al.'s (2014) study on the management of digital innovation project portfolios. Overall, our work follows their example in trying to identify conceptual structures that underlie the management of digital innovation.

A journey of self-discovery. In the above, we ascribed our philosophical beliefs to a clear-cut philosophical paradigm. In reality however, our philosophical position significantly evolved over the course of our doctoral studies. While we now identify as a critical realist, some of the work presented in this thesis has positivist or interpretivist underpinnings. The attentive reader may for instance identify intercoder reliability computations (paper 1a and 1b) and tandem interviewing as typically positivist-oriented techniques (Yin, 2014). Real-time observations and member checks (paper 1a and 1b), on the other hand, generally qualify as interpretivist techniques (Klein & Myers, 1999). Critical realism does not fundamentally dismiss such techniques since it aims "to leverage elements of strengths of both [positivism and interpretivism]" (Wynn & Williams, 2012, p.806). In our case, we felt more comfortable using post-positivist techniques in earlier work because it provided clear methodological guidance, but later longed for the depth of interpretation enabled by interpretivist techniques. In retrospect, this philosophical eclecticism helped us gain a deeper understanding of our philosophical position and a better feel for its methodological implications.

5.2 METHODOLOGY

Research approach. We engaged in *exploratory empirical qualitative* research across the four papers presented in this thesis. First, we took an *exploratory* approach because digital innovation initiation is an emergent and ill-defined phenomenon about which we yet know little. Second, we chose an *empirical* approach because our research objective was to provide guidance to practitioners with useful conceptualisations that draw on real-world data and reflect the reality of the field. Third, we

leveraged a *qualitative* approach because the initiation of digital innovation, as other management-related phenomena, is complex, and its multiple facets are challenging to measure quantitatively. In sum, our data collection aimed for "thick, detailed descriptions of actual actions in real-life contexts" (Gephart & Rynes, 2004, p.455). We abstracted theory from our data by using deductive, inductive, and abductive reasoning (Wynn & Williams, 2012). Figure 6 below summarises our research philosophy and research approach.

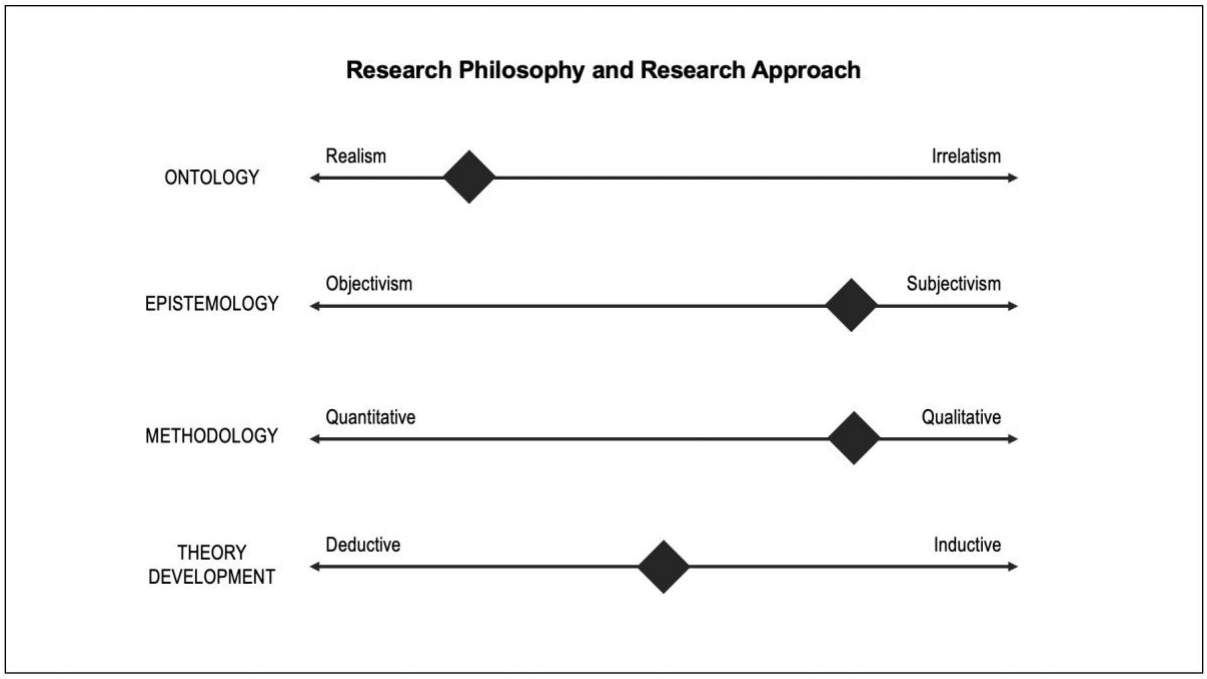

Figure 6. Research philosophy and research approach

Case study. We settled for case study research as our primary research methodology. Generally speaking, case study research is suited for the investigation of contemporary, complex, and ill-defined phenomena because it allows the researcher to deeply engage with a real-world case and capture detailed and contextualised insights (Wynn & Williams, 2012; Yin, 2014). Within case study research, there are two main research designs: the multiple case study and the single case study. The multiple-case design is often considered more compelling and robust (Miles et al., 1994), and is generally understood to be a stronger base for theory building (Eisenhardt & Graebner, 2007). The study of two or more cases can indeed help the researcher identify theoretically relevant constructs across settings, sharpen conceptual definitions at an appropriate level of abstraction, and mitigate over-determined theorising (Eisenhardt, 2021). However, the single-case design can also be eminently justifiable under certain conditions (Myers, 2019; Siggelkow, 2007; Wynn & Williams, 2012). As Yin (2014) puts it, "the rationale for single-case designs cannot usually be satisfied by multiple cases. By definition, the unusual or extreme case, the critical case, and the revelatory case all are likely to involve only single cases" (p.57). The intensive study of a single case can help the researcher uncover particularly vivid and illuminating

insights (Miles et al., 1994) and achieve a contextually relevant analysis of complex organisational phenomena (Wynn & Williams, 2012). Dyer et al. (1991) point out that "the most critical trade-off facing the research in this regard is between the deep understanding of a particular social setting and the benefits of comparative insights. Thus, the more contexts a researcher investigates, the less contextual insight he or she can communicate" (p.614). This trade-off is especially true with longitudinal research, where "the conduct of a multiple-case study can require extensive resources and time beyond the means of a single student or independent research investigator" (Yin, 2014, p.57). In sum, researchers generally aim for having at least two cases to theorise from (ibid), but single-case designs may be preferred if the selected case represents a special or rare instantiation of the phenomenon of interest (Siggelkow, 2007), or when data collection is conducted over an extended period of time.

PRELIMINARY INTERVIEWS					
ORGANISATION	**INDUSTRY**	**INTERVIEW DATA**	**INTERVIEWEE ROLE**	**MATURITY INTERNAL OPEN CALLS**	**CASE ACCESS**
A. (10'000 employees; 4.3B CHF revenue)	Fragrances	**#1** - 12.04.19 (60min onsite) **#2** - 20.04.19 (120min onsite) **#3** - 10.05.19 (120min onsite)	Innov. Intern 1 Innov. Intern 1 Digital Innov. Director	Early stage – **digital** specific	**High** (selected; aka Globex)
B. (5'000 employees; 3.2B CHF revenue)	Banking	**#4** - 16.05.19 (45min call) **#5** - 23.05.19 (30min call)	Innov. Intern 2 Innov. Intern 2	Early stage – **not** digital specific	Very low
C. (6'000 employees; 5.3B CHF revenue)	Technology	**#6** - 27.05.19 (60min offsite) **#7** - 27.06.19 (30min call) **#8** - 29.08.19 (45min onsite)	Innov. Intern 3 Innov. Intern 3 Head Digital Transform.	Very early stage – **potentially digital** specific	Low
D. (50'000 employees; 4.4B CHF revenue)	Banking	**#9** - 20.05.19 (30min call)	Digital Project Manager	Mature stage – **potentially digital** specific	Very low
E. (1'000 employees; revenue NA)	Health (public)	**#10** - 08.07.19 (60min onsite)	Innov. Manager	Very early stage – **not** digital specific	Low
F. (12'500 employees; revenue NA)	Health (public)	**#11** - 23.07.19 (60min onsite) **#12** - 27.08.19 (45min onsite)	Innov. Coordinator Head of Innov.	Early stage – **not** digital specific	Low
G. (155'000 employees.; 146B CHF revenue)	Insurances	**#13** - 30.10.19 (30min call) **#14** - 13.11.19 (45min call) **#15** - 13.12.19 (45min call)	Innov. Intern 4 Innov. Intern 4 Innov. Intern 4	Mature stage – **not** digital specific	Medium
H. (11'000 employees; 4.2B CHF revenue)	Chemicals	**#16** - 16.12.19 (180min onsite)	Senior Technical Advisor & Head New Business Development	Very early stage – **potentially digital** specific	Low
I. (16'500 employees.; 6.7B CHF revenue)	Fragrances	**#17** - 6.02.20 (120 min offsite)	Former CIO (retired in 2016)	Early stage – **not** digital specific	Low
J. (1'000 employees; 593M CHF revenue)	Energy	**#18** - 07.09.20 (45min call) **#19** - 11.02.20 (45min call) **#20** - 26.05.21 (30min call)	Innov. Intern 5 Innov. Intern 5 Innov. Intern 5	Early stage – **potentially digital** specific	**High** (unrealistic; covid-19)

***Note**: Organisations were screened for (a) incumbent (size, revenue, market share) and (b) initiatives for (digital) innovation (e.g. idea campaigns, innovation incubator, innovation workshops, innovation labs). Access was obtained through the personal contacts of the research team. Organisation data as of 2021.*

Table 8. Preliminary interviews in incumbent organisations

Case selection. We selected the Globex organisation for our case study since it was the only case that both presented a good theoretical fit with our research question and offered adequate access for data collection (Miles et al., 1994). Table 8 above provides an overview of twenty preliminary interviews that we performed in a total of ten incumbent organisations in order to identify case

candidates for our research. Our preliminary interviews showed that internal open calls for innovation have gained in popularity in incumbents across industries, yet few have started to implement digital-specific internal open calls. Moreover, most organisations provide only limited access to their digital innovation data (the interested reader may refer to the limitations section on page 77 for more details). By contrast, Globex had started to implement a number of initiatives dedicated to initiating digital innovation with employees across functional departments, and was open to sharing its experiences and learnings with us. We found Globex to be a revelatory case as it provided a unique opportunity to explore the unstudied phenomenon of digital-specific internal open calls in a real-life context (Yin, 2014). In sum, Globex constituted a suitable case for the following reasons:

- Real-life cases of open calls for digital innovation in incumbents are scarce. Globex constitutes a **revelatory case** for digital-specific internal open calls (Yin, 2014);
- Globex is a traditionally-structured and long-standing leader in its industry (i.e. incumbent) that had historically relied on its IT unit to develop digital ideas, but was keen to increasingly initiate digital innovation with employees beyond IT. It thus offered a good **theoretical fit** with our research question;
- Globex had decided to sharpen its focus on digital innovation in 2017. When we first made contact in 2019, Globex was refining its idea management programme, its digital innovation workshops and showrooms, and its use of low-code technologies, thus offering an **opportune time** to conduct our study;
- Globex provided access to **thick data** by allowing for recurring on-site interviews and observations, informal discussions, and the collection of extensive internal documentation, enabling us to study and theorise on multiple facets of internal open calls for digital innovation;
- Globex agreed to **longitudinal data** collection with a flexible timeline for interviews and observations, enabling us to study and theorise on transformation processes with regards to internal open calls for digital innovation;
- Digital innovation initiatives at Globex were overseen by a dedicated team of seven full-time members and already involved several hundred employees, allowing for a good number of interviewees with **different perspectives** on internal open calls for digital innovation.

Longitudinal single case. We leveraged a longitudinal case study design to gain deep insights into the evolution of digital innovation initiation at Globex over time. As we engaged with our case during a time when it was transforming its processes and practices to adapt to the digital nature of innovation, a longitudinal single case approach allowed us to compare different states of transformation and theorise

on the underlying practices and processes. This brought us closer to capturing our phenomenon of interest in all of its socio-technical complexity.

5.2.1 DATA COLLECTION

Participant-observation. Our overall data collection consisted of (1) participant-observation, (2) interviews, and (3) secondary data. Regarding (1) participant-observation, our research team performed 6 months of active participation (i.e. becoming an active member of the pool of participants during the time of the study) and 1 day of passive participation (i.e. being in a bystander role while asking questions to informants). Participant-observation was particularly helpful to get up close to individuals and examine their interactions, both with each other and with digital technology. This proximity enabled us to deeply study the initiation activity and to theorise on the complex intermingling of its social and technological components. We recorded our observations in field notes, drawings, pictures, and observation reports (see pp. 178-180). We deployed a number of tactics to mitigate the potentially detrimental impact of researcher involvement, such as member-checking (i.e. asking participants for feedback on the accuracy of the recorded observational data), investigator triangulation (i.e. having multiple researchers collect observational data), and methodological triangulation (i.e. using multiple methods, such as active and passive observation) to cross-check information and ensure sufficient detachment and objectivity.

Interviews. Next to participant-observation, we relied extensively on (2) interviews as another primary source of data. Specifically, our research team performed a total of 28 interviews, 18 of which involved our case organisation. To match the exploratory nature of our research, we designed semi-structured interview protocols that only included a small number of pre-planned open-ended questions. Open-ended questions were particularly useful in encouraging participants to highlight what seemed important to them, rather than what we thought was important. We kept the interview protocols flexible and adapted the questions on the fly to match the flow of the conversation. We favoured on site face-to-face interviews with single participants. This interview format helped us put participants at ease, engage more deeply, and gather contextual data about their work environment. We also performed tandem interviews during which two researchers interviewed participants together (i.e. one researcher guided the conversation while the other one took notes and jumped in occasionally). This enabled us to reduce the cognitive load in early stages of our research and to build a more robust understanding of our case. We recorded all our interviews and transcribed them as soon as possible. Early transcription helped us stimulate our analytical reflection already during the data collection phase and come up with questions for future interviews while the data was still fresh in our mind. We manually transcribed our interview data in text format and added notes for contextual information, such as physical space and general atmosphere, salient paralinguistic cues (i.e. voice pitch, volume, rhythm) and nonverbal communication (e.g. laugher, sigh, pause) as reminders for later analysis.

Secondary data. Our (3) secondary data consisted of internal company records, analyst reports and vendor documents (56 documents; 509 pages), and user reviews (953 reviews; 667 pages). We collected this data either directly at the case organisation (i.e. via email, books, and the Intranet) or online. Most of our online data was openly available on websites that granted free usage for research and other non-commercial purposes. One notable exception was Gartner's analyst reports which could only be found with paid access. Before collecting our secondary data, we preformed due diligence on the data source by checking for trustworthiness, relevance, and currency. We stored our primary and secondary data locally on our computer and in private (or shared for collaboration) cloud databases. Table 9 below provides an overview of our data collection. A detailed description of our secondary data collection is provided in each research paper in the Appendix (notably on pp.108-110 and p.135).

	PRIMARY DATA	SECONDARY DATA	TACTICS
GLOBEX CASE PAPERS 1A, 1B & 3	18 one-to-one interviews & 6 months active observation & 1 day passive observation	Internal documents (e.g. strategy roadmaps, reports, meeting memos)	Member-checking Investigator triangulation Methodological triangulation Prompt interview transcription Theoretical saturation
PAPER 2	10 one-to-one interviews	Analyst reports & vendor documents & user reviews	Member-checking Methodological triangulation Prompt interview transcription Theoretical saturation

Table 9. Overview of data collection

Saturation. We collected data until we reached *theoretical saturation*. That is, we continued collecting data until we did not find any emergent themes in the new data that could help us further develop our theoretical concepts and relationships (Saunders et al., 2017; Glaser and Strauss, 1967). Concretely, we performed interviews, observations, and secondary data collection until we did not find additional data whereby we could further develop our process model for digital idea development in explicit open calls (papers 1a and 1b), our process model for digital idea development in implicit open calls (paper 2), and our orchestration, self-orchestration, and choreography competences for mixed open calls (paper 3). We collected as much data as possible on the phases, roles, processes, practices, and capabilities involved in the development of digital ideas with non-IT employees, and we stopped collecting when we found that the newest data did not contain any emergent themes to further develop these concepts. This is in contrast to *data saturation*, where data collection continues until new data is redundant of data already collected, and nothing new is apparent (Saunders et al., 2017), i.e. until "the researcher

begins to hear the same comments again and again" (Grady, 1998, p.26). We did not aim for data saturation because of the evolving nature of digital innovation management at Globex and the thickness of the collected data (Saunders et al., 2017). In other words, we expected that additional data would have provided new (non-redundant) information, but that this information would not have been relevant to the development of our theorisation.

5.2.2 DATA ANALYSIS

Data analysis. Our data analysis consisted of iteratively recognising data patterns and comparing them to established concepts and theories in the literature. In practice, we highlighted words, text passages, and graphical elements that captured either known or novel concepts and relationships. This thematic coding process alternatingly called for deductive and inductive reasoning (Wynn & Williams, 2012). Whenever possible, we applied multiple coder strategies, where two researchers independently coded each set of data (after being trained on the codes) and discussed their coding results until they reached a common understanding. Next to coding with pen and paper, we used the MAXQDA coding software to annotate long documents such as interview transcripts.

	PAPERS 1A & 1B	PAPER 3
RESEARCH INTEREST	Explicit open calls for digital innovation	Mixed open calls for digital innovation
LEVEL OF ANALYSIS	Department	Department, organisation, individual
UNIT OF ANALYSIS	Idea management programme	Digital innovation initiatives
ANALYTICAL FOCUS	Idea campaigns and idea management platform (narrow)	Idea campaigns, digital innovation workshops, digital innovation showroom, LCDPs (broad)
DATA ANALYSIS	Thematic coding on all available data	Thematic coding on all available data
AGGREGATED THEMES	Phases and Roles	Capabilities, Processes, and Practices
KEY FINDINGS	Process perspective on idea development	Process perspective on orchestration capabilities

Table 10. Twofold data analysis of the Globex case data

Twofold data analysis. Table 10 above details how we leveraged the same dataset from Globex to study both explicit open calls and mixed open calls for digital innovation. As the data we collected at Globex contained in-depth information about both the idea management programme and the wider digital innovation initiatives, we were able to perform two distinct analysis with each a different analytical focus on a different level of analysis. Specifically, papers 1a and 1b investigate *explicit* open calls for digital innovation through the study of Globex's idea management programme. In these two papers, we highlight key phases and roles in the idea development process by analysing the idea

campaigns and idea management platform that underlie Globex's idea management programme. By contrast, paper 3 investigates *mixed* open calls for digital innovation through the study of Globex's wider digital innovation initiatives. In this paper, we highlight capabilities, processes, and practices that support the orchestration of employees' contributions in the idea management programme and beyond, i.e. in idea campaigns, digital innovation workshops, digital innovation showrooms, and low-code development platforms (LCDPs). Accordingly, our level of analysis shifted from the department level (i.e. for the study of phases and roles) to also include the organisational and individual levels (i.e. for the study of capabilities, processes, and practices).

Theorisation. We aimed to leverage our data beyond theoretical description (i.e. describing the data through existing theoretical lenses) and engage in theory development (i.e. developing new, revised, or extended theories, models, and propositions). However, the abstraction of theory from case data involves elements of interpretation (even intuition) that are difficult to articulate clearly. We therefore leveraged data structures to demonstrate rigor in our abstraction process (Gioia et al., 2013). An example of how we visually structured our thematic analysis into first-order codes, second-order themes, and overarching theoretical dimensions is available in the Appendix (see p.111).

Generalisability. Case study research does not pretend for statistical generalisability, but rather aims for analytical generalisability (Langley & Abdallah, 2011). Our findings are therefore not generalisable to the overall population of incumbent organisations. However, they can be generalised to some extent to theoretical propositions about digital innovation initiation (Lee & Baskerville, 2003). We advise the reader to keep in mind that our single case study design implies weaker generalisability than multiple case study designs, since our analysis relies on the investigation of a single organisational context. The attempt to develop theories that closely match the empirical data collected within a single organisation may for instance lead to overly complex or over-determined theorising (Eisenhardt, 2021).

5.2.3 METHODOLOGICAL BRICOLAGE

An organising metaphor. While our methodology in papers 1a, 1b and 3 agrees with case study research, the methodology we apply in paper 2 does not strictly comply with existing methodologies for qualitative research. Instead, our approach is in line with "methodological bricolage" (Pratt et al., 2022), which is an organising metaphor to conducting high quality qualitative research. As conceived by Pratt et al. (2022), methodological bricolage encourages researchers to creatively tailor their methods section to their specific research objective and research context. It aims to free researchers from strictly complying to rigid methodological templates and to broaden their methodological choices. It encouraged us to acknowledge our unique research setting and to select research methods that fit the reality of the field. Specifically, paper 2 studies the nascent phenomenon of low-code development with non-IT employees, which is not yet wide-spread among organisations. As we were not able to gain

access to a case that matched our specific research interest (i.e. low-code development of innovative ideas with non-IT employees), we carefully combined expert interviews and secondary data to catch an early glimpse of the phenomenon. Table 11 below summarises the main characteristics of case study methodology and methodological bricolage[2]. The interested reader may also refer to Appendix F (p.171) for a general discussion of methodological bricolage.

	CASE STUDY METHODOLOGY	METHODOLOGICAL BRICOLAGE
OVERALL PURPOSE	Generate an in-depth, multi-faceted understanding of complex phenomena in a real-life context.	Harness researchers' agency and creativity to mindfully craft methodologies tailored to the specific research objectives and context.
KEY ADVANTAGES	Close interaction with unit(s) of interest and deep understanding of their behaviour, interaction, and environment.	Deep connection with the data via unique method combinations and well-informed methodological innovations.
KEY CHALLENGES	1. Implies high cognitive load due to massive amounts of messy data. 2. Potentially suffers from ambiguity in theory building (i.e. abstracting theory from data) due to large number of variables. 3. Offers limited statistical generalisability due to small number of cases.	1. Requires familiarity with available methodological resources and their compatibility. 2. Requires methodological sophistication from readers and reviewers. 3. Potentially risks being subverted to an "everything goes" approach; researcher must show integrity, competence, and benevolence.
MAIN REFERENCES	Eisenhardt (1989, 2021) (P/P); Gioia et al. (2013) (C/I); Klein and Myers (1999) (C/I); Miles et al. (1994) (C/I); Wynn and Williams (2012) (CR); Yin (2014) (P/P)	Seminal paper by Pratt et al. (2022)

Table 11. Research methodology and methodological approach

5.3 RESEARCH ETHICS

Actions for ethics. As with any form of research that deals with living subjects, our work must take into account ethical considerations to safeguard the basic norms and values of the research community (Orb et al., 2001). Fundamentally, we had to make sure that participants suffered no harm from the direct or indirect effects of our studies. We addressed this concern in the following ways. First, we obtained the informed consent of all our participants, and we reiterated the voluntary nature of their participation in interviews that addressed potentially sensitive or harmful topics. Second, we remained

[2] Philosophical positions are indicated in brackets: Positivism/Post-Positivism (P/P), Critical Realism (CR), Constructionism/Interpretivism (C/I).

transparent in our research activities at all times. We systematically disclosed the objectives of our study and our role as researchers, and we listed our publication outlets upon request. Third, we provided anonymity to our participants. We masked the name and location of our case and obscured the names of our informants in interview transcripts, observation reports, and publications. When requested, we explained the extent of anonymity provided. Fourth, we did not disclose information we knew was sensitive or potentially harmful, such as spoken statements that our informants did not want us to use. Fifth, we addressed data privacy concerns by storing our data on a secure cloud. Finally, we agreed to delete all data upon competition of the research.

CHAPTER 6. SYNTHESIS OF RESEARCH STREAMS

This section provides an overview of our research papers. It summarises the background, objectives and methods, findings and contributions, and limitations and outlook of our work in three research streams.

6.1 RESEARCH STREAM 1 : EXPLICIT OPEN CALLS

The two papers presented in this research stream can be found in Appendix B and C on page 89 and 112 respectively.

	N°	TITLE	QUESTION	METHOD	CONTRIBUTIONS	OULET
STREAM 1 – EXPLICIT	1a	Idea Management in the Age of Digital Innovation – An Exploratory Case Study	*How is idea management transformed to help seize digital innovation opportunities?*	Longitudinal in-depth case study at Globex.	**To theory**: Explores DIM's core tenets during initiation (i.e. fluid processes and emergent actors). **To practice**: Dimensions of organisational inertia and actions to address it during initiation.	Full paper published in Proceedings of Association Information et Management (AIM) 2020.
	1b	Idea Management in a Digital World – An Adapted Framework	*How can idea management programmes be conceptualized in light of digital innovation?*	Longitudinal in-depth case study at Globex.	**To theory**: Enriches DIM with a process perspective on initiation (development of a refined framework). **To practice**: Processes and tools for sense-making and orchestration in the initiation of digital innovation.	Full paper published in Proceedings of 54th Hawaii International Conference on System Sciences (HICSS) 2021.

Table 12. Overview of research stream 1

6.1.1 BACKGROUND

Idea management as explicit open calls. Idea management refers to a set of activities that organizations undertake to systematically exploit the innovation potential of employees in explicit open tenders for ideas (Thom, 1980). The inception of idea management can be traced back to the 18th century when physical idea boxes first encouraged employees to submit ideas for local improvements in the factory layout and production lines (Thom, 2015). These ad-hoc initiatives gradually grew into strategic organisational programmes as organisations attempted to further harness the business potential of their employees' ideas (Oberländer et al., 2021). Today's idea management programmes generally comprise processes for idea sourcing, selection, and development, and leverage dedicated idea management software (Brem & Voigt, 2007). The importance of idea management as a long-standing

managerial tool for innovation is increasingly recognised, and its underlying components enjoy wide consensus in the innovation management literature (van den Ende et al., 2015).

Idea management for initiation. Idea management programmes rest on the assumption that employees have hidden potential for innovation, and that this potential can be exploited to the benefit of the organisation. It acknowledges that in undertaking supportive operational functions employees typically acquire exclusive, in-depth, and highly context-dependent insights that managers do not possess (Kesting & Ulhøi, 2010). These insights constitute an often-underutilized resource for innovation, especially in incumbent organisations (Oberländer et al., 2021). While employees normally have no legitimate right to make strategic decisions, idea management recognises that the generation and implementation of valuable new ideas can originate from employees across hierarchy levels and functional departments (Kesting & Ulhøi, 2010). In contrast to R&D and other special functions widely studied in the innovation management literature, research on this type of employee participation is still in its infancy (Opland et al., 2020).

Exploring the initiation process. Idea management is of particular interest here because of its relevance to the initiation of digital innovation, especially from a process perspective (Fichman et al., 2014). In recent years, a growing number of organizations have oriented or reoriented their idea management programmes towards supporting the front-end of the digital innovation (Opland et al., 2022). In the idea management literature, dominant conceptualizations still assume idea development phases and roles to be distinct and well-defined in linear stage-gate processes (Gerlach & Brem, 2017). This is in sharp contrast to recent developments in the IS literature where overlapping phases and emergent participation have been observed for the development of digital ideas (Arvidsson and Mønsted, 2018). These findings question our current knowledge of idea management. Specifically, we lack an understanding of how digital ideas are managed within organisations, and how innovation management is transformed to match the digital nature of ideas (von Briel et al., 2018). We argue that the idea management literature and its conceptual building blocks (i.e. phases and roles) can serve as a scaffold to revise existing conceptualisations. More generally, studying real-world idea management programmes provides an opportunity for new theorising on how organisations initiate digital innovation with non-IT employees (Nambisan et al., 2017; Opland et al., 2022).

6.1.2 OBJECTIVES AND METHODS

Objectives. While the idea management literature offers valuable insights into employee participation in innovation, the specificities of digital innovation have hardly been addressed (Gerlach & Brem, 2017). As a result, we do not know how idea management unfolds in a digital context and we struggle to provide clear guidance on how to initiate digital innovation in organisations (Oberländer et al., 2021). We lack a fundamental discussion of the underlying phases and roles to be able to leverage idea

management to its full potential in a digital world (Mamonov & Peterson, 2021). Accordingly, the objective of this research stream is to validate the core tenets of digital innovation management (i.e. fluid processes and roles) with regards to idea management, and to leverage new logics (i.e. open innovation and problem-solution pairing) to develop a refined conceptualisation of idea management for digital innovation. We answer the following research questions:

How is idea management transformed to help seize digital innovation opportunities? (Paper 1a)
How can idea management programmes be conceptualized in light of digital innovation? (1b)

Case selection. To address these research questions, paper 1a and 1b explore idea management at incumbent organisation Globex (name changed). Globex is a traditionally structured company that has been successfully maintaining its leadership position in the fragrance industry for multiple decades. At the time of the study, Globex employed roughly 7'000 employees worldwide. It launched its idea management programme in 2017 with the aim to support employees across departments in the development of innovative products, services, and processes either embedded in IT (e.g. hardware, software) or enabled by IT (e.g. digital business model). We obtained access to the case through a fellow researcher's internship in the digital innovation department at Globex.

Data collection and analysis. We performed a longitudinal in-depth single case study of Globex's idea management programme between March 2019 and February 2020. Our data collection consisted of six months of active participant-observation at the digital innovation department, 1 day of passive participant-observation at an internal digital innovation workshop, 17 semi-structured in-depth interviews (10 respondents; ~18 hours; 108 pages of transcripts) with digital innovation managers and employees participating in idea campaigns and digital innovation workshops, and internal documentation (110 pages). Data analysis consisted in thematic coding with deductive codes on idea management, digital innovation management, organisational transformation, and inductive codes on problem-solution pairs, sense-making, and blurred process and role boundaries. The Appendix of paper 1a (page 108-111) provides detailed insights into the data collection and analysis.

6.1.3 FINDINGS AND CONTRIBUTIONS

Findings of Paper 1a. This paper examines idea management from the perspective of organisational transformation. Specifically, we analyse how the idea management process is transformed by the digital nature of ideas. We find that idea management undergoes transformations with regards to the underlying actors and phases, which results in an increased need for IT resources during idea development and leads to economic and political inertia. We show that the systematic decomposition of innovative ideas into verifiable and co-evolving problem and solution pairs can help incumbents alleviate organisational inertia by involving IT stakeholders more efficiently. We argue that firms must abandon their static and

deterministic approach to idea development in favour of a more open and fluid approach to the front-end of digital innovation.

Findings of Paper 1b. With the findings of paper 1a in mind, we refine existing idea management frameworks with elements of open innovation (i.e. open innovation funnel) and problem-solution pairing (i.e. dynamic problem-solution pairs) to better capture idea development in a digital context. In paper 1b, we conceptualise idea management as the constant exploration of problem and solution components guided by sporadic feedback from a loosely connected crowd of contributors. More specifically, our framework (see Figure 7 below) depicts idea management for digital innovation as a process of open problem-solution *matching*, *forking and merging*, and *refinement*, each of which may contain blurred episodes of idea generation, improvement, and evaluation and involve an emergent set of actors. This is in contrast to traditional conceptualisations of idea management that assume consecutive phases and predefined actors. In sum, we find that idea management programmes act as problem and solution brokers, helping the organisation orchestrate and make sense of employees' ideas. Overall, our framework highlights the difficulty of exploiting the generative potential of digital ideas with a classic stage-gate approach to idea development.

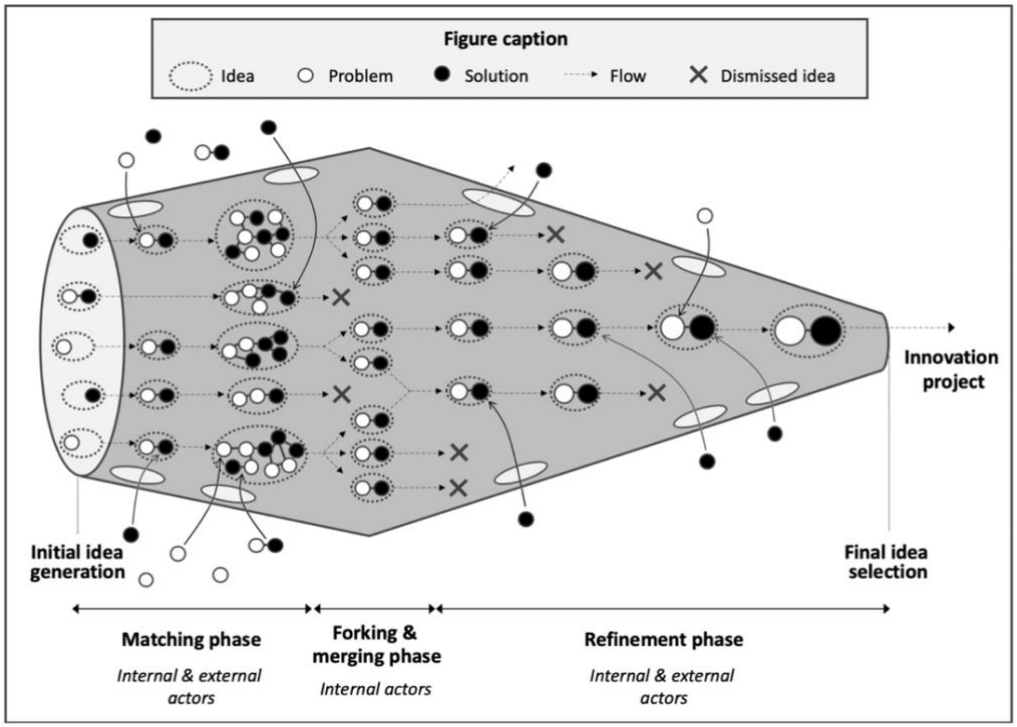

Figure 7. A revised idea management framework

Theoretical contributions. Our main contribution to the literature is a "Revised Idea Management Framework" (see Figure 7 above). The framework adds to the body of knowledge on digital innovation with a process perspective on initiation. Our framework ideally covers the entire idea management

process, starting from idea generation to final idea selection. Beyond validating the central tenets of fluid process and emergent agency put forward in the digital innovation management literature, we extend existing conceptualisations of initiation with a granular understanding of the underlying problem-solution pairing and discuss how it can support orchestration and sense-making processes.

In this first research stream, we engage in theoretical description and theory building. We engage in theoretical description by applying the concepts of open innovation and problem-solution to the idea management process, and by applying the concept of organisational inertia to the underlying process of idea management transformation. On the other hand, we engage in theory building by combining the building blocks of idea management, open innovation, and problem-solution pairing into a revised conceptualisation of the idea management process.

Practical contributions. With regards to practice, paper 1a and 1b have implications for *innovation managers* who are currently understanding the development of innovative digital ideas as a traditional stage-gate processes. We recommend taking a fluid and internally open approach instead, where the generativity of digital technology can iteratively be explored. We further advise them to make this exploration more manageable through the systematic decomposition of digital ideas into verifiable problems and solutions. Our framework supports these recommendations by shifting the focus from rigid idea generation, improvement, and evaluation phases towards flexible problem-solution *matching*, *forking and merging*, and *refinement*. Overall, we provide practitioners with an increased awareness of the benefits and pitfalls of traditional idea management with regards to digital innovation. This will hopefully support them in reassessing their existing idea management programmes for the digital age.

6.1.4 LIMITATIONS AND OUTLOOK

Limitations. We explore the initiation of digital innovation by studying the evolution of an idea management programme at a real-world incumbent. However, we have not been able to observe the final state of the idea management programme, as it was part of a long-winded and ongoing effort for digital transformation. Despite our longitudinal approach, our research captures only a snapshot of a much longer transformation process. We thus encourage future research to take an even more longitudinal approach to study the initiation of digital innovation, as most organisations are still in the process of (re)defining their organisational processes in this regard.

Outlook. We identify three promising avenues for future research. First, we see a research opportunity in keeping the focus on idea management programmes and further validating, amending, and enriching our framework in various organisational contexts, with firms of different sizes, industries, and innovation objectives. Future research could then compare idea management for digital innovation across organisations, highlight particularly successful patterns and uncover actionable best practices. Second, future research could focus on how ideas for digital innovation form and evolve outside of

formal idea management programmes. This would allow to form a more holistic understanding of the organisational processes that underlie the initiation of digital innovation. Third, we strongly encourage research on how organisations orchestrate and make sense of ideas for digital innovation. In our research, we highlight the potential of idea management programmes for the efficient matching, forking, merging, and refinement of problem-solution pairs. While this is a first step in understanding orchestration and sense-making for digital innovation, we have only scratched the surface of how these logics are instantiated in organisations and much is still to be achieved in this regard.

6.2 RESEARCH STREAM 2: IMPLICIT OPEN CALLS

The paper presented in this research stream can be found in Appendix D on page 129.

	N°	TITLE	QUESTION	METHOD	CONTRIBUTIONS	OUTLET
STREAM 2 – MPLICIT	2	Innovating with Employees – An Exploratory Study of Idea Development on Low-Code Development Platforms	*How are innovative ideas developed on low-code development platforms?*	Expert interviews and secondary data (analyst reports, vendor documentation, user reviews).	**To theory**: Refines DIM with a practice perspective on initiation (development of an initial framework). **To practice**: Initial blueprint for idea development on low-code platforms (stakeholders, roles, practices, challenges, support factors).	Full paper published in Proceedings of European Conference on Information Systems (ECIS) 2021.

Table 13. Overview of research stream 2

6.2.1 BACKGROUND

Low-code development as implicit open calls. Low-code development has been drawing the attention of practitioners since 2014, yet it is still a nascent phenomenon that has barely been studied in IS research. In broad terms, low-code development refers to the creation of software applications with minimal hand-coding (Prinz et al., 2021). As such, it draws close parallels with rapid application development methods that support fast and iterative delivery through re-usable software components (Rymer & Seguin, 2019). Specifically, low-code development platforms (LCDPs) usually feature a visual editor for users to combine and recombine pre-programmed components into functional applications (Luo et al., 2021). The visual user interface is key to decomplexifying application development and making idea development accessible to employees across the organisation (Maruping & Matook, 2020), thereby presenting a promising avenue for implicit open calls for digital innovation.

LCDPs for initiation. Although it is now widely recognised that digital technology can support innovation practice (Ciriello et al., 2019), surprisingly few organisations have adopted employee-specific tools that reach beyond idea generation (Opland et al., 2020). Against a background of resource-strapped IT units and an untiring demand for digital innovation however, low-code development is predicted to become more commonplace for the development of digital ideas as platform offerings mature (Prinz et al., 2021). LCDPs are expected to be especially well-suited for employees in business roles who lack coding experience and currently struggle to develop their digital ideas. Low-code development may indeed enable them to develop digital artefacts quickly and easily, by visually adding, adapting, or discarding pre-programmed and instantly functional technical components (Maruping & Matook, 2020). Being able to develop applications outside of the IT unit may help organisations unlock the potential of non-IT employees and strengthen the front-end of digital innovation (Prinz et al., 2021).

Exploring initiation practices on LCDPs. Low-code development is of particular interest here because of its relevance to the initiation of digital innovation, and especially to non-IT employees' initiation practices. A growing number of organisations have started to adopt LCDPs in recent years to support employees when they develop their digital ideas, either as part of an idea management programme or as standalone tools. However, we lack a thorough theoretical understanding of how non-IT actors create digital innovations with low-code technology, therefore limiting our ability to provide guidance on the matter (Kohli & Melville, 2019). Yet again, the idea management literature and its conceptual building blocks (i.e. phases, actors, and roles) can serve as a scaffold to develop an initial conceptualisation of initiation on LCDPs. Specifically, we expect these building blocks to offer the appropriate level of granularity to capture individual low-code development practices in a structured way (Nambisan et al., 2017). More generally, studying non-IT employees' uses of LCDPs within incumbents provides an opportunity to enhance our theorising on digital innovation initiation.

6.2.2 OBJECTIVES AND METHODS

Objectives. Low-code development promises to put digital innovation within the reach of employees with rich business knowledge but little coding experience. Despite the growing interest for digital innovation practices however, the specificities of low-code development have received scant academic attention. Consequently, we do not know how low-code development supports the practice of digital innovation, and we lack actionable insights that can inform the use and design of LCDPs. Accordingly, our objective in this second research stream is to provide a nuanced understanding of employees' innovation practices on LCDPs. We answer the following question:

How are innovative ideas developed on low-code development platforms?

Methods. We address this research question with an exploratory study of LCDP use. Specifically, we conduct 10 expert interviews (114 pages of transcript) with employees and managers at an LCDP vendor who provides incumbents with an in-house developed low-code platform specifically conceived for non-IT employees. Additionally, we collect 953 user reviews (667 pages) and 56 analysts/vendor documents (509 pages) on innovative low-code application development by non-IT employees. We analyse our data with thematic coding. Specifically, we leverage deductive codes on idea management and LCDP use, and inductive codes on stakeholders, roles, and support factors. Moreover, we inductively code emergent themes around employees' practices on LCDPs and employee empowerment. Given that the interview data was collected by our co-author, we made sure to gain an overview of the entire dataset before starting to code by listening to all interview recordings and asking our co-author to share relevant contextual information about her interviewing process upfront.

6.2.3 FINDINGS AND CONTRIBUTIONS

Findings of Paper 2. Our data shows that non-IT employees take an active role throughout idea development on LCDPs, leading the way from idea generation through deployment. As shown on Figure 8 below, we find that their idea development practices on LCDPs unfold in overlapping and iterative cycles of improvement and implementation, and evaluation and deployment. Accordingly, business managers, end-users, IT developers, and LCDP vendors are punctually involved in various idea development practices. We identify a set of success factors that support this sporadic participation (see Figure 9 below). The highly fluid process and emergent participation on LCDPs are fundamentally in line with our findings from research stream 1.

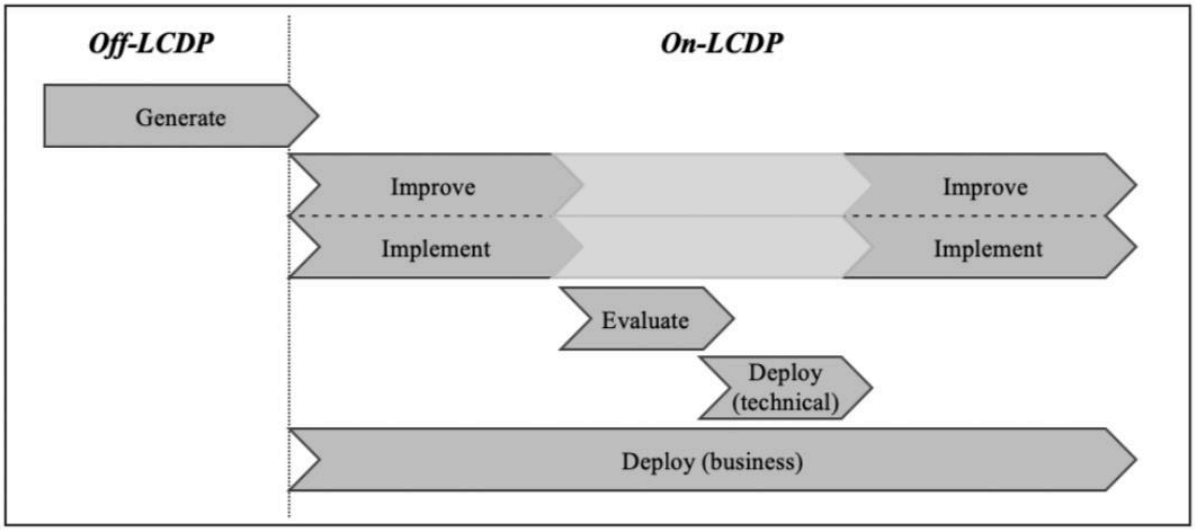

Figure 8. Temporal overlaps in idea development on LCDPs

Paper 2 further highlights that low-code development empowers non-IT employees with greater levels of flexibility and autonomy in their idea development practices. First, we find that LCDPs support their functional *flexibility* as they can more readily switch between roles and take ownership of tasks that were traditionally assigned to other stakeholders. We attribute this enhanced flexibly to the partial deskilling of application development activities on LCDPs, which enables non-IT employees to perform a variety of decomplexified technical tasks. Functional flexibility can result in a better allocation of resources throughout the organisations, especially with regards to IT staff. Second, we find that LCDPs support non-IT employees' *autonomy* in that they are able to kickstart idea development themselves. On LCDPs, non-IT employees mostly decide on the sequence and speed of idea development themselves. The ability to develop functional applications with little resources removes traditional innovation management constraints and gives non-IT employees the power to explore the generativity of digital technology more deeply. We thus argue that flexibility and autonomy in the initiation of innovation can favour more valuable contributions.

Finally, this research stream provides a nuanced view of low-code development with non-IT employees by explicitly acknowledging for the new challenges it brings along. Specifically, we identified a set of challenges that can undermine LCDPs' success if left unaddressed. Most notably, we find that organisations might experience challenges regarding their innovation culture and IT governance. They should be especially careful to provide adequate training to non-IT employees and ensure sufficient vendor support to avoid the mindless use of LCDPs. If they fail to do so, application duplicates, technical incompatibilities, and inefficiencies may constitute common setbacks caused by non-IT employees' low-code development practices. This suggest that integrating LCDP use in formal digital innovation programmes might be more valuable than using the platform as a stand-alone tool.

Theoretical contributions. We contribute to the digital innovation literature with an initial conceptualisation of idea development on low-code development platforms (see Figure 9 below). Besides providing an overview of the underlying actors and activities, our conceptualisation offers detailed insights into blurred role boundaries in digital idea development. This is notably manifested by overlaps in IT and non-IT employees' initiation practices, the related interdependence challenges, and recommended success factors. Overall, our findings have implications for the digital innovation management literature, and particularly for the study of digital platform governance.

		Roles in idea development[1]						
		Ideator	Idea manager	Discussion group	Development team	Idea selector	Deployment team (bus)	Deployment team (tech)
LCDP stakeholders	Ordinary employee	X	X	X	X	X	X	
	Business manager		X			X	X	
	End-user			X			X	
	IT developer			X	X	X		X
	LCDP vendor				X			X
Process phases[2]		Generate	Improve & Implement			Evaluate	Deploy	
Support factors		• Innovation culture • IT training • IT governance • Vendor support						

Figure 9. A framework for idea development on LCDPs

In this second research stream, we engage both in theoretical description and theory building. We engage in theoretical description when we apply key concepts of idea management (i.e. stakeholders, roles, phases) to describe idea development practices on LCDPs. We engage in theory building when we revise and leverage these concepts in our conceptualisation of idea development on LCDPs.

Practical contributions. Our study of idea development on LCDPs draws on idea management concepts that are widely recognized in the practitioner world. Thanks to this common ground, we can provide practitioners with a workable blueprint for low-code development with non-IT employees. Specifically, we offer recommendations regarding stakeholders and their role at different points during idea development. We expect these insights to be of particular value to *middle-level business managers* in incumbent organisations who are looking for ways to support their employees in the development of digital ideas. Concretely, we advise managers to start by assessing the suitability of low-code development for their specific organisational context by appraising whether the organisational culture and IT governance are sufficiently flexible to allow for the exploratory use of digital technology beyond the IT unit. Next, we recommend them to perform due diligence on LCDP vendors by checking their user support and overall responsiveness. Finally, we advise them to actively prevent inefficiencies when non-IT employees develop their ideas on LCDPs by regularly providing them with adequate training on the platform. These insights may also prove useful to LCDP vendors who wish to enhance their platform and related offerings for incumbents specifically.

6.2.4 LIMITATIONS AND OUTLOOK

Limitations. We acknowledge limitations to our research methodology. Most importantly, we contend that expert interviews with platform specialists, user reviews, and analysts' reports can only partially inform on LCDP use in organisational contexts. Due to the limited number of incumbents that have currently adopted LCDPs for idea development with non-IT employees on a wider scale, we have not been able to identify a revelatory case for conducting a case study on the topic. We relied instead on expert interviews, which we triangulated with secondary data from users, analyst firms, and platform vendors. This data provided valuable initial insights into the prospected and real use of LCDP, yet we concede that a more thorough conceptualisation of idea development on LCDPs entails the observation of and interaction with employees as they create innovative low-code applications.

Outlook. Future research may investigate four particularly promising research avenues. First, future research could compare the initiation practices of non-IT employees across digital technologies to uncover patterns that inform our understanding of non-IT employees' digital innovation practices. Second, scholars may examine the characteristics of non-IT employees who engage in low-code development (e.g. in terms of skills, motivation, organisational affiliation) and how this impacts their practices on LCDPs. Third, we encourage scholars to look into how the modular architecture of platforms and other design requirements provide employees the flexibility and autonomy they need to efficiently navigate the front-end of digital innovation by themselves. Fourth and last, we see an avenue for research in studying the challenges and tensions associated with the low-code movement, notably in terms of IT and non-IT interdependence, and theorising on platform governance and design.

6.3 RESEARCH STREAM 3: MIXED OPEN CALLS

The paper presented in this research stream can be found in Appendix E on page 150.

	N°	TITLE	QUESTION	METHOD	CONTRIBUTIONS	OUTLET
STREAM 3 – MIXED	3	A Case Study of Enterprise-wide Digital Innovation – Involving Non-IT Employees	*How can incumbent organisations coordinate and integrate their employees' contributions to digital innovation?*	Longitudinal in-depth case study at Globex (observational, interview, and secondary data).	**To theory**: Refines DIM with a competence perspective on initiation (defines three novel competences: orchestration, self-orchestration, choreography). **To practice**: Managerial actions to enhance digital innovation capability and digital business strategy.	Full paper published in Proceedings of European Conference on Information Systems (ECIS) 2022.

Table 14. Overview of research stream 3

6.3.1 BACKGROUND

Organisational competences. The resource-based view of the firm defines organisational competences as an organisation's ability to leverage its resources for competitive advantage (Wade & Hulland, 2004). Although non-IT resources play an important role for competitive advantage in contexts of fast-paced digital innovation (Kohli & Melville, 2019), surprisingly little is known about the related organisational competences (Mamonov & Peterson, 2021). In particular, the IS literature has not yet investigated how the contributions made by non-IT employees to enterprise-wide initiatives for digital innovation (i.e. mixed open calls) can efficiently be leveraged (Opland et al., 2020). This is although previous research has hinted at a number of challenges when non-IT employees' ideas are transferred into marketable digital solutions by IT employees (e.g. Ciriello et al., 2019).

Orchestration. Orchestration provides a valuable lens to make sense of collective innovation efforts, including digital innovation. As an organisational competence, it is essentially concerned with the ways in which distributed innovation agencies can efficiently be governed for their diverse knowledge to be successfully integrated. Previous work on the topic has mainly reported on centralised forms of inter-firm orchestration (e.g. Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011) and knowledge integration challenges between orchestrated actors who traditionally operate separately (e.g. Afuah & Tucci, 2012; Nambisan et al., 2017). It has further highlighted how digital innovation artefacts support cross-boundary collaboration (e.g. Ciriello et al., 2019; Urbinati et al., 2021). However, more research is needed to understand how orchestration unfolds within organisations and what role digital artefacts play in shaping, enabling, and constraining the coordination and integration of diverse internal contributions to digital innovation (Nambisan et al., 2017).

6.3.2 OBJECTIVES AND METHODS

Objectives. While the IS literature generally recognises the growing participation of non-IT actors in the initiation of digital innovation, it has hardly explored the associated coordination and integration challenges with regards to IT and non-IT employees. We address this gap with a study on orchestration competences in mixed open calls at incumbent organisations. Specifically, we answer the following research question:

How can incumbent organisations coordinate and integrate their employees' contributions to digital innovation?

Methods. We address this research question with our Globex case data. Specifically, we analyse the interview, observational, and secondary data described in research stream 1 (see page 54; data collection complemented by one additional interview). In our thematic analysis, we leverage deductive codes on orchestration, idea development, IT and non-IT contributions, and digital artefacts, and we leveraged inductive codes on self-orchestration competence, choreography competence, and related tensions.

6.3.3 FINDINGS AND CONTRIBUTIONS

Findings of Paper 3. Our main finding are three organisational competences (i.e. orchestration, self-orchestration, and choreography) and three digital innovation artefact roles (i.e. activity, epistemic, boundary) that jointly support the coordination and integration of IT and non-IT employees' contributions to the initiation of digital innovation. Figure 10 below provides an overview of the three competences and Figure 11 (p.67) summarises the three artefact roles. Finally, Figure 12 (p.68) positions these findings in light of the literature on digital business strategy.

	Orchestration	Self-orchestration	Choreography
Key challenges	Employees' various backgrounds cause contributions to be **diverse**.	Employees' active involvement causes contributions to be **emergent**.	Employees' lack of digital expertise causes contributions to be **ill-defined**.
Managerial interventions	- Launch idea campaigns - Structure innovation process - Negotiate IT resources	- Acknowledge IT bottleneck - Set up digital showroom - Promote digital prototyping	- Hire UX designer - Refine innovation workshops - Optimise IT resource use
Main objective	*Oversee contributions to digital innovation.* **Marshalling** employees' ideas for digital innovation enabled the department to **channel** efforts towards strategic opportunities.	*Enhance self-efficacy for digital innovation*. **Decoupling** digital prototyping activities from the IT unit brought economic freedom via low-cost development and enabled employees to **iterate** quickly.	*Build a common understanding of digital innovation*. **Streamlining** digital prototyping activities helped **align** IT and non-IT employees' contributions to digital innovation.
Case illustration	Employees' stage-gate presentations enabled the department to guide idea development with key business and IT stakeholders.	Low-code technologies allowed employees to explore contradictory insights and pivot independently from the IT unit.	Prototyping platforms incorporated technological guidelines that eased the transition towards a deployable digital artefact.

Figure 10. Competences for the initiation of digital innovation

Competences. The (1) orchestration competence builds on the idea that organisations must centrally coordinate and integrate contributions to digital innovation as internal innovation actors become more distributed and role boundaries become more diffused. We define the orchestration competence as *an organisation's ability to leverage digital innovation artefacts to guide the development and implementation of digital ideas with IT and non-IT employees*. Specifically, employees at our case produced PowerPoint presentations for their stage-gate presentations, which the digital innovation department leveraged to decide what business and IT stakeholders to involve for idea development. The orchestration competence thus relied on the use of digital innovation artefacts (e.g. PowerPoint presentations) to oversee employees' contributions to digital innovation, marshal their *diverse* digital ideas, and channel them towards strategic opportunities.

The (2) self-orchestration competence extends on the idea that organisations must support the integration and coordination of contributions to idea development on the level of individual employees. This is because employees are best positioned to fully leverage the malleability of digital technology while reducing the ambiguity of their digital ideas. We define the self-orchestration competence as *an organisations' ability to leverage digital innovation artefacts to uncover individual needs and assumptions*. Specifically, employees at our case experimented with rapid prototyping technologies (e.g. clickable wireframes, 3D prints) to explore digital ideas, check the underlying assumptions of feasibility, viability, and desirability, and pivot independently from the IT unit. The self-orchestration competence thus relied on the use of digital innovation artefacts (e.g. digital prototypes) to enhance the self-efficiency of non-IT employees, decouple their digital exploration activities from the IT unit, and quickly iterate on *emergent* contributions.

The (3) choreography competence helps organisations align employees' contributions and further enhance the use of available IT resources. We define the choreography competence as *an organisation's ability to leverage digital innovation artefacts to align understandings and interests between IT and non-IT employees*. Specifically, our case leveraged low-code prototyping platforms to ease the transition from digital ideas into deployable digital artefacts. LCDPs' pre-coded building blocks already incorporated basic technological guidelines that helped align understandings among IT and non-IT employees. The choreography competence thus relied on the use of digital innovation artefacts (e.g. low-code applications) to foster a common understanding of non-IT employees' *ill-defined* digital ideas, streamline digital prototyping activities, and more efficiently involve IT employees for deployment.

Artefact roles. We find that digital innovation artefacts support the competences described above by enacting three roles: activity objects, epistemic objects, and boundary objects. Digital innovation artefacts act as (1) activity objects when they help *direct* initiation activities. In our case, the digital innovation department made use of PowerPoint presentations as activity objects. These activity objects guided non-IT employees towards strategic opportunities and helped define stakeholder involvement.

Digital innovation artefacts act as (2) epistemic objects when they help *uncover* what is not yet known. Specifically, employees in our case used rapid prototyping tools to test the desirability of the envisaged digital solution with prospected users, refine early estimations of financial viability, and challenge basic assumptions of technical feasibility.

Digital innovation artefacts act as (3) boundary objects when they help *align* understandings across functional boundaries. In our case, LCDPs facilitated the collaboration between IT and non-IT employees by providing a guiding canvas for the prototyping of innovative digital applications, and the resulting low-code applications provided a shared understanding of the envisioned digital solution.

Role	Definition (Ciriello et al., 2017)	Case illustration	Competence
Activity object	Activity objects embody different types of knowledge, thereby generating contradictions, triggering collaboration, directing activities, and sparking innovation.	The department leveraged digital artefacts to oversee idea development and enhance its fit with strategic interests *(guide development and implementation)*.	Orchestration
Epistemic object	Epistemic objects embody what one does not yet know and thereby generate desire and attachment through their unfulfilled nature.	Employees used low-code prototyping technology to unearth needs and challenge assumptions with key stakeholders *(uncover needs and assumptions)*.	Self-orchestration
Boundary object	Boundary objects enable collaboration by developing and maintaining coherence across social worlds.	Prototyping platforms promoted a shared understanding of the envisioned solution and helped guide technical implementation *(align understandings and interests)*.	Choreography

Figure 11. Artefacts and their role for digital innovation competences

Overall, our findings emphasise that digital innovation artefacts constitute both a liberating force that frees non-IT employees from traditional innovation management constraints and a constraining force that imposes a frame on their emergent innovation practices. Specifically, we view non-IT employees as an empowered workforce in that they are able to "take more initiative and make own decisions to find solutions for overarching institutional problems (i.e. digital innovation) through their participation in internal crowd work (i.e. mixed open calls)" (Durward et al., 2019, p.4525). On the other hand, their digital creativity was limited by the realities of the digital prototyping platform and the strategic priorities put forward by the digital innovation department. We make sense of this finding as an arising tension between the empowerment and control of non-IT employees in digital innovation initiation.

Digital business strategy. The three orchestration competences described above suggest that non-IT employees centrally contribute to building organisations' overall capability for digital innovation. Given that digital innovation has become a strategic concern for most organisations today, we argue that non-IT employees participate in shaping organisational strategy. More specifically, we view non-IT employees as contributing to organisations' *digital business strategy*. According to Teubner and Stockhinger's (2020) literature review on the topic, digital business strategy generally aims at enabling innovative solutions with digital technology, dealing with new concerns in business strategy making

that arise from digitalisation, and generating value in a digital business environment. In Figure 12 below, we build on Teubner and Stockhinger's (2020) understanding of digital business strategy (DBS) as the intersection of organisations' existing business and IT strategies, and we illustrate the relationship between DBS and the orchestration, self-orchestration, and choreography competences. Concretely, we argue that the three competences shape DBS via the digital innovation artefacts developed by non-IT employees (arrow up). These digital innovation artefacts indeed represent workable option for capturing the value potential of digital technology, thus affecting DBS. On the other hand, we understand the three competences to be influenced by the prevailing business and IT strategy (arrows down). In fact, the business and IT strategy determines the type of digital innovation artefacts that are available for use and the extent to which they can be leveraged by non-IT employees in their innovation practices.

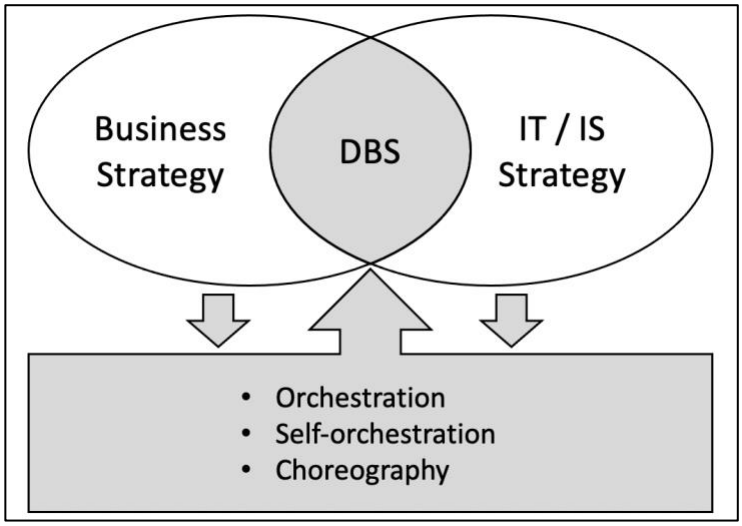

Figure 12. Orchestration competences and strategy

Theoretical contributions. We contribute to theory by enriching prior studies on organisational capabilities for digital innovation with an analysis of the underlying competences. Specifically, we conceptualise three novel organisational competences (i.e. orchestration, self-orchestration, and choreography) that help organisations coordinate and integrate internal contributions to the initiation of digital innovation. We highlight tensions between the empowerment and control of non-IT employees when they develop digital innovation artefacts. Moreover, we contribute with a discussion of how the three orchestration competences shape digital business strategy.

In this third research stream, we engage in both theoretical description and theory building. We engage in theoretical description when we apply the resource-based view (i.e. capabilities, competences, processes, resources) to incumbents' enterprise-wide initiatives for digital innovation. We engage in theory building when we define three novel organisational competences and their underlying processes and practices, and when we refine the characteristics and roles of digital innovation artefacts.

Practical contributions. We contribute to practice with a set of managerial actions that support the development of orchestration competences with mixed open calls (see "managerial interventions" on Figure 10 above). Our main recommendation to organisations is to combine idea management programmes and digital prototyping platforms to initiate digital innovation with non-IT employees. More specifically, we advise practitioners to set up a dedicated digital innovation team to launch open calls for digital innovation ideas (e.g. via idea campaigns), developing a structured innovation process, and promoting the use of digital innovation artefacts (e.g. by providing access to digital prototyping platforms and showcasing digital innovation artefacts). Moreover, we advise organisations to have trained professionals educate non-IT employees on digital innovation methods (e.g. via innovation workshops) and support their use of digital prototyping tools (e.g. via follow-ups with UX designers). Finally, we recommend incumbents to reflect on the impact of non-IT employees' digital ideas on their digital business strategy. They may enhance the strategic potential of non-IT employees' digital ideas by considering additional spaces for easy and safe digital experimentation.

6.3.4 LIMITATIONS AND OUTLOOK

Limitations. While we were able to collect rich data from digital innovation managers and non-IT employees, our case provided only limited insights into the IT side of digital innovation initiation. We partially addressed this limitation by leveraging the long-standing research into IT units, and notably the IT ambidexterity literature. We further mitigated this methodological shortcoming by triangulating our interview, observational, and secondary data with informal discussions with IT managers and employees at other incumbent organisations (list of interviewees available upon request). Altogether, we believe this yielded a sound initial understanding of organisational orchestration competences.

Outlook. We see two main avenues for future research. First, future studies may look at the role of digital innovation artefacts in initiation practices with a particular focus on the empowerment-control tension. Our work suggests that easy-to-use digital technology creates new tensions when initiating digital innovation, and future research should deepen our understanding of how organisations can address this and similar tensions (e.g. malleability and rigidity (Ciriello et al., 2019); generativity and restriction (Tilson et al., 2010)). Second, future research may focus on how non-IT employees help shape digital business strategy with their digital ideas. Our work highlights the importance of orchestration, but more research is needed to understand exactly how the digital ideas of non-IT employees affect digital business strategy, and how established business and IT strategies enable or constrain enterprise-wide strategy making.

CHAPTER 7. OVERALL CONTRIBUTIONS AND CONCLUSION

This final chapter synthesises the key contributions of this thesis. It provides an outlook for scholars, presents the main limitations of our work, and opens the discussion to the broader research landscape.

7.1 OVERALL CONTRIBUTIONS

Back to Alice. The aim of this thesis was to help Alice's organisation strive in the digital age by helping it harness its full innovation potential. Using longitudinal and in-depth qualitative research methods, we explored the processes, practices, and competences that underlie the initiation of digital innovation in real-world incumbents. We developed process models, highlighted challenges, and defined success factors. Based on this, what should Alice's organisation do?

How can incumbent organisations initiate digital innovation with non-IT employees?

Our short answer: *Use formal programmes and inherently open technologies to involve non-IT employees; and remember to fully leverage digital innovation artefacts in these mixed open calls.*

- **Seek out digital ideas in open calls.** Alice is not an IT professional, nor is she particularly digital-savvy. Still, at work and at home, she is constantly interacting with digital technology. At times, this causes frustrations and triggers hope for what is to come; this is when and where digital ideas are made. To help them escape employees' minds, digital ideas should be actively sought out across functional departments in open calls for digital innovation.
- **Provide support and legitimacy.** Although she may have some potentially great ideas, Alice will hardly act on them unless she feels legitimate and supported to do so. Idea management programmes are useful in this regard, as they delineate typical idea development activities and provide a template for action. Within these programmes, some idea campaigns should be dedicated to digital innovation specifically. This helps communicate managerial support for digital exploration and facilitates the access to key resources such as time, money, and IT infrastructure.
- **Reduce the IT bottleneck.** Organisations that recycle their existing idea management programmes to initiate digital innovation may be tempted to maintain a classic stage-gate approach. However, such attempts will quickly result in a bottleneck. This is because non-IT employees typically submit way more ideas than the IT unit can handle. As a result, the iterative prototyping of digital ideas may fall behind a long list of operational IT priorities. However, do not jump to the conclusion that iterations should be skipped – for this would kill the generative potential of digital ideas! Instead, Alice and her colleagues should be encouraged to start developing their ideas themselves. Concretely, low-code development platforms can support the quick and cheap

development of digital applications by non-IT employees who have a basic understanding of modelling principles, even if they do not know how to write code.

- **Appoint an orchestrator.** With non-IT employees participating both in idea campaigns and low-code development, a lot will be going on – especially in terms of technical gadgets and security loopholes. To avoid these inefficiencies, non-IT employees' innovation practices must be guided but without excessively constraining their digital creativity. This is why idea management programmes and low-code development platforms should be combined in mixed open calls. This approach entails the nomination of an orchestrator (a digital innovation department or similar) that gathers digital ideas and channels them towards strategic opportunities. The orchestrator can also enhance non-IT employees' self-efficacy by promoting new prototyping tools and streamlining their practices with periodic training on rapid digital prototyping.
- **Exploit jam sessions.** Management's decisions are imperfect when it comes to predicting what the next big thing is, or what many little things lead up to it. Luckily, more and more employees are moving from interchangeable low-skilled workers to invaluable life-long learners who expect to realise their potential on the job. Orchestrator should thus give credit to their ability to self-orchestrate and to co-create the overall innovation choreography. But when Alice is jamming around with digital ideas, who knows where this may lead to? While recognising that innovating with non-IT employees can be a new approach to strategy making is extremely powerful, it is not for the faint of heart. Mixed open calls are ideal in this regard, as they allow to exploit entrepreneurial mindsets within an organisation while keeping an eye on strategy.
- **Over to you!** We hope these recommendations will prove useful to debunking inadequate approaches to innovation management and successfully redesigning them for the digital age.

7.1.1 KEY CONTRIBUTIONS

Old wine in new bottles? Digital innovation research was born out of doubts whether existing theory can adequately capture the digital nature of innovation. In early years, research thrived on bold calls to reassess innovation management for the digital age. However, critical voices soon suspected that the nascent field is simply purring old wine into new bottles, hiding behind inconsistent concepts and tautological definitions. Recent work has started to address these critiques. During our doctoral studies, considerable effort has been put into consolidating prior knowledge, refining core concepts, and shaping research agendas that diligently pinpoint remaining knowledge gaps. Up to the final year of our doctoral studies, the IS discipline continued to host constructive discussions on the technical, social, and socio-technical characteristics of digital innovation, and it is still debating the key differences between digital and traditional innovation. Overall, this thesis has both benefited from and contributed to the quest for conceptual clarity and deep theorising in digital innovation research.

Why we plead for new wine. Our research suggests that digital innovation management is fundamentally different from traditional innovation management. Traditional innovation management implies a fixed set of actors for initiation that includes the ideator, idea manager, and idea evaluator in dedicated phases of idea generation, idea improvement, and idea evaluation. With digital technology, these boundaries have faded. Characteristics that are central to digital technology, such as reprogrammability, not only lead to greater ambiguity in innovation outcomes (i.e. what does it do? Who is it for?), but also to greater generativity in innovation processes (i.e. what else can it do? Who can develop it further?). In the words of Yoo et al. (2010), "reprogrammability allows a digital device to perform a wide array of functions" (p.726), like for example microchips that can be "programmed to record acceleration, braking and speed, communicate with insurance companies, and reduce premiums for good driving patterns" (Yoo et al. 2013, p.11). Unlike analog technology, the functions of digital devices can be separated from their physical embodiment, creating fluid product boundaries and meanings (ibid). As a result, digital artefacts are "highly evolving" with "nearly limitless possibilities for recombination" (Yoo et al., 2010, p.7). As Arvidsson and Mønsted's (2018) illustrate, even failed digital ideas can be picked up and reprogrammed into successful digital innovations. Innovation processes have consequently become more generative and innovation outcomes more ambiguous (Hund et al., 2021). In our studies, we observed how digital innovation artefacts (i.e. digital prototypes, e.g. low-code applications) were reprogrammed for the potential of digital ideas to unfold more fully. This can be done increasingly quickly and easily. As Maruping and Matook (2020) point out, the low-code movement significantly lowers the technical barriers to digital idea development and enables a more active form of participation by individuals with little or no coding skills. With our research, we found that the lowering of technical barriers enables non-IT employees to leverage the reprogrammability of digital technology and take on new roles in a more fluid idea development process, putting traditional innovation management wisdom into question. Specifically, we found that traditional approaches to initiation extensively rely on explicit open calls, such as idea campaigns and challenges; however, employees can hardly adjust the idea development process in such open calls to account for the reprogrammability of their digital idea. Implicit open calls, on the other hand, are embedded in easy-to-use digital technology that supports the reprogrammability to digital innovation artefacts, offering high levels of flexibility for idea development. The "digital" aspects of innovation are thus genuinely redefining the playing field for employee participation in initiation, calling for new managerial approaches to better acknowledge the greater levels of ambiguity and generativity in digital innovation (see Figure 13 below).

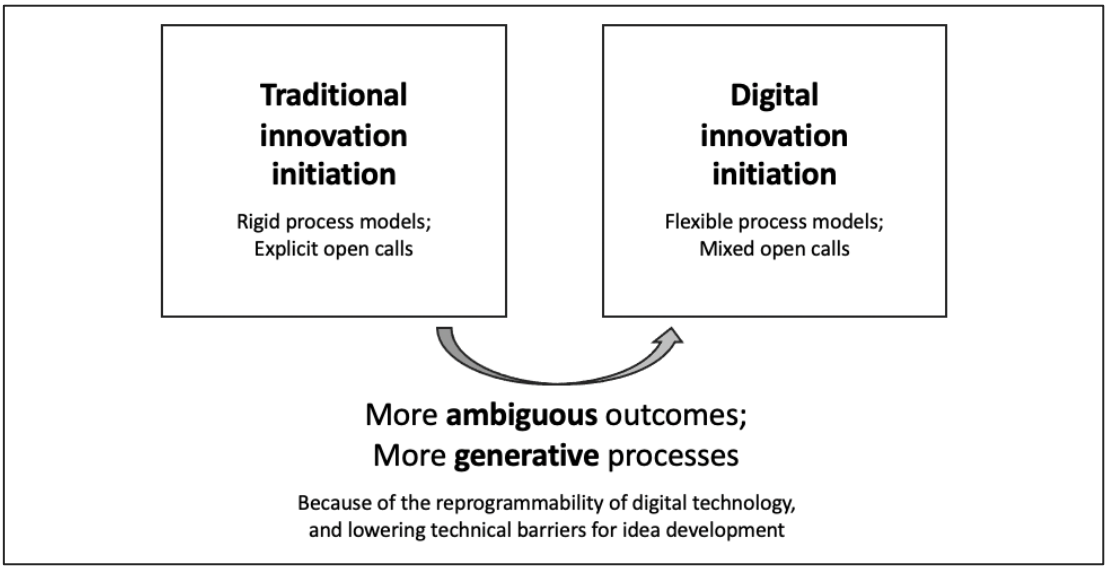

Figure 13. Traditional vs digital innovation initiation

Key theoretical contributions. Our four research papers *validate the central tenets of digital innovation research with regards to the initiation activity* (i.e. fluid boundaries, Yoo et al., 2010) and *enrich extant conceptualisations of digital innovation management* with an understanding of how digital ideas form and evolve within organisations. Concretely, we develop two process models (i.e. idea management and idea development; papers 1b and 2), conceptualise three novel organisational competences (i.e. orchestration, self-orchestration, choreography; paper 3), and specify three digital artefact roles (i.e. activity, epistemic, boundary; paper 3) that support digital innovation initiation with non-IT employees in incumbents. Furthermore, the background section of this thesis contributes to consolidating the field with a revised definition of initiation and a review of initiation actors and activities. We hope that our focus on the currently understudied initiation activity will help scholars gain a more complete picture of digital innovation management and achieve a better understanding of the theoretical differences between traditional and digital innovation.

7.1.2 OUTLOOK FOR SCHOLARS

Three research avenues. Based on the above-mentioned contributions, future studies would do well to consider at least the following three research avenues.

- **Avenue 1: IS strategizing.** We find that non-IT employees help develop three competences that critically support digital innovation capability and competitive advantage. Future research should therefore reconsider non-IT employees' role with regard to the IS strategy. Specifically, future research should theorise on how non-IT employees' digital innovation practices align with existing business and IT strategies, and how they shape new digital business strategies. This calls for research designs that begin with an empirical focus on the micro-level activities that constitute

the "doing of strategy" and cut across levels to capture the interactions between individual practices, organisational processes, and strategy. "As-practice" research, and particularly the research stream on strategy as practice (Langley & Abdallah, 2011), may prove valuable in understanding digital business strategy as "something people [i.e. including non-IT employees] do" rather than something organisations "have" (ibid, p.124).

- **Avenue 2: Employee empowerment and motivation.** We find that non-IT employees participating in internal open calls are empowered workers in the sense that they have increased formal authority for initiation and achieve greater efficiency by taking on activities that were traditionally assigned to IT professionals (Durward et al., 2019). While most non-IT employees had a positive experience of empowerment, our case suggests that it may cause an increase in perceived workload in others. To date, little is known about the additional cognitive burden and behavioural requirements of performing digital innovation activities alongside one's traditional role. Future research should thus explore how non-IT employees individually cope with these additional expectations, and what organisational processes and structures can reduce perceived workload and enhance motivation. Regarding motivation specifically, it may be worth investigating whether individuals who engage in initiation are truly motivated by the idea development activities they engage in, or whether they take advantage of digital innovation artefacts as a way to display compliance with managerial expectations (Karoui et al., 2015). Initial insights from our case offers support for both, as we found some employees to develop digital innovation artefacts out of intrinsic motivation while others mostly longed to increase their social position within the organisation.
- **Avenue 3: Digital innovation artefacts.** We find that digital innovation artefacts play a central part in initiating digital innovation. They enable non-IT employees to gain self-efficiency in technical development and limit or postpone the involvement of IT staff. However, this may lead to redundant solutions and technical inefficiencies. Practice is currently leading the way in low-code development and rapid prototyping, and we lack a deep understanding of digital innovation artefacts and their theoretical implications. Future research should thus take the lead in investigating how digital innovation artefacts can be designed to create a safe space for experimentation and an efficient vector for implementation and deployment. Design science research (DSR) may constitute a particularly promising approach to designing digital technology that supports the initiation needs of non-IT employees (Hevner & Chatterjee, 2010).

7.1.3 CONTRIBUTIONS TO THE BROADER RESEARCH LANSCAPE

Five research themes. Hund et al.'s (2021) recent literature review reveals that digital innovation research currently clusters around five broad research themes. We now open the discussion to the

broader research landscape by positioning our main contributions within these five research themes. Figure 14 below provides an illustration.

- **Theme 1: Redefinition of boundaries.** The digital nature of innovation leads to blurred boundaries in organisations in terms of product boundaries, role boundaries, organisational boundaries, and industrial boundaries (Nambisan et al., 2017; Yoo et al., 2010). We contribute to this theme with an in-depth analysis of blurred role and process boundaries in the initiation activity. We synthesise our insights on the blurred role of non-IT employees, IT actors, and managers in a process model of digital idea management (papers 1a) and idea development on LCDPs (paper 2).
- **Theme 2: Digital systems.** The modular architecture of digital infrastructure, platforms, and ecosystems (Tilson et al., 2010; Tiwana et al., 2010) fosters the participation of various actors in innovation activities and results in new interdependences (Vega & Chiasson, 2019). We contribute to this theme with an in-depth analysis of non-IT actors' participation in initiation activities on low-code development platforms. We highlight the interdependence challenges associated with the low-code movement, and we synthesise our insights in a set of success factors for the development of digital ideas on LCDPs (paper 2).
- **Theme 3: Digital innovation strategy.** The close intertwinement of digital technologies and organisational processes questions the distinction between business and IT strategies (Berente, 2020; Bharadwaj et al., 2013) and triggers a shift towards digital business strategies (Teubner & Stockhinger, 2020). Digital business strategy gives more weight to non-managerial actors who help identify arising digital opportunities, make sense of malleable and perpetually evolving digital technology, and mitigate the potential risks of innovative ideas (Legner et al., 2017). We contribute to this theme with an analysis of how non-IT employees (as non-managerial actors) help shape digital business strategy with their digital innovation artefacts (paper 3). Moreover, we conceptualise three novel orchestration competences (i.e. orchestration, self-orchestration, choreography; paper 3) that enable organisations to better leverage the digital innovation potential of non-IT employees in their digital business strategizing.
- **Theme 4: Organisational determinants.** The growing pressure for digital innovation causes organisations to transform their shape, ways of organising, identity, and culture (Hund et al., 2021). Such deep transformations are typically met with resistance unless they are supported by agile practices (Chan et al., 2019) and ambidextrous mindsets (Magnusson et al., 2021). We contribute to this theme with an analysis of organisational inertia in the initiation of digital innovation (paper 1a). We specifically highlight the resistance that digital ideas stemming from non-IT employees face in classic stage-gate approaches to innovation, and we discuss its economic and political dimensions. We further contribute with an analysis of the transformation of traditional stage-gate innovation processes into iterative digital initiation processes (paper 1b). We emphasise that the

shift towards iterative initiation entails making the exploration of digital ideas more affordable (both economically and politically), and we discuss the associated transformations in sense-making and orchestration logics.

- **Theme 5: Arising tensions.** Digital innovation activities call for new ways of working that are often opposed to established organisational routines. This can cause competing concerns and paradoxes in organisations (Hund et al., 2021). These tensions particularly affect incumbent organisations, as they are characterised by a focus on exploitation rather than exploration (Svahn et al., 2017). More generally, digital technology itself incorporates paradoxical characteristics, such as malleability and rigidity (Ciriello et al., 2019), or generativity and restriction (Tilson et al., 2010). We contribute to this theme with an analysis of tensions that arise in the initiation activity, i.e. between empowerment and control in non-IT employees' practices on low-code platforms (paper 2) and the surrounding managerial processes (paper 1b). We propose that the relationship between digital technology use and the empowerment-control tension is mediated by the use of digital innovation artefacts (paper 3).

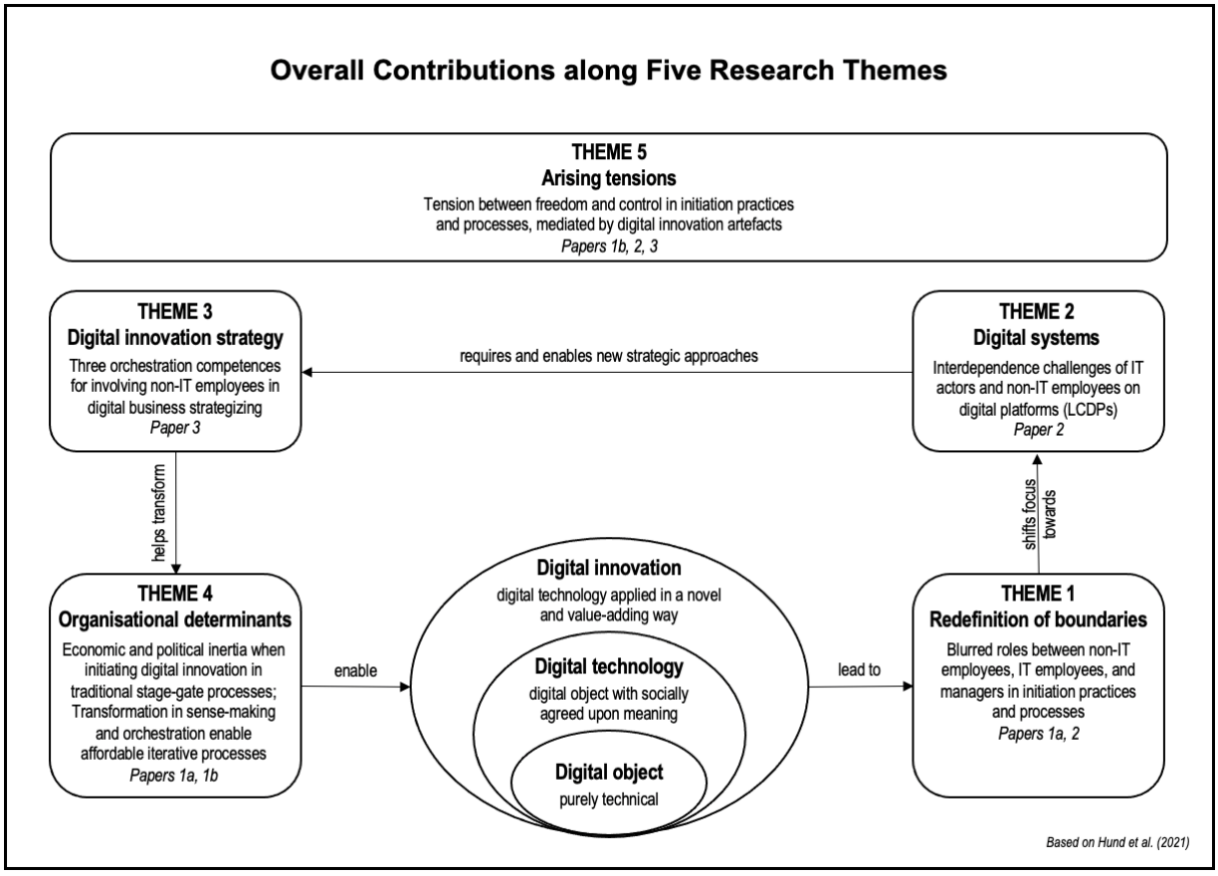

Figure 14. Overview of overall contributions along five research themes

7.2 LIMITATIONS

Research design. While we concede great value to theorising from multiple cases, we did not enrich the findings from our single case with cross-case triangulation. The reasons are twofold. First, real-world cases on our focal phenomenon are scarce. The set of preliminary interviews that we performed at the outset of our research suggest that few incumbents have implemented enterprise-wide initiatives for digital innovation initiation. Moreover, potentially relevant cases (i.e. organisations C, D, and H in Table 8 on p.45) were not accessible for in-depth data collection. Indeed, the strategic relevance of digital innovation made many incumbents reluctant to share in-depth data on the topic. Second, the COVID-19 epidemic caused unplanned disruptions in our research process. In particular, a range of sanitary measures adopted between March 2020 and February 2022 significantly hampered data collection in real-world organisational settings. Lockdowns brought organisational activity to a temporary halt and made it impossible to access the field for prolonged periods of time (i.e. organisation J). Because a normalisation of the situation could not reasonably be determined, an extended search for additional cases was deemed unrealistic and alternative data collection strategies were pursued (i.e. secondary data collection; paper 2). As a result, we lacked suitable candidates for cross-case triangulation and were forced to give up on the multiple case study design. We acknowledge this as a limitation to the generalisability of our findings and view it as an avenue for future research.

Research ethics. We did not request approval from the Institutional Review Board (IRB) for the research presented in this thesis. Nonetheless, we took actions to maintain the highest standards of rigour and integrity, notably with regards to the caring for and respecting of our study participants. We did not resort to any experimental interventions or participation incentives, and our research did not involve sensitive topics or special populations. Moreover, we took great care to obscure personal identifiers in our data and ensure informed consent among our study participants (see consent form on p.177 in Appendix H).

7.3 CONCLUSION

Unleashing digital innovation with non-IT employees – in an orchestrated manner. "The time for new theorizing about digital innovation is now" (Nambisan et al., 2017, p.224). Five years after this resounding call, digital innovation has attracted considerable attention from scholars and practitioners alike. The international strike for climate, the global pandemic, and the Russia-Ukraine war all acted as painful reminders of how heavily we depend on the creation of innovative digital solutions, and how dearly we need incumbent organisations to contribute to these innovation efforts. In light of today's challenges and opportunities, this thesis contributes to answering Nambisan et al.'s (2017) call by theorising on the participation of non-IT employees in the initiation of digital innovation. Based on in-depth research with real-world incumbents, we find that non-IT employees' contributions to digital innovation need not be restricted to ideation, but should be extended to the development of digital ideas into implementable concepts. In such a scenario, the roles enacted by non-IT employees partially overlap with those typically assigned to IT employees within incumbents. This results in an increased interdependence between IT and non-IT employees and calls for the development of three novel organisational competences to efficiently coordinate and integrate their contribution: orchestration, self-orchestration, and choreography competences. We find these competences to rely on the mindful use of digital innovation artefacts in initiation processes and practices. More generally, building these competences entails transforming existing structures, reassessing IT governance, and rethinking IS strategy, all of which constitute fruitful avenues for future research. Overall, we hope this thesis will prove valuable to incumbent organisations by helping them leverage employees' ideas as scattered bricks and assemble them into powerful windmills that vigorously spin in the winds of change brought by digital technology.

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APPENDIX

APPENDIX A – PUBLICATION LIST AND AUTHOR CONTRIBUTIONS

PAPER	AUTHORS AND CONTRIBUTIONS	OUTLET
1a. Idea Management in the Age of Digital Innovation: An Exploratory Case Study	**Désirée Krejci** – Data collection, analysis, write-up, submission, presentation **Stéphanie Missonier** – Case access and supervision	AIM 2020 ***Appendix B***
1b. Idea Management in a Digital World: An Adapted Framework	**Désirée Krejci** – Data collection, analysis, write-up, submission, presentation **Stéphanie Missonier** – Case access and supervision	HICSS 2021 ***Appendix C***
2. Innovating with Employees: An Exploratory Study of Idea Development on Low-Code Development Platforms	**Désirée Krejci** – Data collection, analysis, write-up, submission, presentation **Satu Iho** – Data collection and. analysis **Stéphanie Missonier** – Case access and supervision	ECIS 2021 ***Appendix D***
3. A Case Study of Enterprise-Wide Digital Innovation: Involving Non-IT Employees	**Désirée Krejci** – Data collection, analysis, write-up, submission, presentation **Lionel Küng** – Case access, data collection and analysis **Stéphanie Missonier** – Case access and supervision	ECIS 2022 ***Appendix E***
4. Supporting Knowledge Integration with Low-Code Development Platforms	**Désirée Krejci** – Data collection, analysis, and write-up **Satu Iho** – Data collection, analysis, write-up, submission, presentation **Stéphanie Missonier** – Case access and supervision	ECIS 2021 (not included in thesis)

Table 15. List of publications and authors contributions

APPENDIX B – RESEARCH PAPER 1A

Idea Management in the Age of Digital Innovation: An Exploratory Case Study

Research Paper accepted to AIM 2020

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Abstract (in French)

Pour bon nombre d'entreprises, l'innovation digitale est devenue synonyme d'impératif stratégique et de priorité opérationnelle. Paradoxalement, l'innovation digitale est un terme fourre-tout dont la signification floue rend la mise en pratique difficile. La manière dont les idées spécifiquement destinées à constituer de futures innovations digitales doivent être gérées est un phénomène récent sur lequel la littérature reste jusqu'à présent muette. Nous apportons une première compréhension empirique à ce phénomène à travers une étude de cas sur la gestion d'idées telle que pratiquée dans une entreprise traditionnelle dans le cadre de sa stratégie de transformation digitale. Nous contribuons à la littérature sur la gestion d'innovations digitales et la transformation organisationnelle en démontrant comment la digitalisation transforme la phase d'initiation de la gestion de l'innovation. Notre cas indique que l'initiation d'innovations digitales nécessite un processus de gestion des idées flexible et une participation hétérogène d'acteurs. Une gestion des idées innovantes sous forme de couples de problèmes et de solutions en constante coévolution y est propice et aide à surmonter des inerties économiques et politiques dans l'initiation d'innovations digitales. Nous espérons ainsi guider les praticiens dans la mise en œuvre d'un processus de gestion d'idées propice au développement d'innovations digitales.

1 Introduction

Digital innovation management is the scholarly field which investigates how new digital technologies change innovation processes and outcomes. Its leading scholars (e.g. Fichman et al., 2014; Nambisan et al., 2017; Yoo et al., 2012) have argued that digital innovation can refer, either in isolation or in combination, to innovation outcomes (a) embedded in IT (e.g. digital artefact), (b) enabled by IT (e.g. digital business model), or (c) supported by IT in their development process (e.g. digital prototyping). Most firms have recognized digital technology as a powerful fertilizer for innovation and have defined

digital innovation as a critical part of their digital transformation strategy (Hess et al., 2016). However, there is a certain confusion in the practitioner world about how digital transformation strategies should be operationalized with regard to innovation (Chanias et al., 2019).

While the extant literature offers rich insight into digital innovation development (i.e. adoption and design) and implementation (i.e. governance and maintenance), little is known about digital innovation initiation (i.e. opportunities identification) (Kohli & Melville, 2019). Specifically, scholars have not yet looked into how organisations need to transform their idea management practices to initiate digital innovation. In order to address this gap in knowledge, we draw on idea management literature (Gerlach & Brem, 2017) in combination with digital innovation management literature (Nambisan et al., 2017) to examine how idea management, as "a sub process of innovation management with the goals of effective and efficient idea generation, evaluation and selection" (Brem & Voigt, 2007, p.306), is transformed for the purpose of initiating digital innovation. We thus pose the following research question:

How is idea management transformed to help seize digital innovation opportunities?

We address this question with a longitudinal case study of how idea management is practiced in an incumbent firm in the fragrance industry (i.e. Globex, name changed) as part of its digital transformation strategy. Our findings suggest that in order to seize digital innovation opportunities firms must transform their idea management to (1) handle a more fluid idea management process and (2) leverage a more heterogenous crowd of idea contributors. We contribute to the literature on digital innovation management (Nambisan et al., 2017; Yoo et al., 2012) by raising awareness on how a dynamic approach to innovative ideas as problem- solution pairs (Von Hippel & Von Krogh, 2015) can support these transformations. We furthermore contribute to the literature on organisational transformation (Besson & Rowe, 2012) by highlighting how such a dynamic approach can help overcome economic and political inertia in the initiation of digital innovation.

Our paper is structured as follows: in Section 2, we provide an overview of the extant idea management literature and indicate how it falls short of considering idea management as an initiator of digital innovation. Section 3 presents our longitudinal case study methodology and describes our case. We present our findings in Section 4 and discuss them with regard to the literature on digital innovation management and organisational transformation in Section 5. Finally, Section 6 concludes by restating our main contributions and highlighting fruitful avenues for future research.

2 Background

This section provides an overview of the extant literature on idea management and states how our understanding needs to be extended in the light of digital innovation.

2.1 Idea management

Idea management broadly refers to a set of activities organizations undertake to systematically utilize creative ideas and has attracted both practitioners' and researchers' interest for some decades (Thom, 1980). Since its inception in the manufacturing industry in the 18th century, idea management has crystalized as "one of the most persistent management concepts ever" (Thom, 2015, p.238) by continuously adapting to changes in economic, social, and technological environments. One notable adaptation is the shift in its scope of practice from collecting ideas of all types (e.g. via suggestion boxes) to leveraging ideas specifically destined for innovation (e.g. via innovation contests) (Flynn et al., 2003). It has been suggested that companies that deploy an idea management program are more successful in their innovation efforts (Boeddrich, 2004).

In a recent review of the idea management literature, Gerlach and Brem (2017) consolidated 15 idea management models dating from 1980 to 2011 in a conceptual framework to reflect the state-of-the-art knowledge in the field. The framework conceptualizes idea management as a process with six successive phases: preparation, idea generation, idea improvement, idea evaluation, idea implementation, and idea deployment. For the purpose of this paper, we restrict the scope of idea management to (1) idea generation, (2) idea improvement, and (3) idea evaluation, since these phases found most support among the reviewed models.

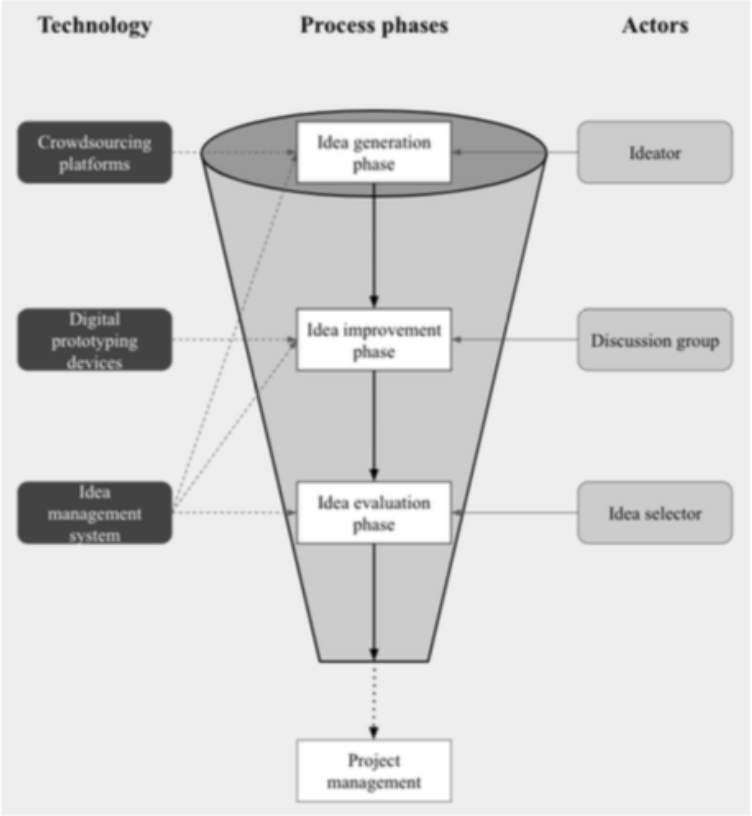

Figure 1. Idea management framework (adapted from Gerlach & Brem, 2017)

Figure 1 depicts an adapted version of Gerlach and Brem's (2017) idea management framework. Ideas enter the funnel on the wide end as they are generated, move through the funnel as they are developed, and exit on the narrow end upon final selection. The funnel stands as a metaphor for the selective nature of idea management, i.e. the decreasing number of ideas along the process. The framework further suggests a generic yet predefined set of actors for each phase (i.e. ideator, discussion group, and idea selector). While some scholars (Brem & Voigt, 2009; Xie & Zhang, 2010) have included a multi-stage shifting process of ideas within their models to account for a more iterative idea selection process, the general consensus views the practice of idea management as a waterfall process consisting of well-defined phases and involving a predefined set of actors for each phase (Gerlach & Brem, 2017).

The idea generation phase (1) is characterized by the generation of a large number of ideas according to a given topic (e.g. internal crowdsourcing; Zuchowski et al., 2016) or not (Bailey & Horvitz, 2010). Next to internal employees, external ideators can constitute a valuable source for idea generation (Mikelsone & Liela, 2015). Ideas are typically captured, either manually or by the means of a digital platform (e.g. crowdsourcing platform; Schlagwein & Bjørn- Andersen, 2014; Leimeister et al., 2009), stored, and tracked by idea managers using idea management systems (Westerski et al., 2011). In this phase, ideas can be classified and pre- selected according to their type (e.g. business or technical, local or corporate-wide) and financial potential (Wrede, 2007).

During the idea improvement phase (2), ideas are developed to better assess their potential. The ideator can enrich his/her idea through discussion groups, workshops, and prototype experimentation (Brem & Voigt, 2009), and redefine it according to newly available information (Fairbank & Williams, 2001). This phase primarily aims at increasing an idea's chances of being selected in the idea evaluation phase (Flynn et al., 2003).

Finally, in the idea evaluation phase (3), idea selectors decide on the most promising ideas, provide feedback, and reward ideators. Selection criteria and idea selector profiles can vary according to organizational goals, needs, and culture (El Bassiti & Ajhoun, 2013) and according to idea type (e.g. incremental vs. radical, business vs. technology; Sandström & Björk, 2010). A major goal in this phase is to avoid false positives (i.e. selecting unsuccessful ideas) and false negatives (i.e. rejecting successful ideas) (El Bassiti & Ajhoun, 2013). Selected ideas are kept for deployment, others are abandoned or stored in an idea pool (Bailey & Horvitz, 2010).

2.2 Initiating digital innovation opportunities

While idea management did not historically focus on the initiation of digital innovation, a growing number of firms are facing the challenge of effectively developing innovative ideas that have digital artefacts at their core. Scholars in digital entrepreneurship refer to such ideas as "digital venture ideas" (Von Briel et al., 2018). Von Briel et al. (2018) theorize that the central role played by digital artefacts in digital venture ideas carries important practical implications for the opportunity initiation process,

i.e. for the development of an idea into the imagined market offering. This echoes repeated calls from the digital innovation literature arguing that digital innovation management needs to be studied as a new phenomenon which is fundamentally different from traditional innovation management (Nambisan et al., 2017; Yoo et al., 2012). Scholars have highlighted two major reasons for that.

First, digital innovation management challenges traditional innovation management by leveraging a heterogenous and dynamic crowd of contributors rather than a predefined collection of actors (Nambisan et al., 2017). With regard to the initiation of digital innovation, scholars have shown how organizations leverage crowdsourcing and innovation contests (e.g. Schlagwein & Bjørn-Andersen, 2014; Blohm et al., 2010) to allow for a collection of actors inside and outside the company to submit ideas. Driven by various goals and motivations, these actors can join in and retract from the innovation process in a mostly unpredictable way (Lusch & Nambisan, 2015).

Second, digital innovation causes traditional innovation process phases to blur or overlap (Nambisan et al., 2017). With regard to the initiation of digital innovation, new digital infrastructures such as 3D printing (Rayna & Striukova, 2016), digital makerspaces (Smith et al., 2013), or low-code platforms (Sanchis et al., 2020) enable ideas to be quickly prototyped and tested through iterative experimentation cycles (Ries, 2011). The use of agile methodologies and user centric design for the development of ideas (e.g. Lean Start-up, Design Sprints) further breaks with the presupposition of linear innovation processes and blurs the temporal boundaries between innovation phases (Nambisan et al., 2017).

In sum, digital innovation challenges our traditional understanding of innovation management processes and sub-processes. We expect idea management, as a sub-process pertaining to the initiation of innovation opportunities, to mirror the above-described transformations, i.e. more fluid processes and more dynamic actors. Despite its central importance for practitioners, however, the literature fails to adequately account for these transformations in the initiation of digital innovation (Kohli & Melville, 2019) and link it to the literature on organizational transformation (Besson & Rowe, 2012). We address this gap through an exploratory longitudinal case study on *how idea management is transformed to help seize digital innovation opportunities.*

3 Research methodology

Idea management is a complex phenomenon that requires the investigation of a rich data set. We gathered such a rich data set by preforming an in-depth longitudinal case study of a traditional organization which transformed its idea management practices specifically to foster digital innovation (Yin, 2014).

3.1 Case selection and data collection

We selected the case of a well-established and traditionally structured company operating in the fragrance industry which we refer to as Globex (name changed). At the time of the study, Globex employed roughly 7'000 employees worldwide working in its main business units (i.e. fragrances and flavors) and its transversal support units (i.e. human resources and information systems).

Globex constitutes a revelatory example of how incumbent firms, whose core business is not historically built around digital technologies, but rather around intensive Research and Development (R&D) activities typically transform idea management to help seize digital innovation opportunities. Specifically, Globex leverages idea management with the goal of achieving innovative outcomes either embedded in IT (e.g. digital artefact) or enabled by IT (e.g. digital business model) and destined either for internal or external use. Globex constitutes a relevant case for three main reasons. First, top management at Globex has officially identified digital transformation as a strategic priority in March 2018 in reaction to the increased use of digital technologies in the industry. Notably, the successful use of artificial intelligence algorithms for perfume creation constituted a serious threat of disruption for the industry.

Second, Globex set up a digital innovation department (March 2018) and a digital innovation lab (August 2018) as part of its digital transformation strategy. The digital innovation department was mandated to foster digital innovation throughout the organization and empower employees to develop innovative processes, products or services with a digital core component. It was affiliated to the Information Systems department but acted as a transversal support function to all organizational departments. The digital innovation lab was affiliated to the Information Systems department and mandated to experiment with artificial intelligence. The lab was considered out of the digital innovation department's scope and reported directly to the CIO. Third, the digital innovation department at Globex leveraged idea management as a managerial device to support its mission of fostering bottom-up digital innovation. Furthermore, it licensed an idea management system to promote and handle its idea campaigns and acquired a 3D printer and low-code software to stimulate digital prototyping.

We were able to obtain access to Globex through the professional engagements of one of the co-authors who was hired as an intern to support the digital innovation department for a six month period. Specifically, the said co-author worked at the company's headquarters and focused on the maintenance of the idea management system and the promotion of idea campaigns and workshops. We complemented this participant-observation with 17 interviews, access to the data management system and internal documentation (see Appendix B, C and D for more details on our data collection, the interview list, and the interview guideline).

3.2 Data analysis

Considering the rich body of literature on how ideas are managed in organizations, we followed a thematic content data analysis approach (Miles et al., 2014). We started with a deductive approach and added inductive insights into relevant transformations as they emerged from the data. Finally, we checked the inductive insights against the literature (see Appendix E for our coding scheme).

Specifically, we deducted thematic codes from the idea management framework by Gerlach and Brem (2017) with a specific focus on process phases and actors, and added thematic codes on digital innovation, digital innovation management and organisational transformation. This yielded 37 deductive codes to which we added 3 inductive codes as we got more familiar with the case (Miles & Huberman, 1994). We derived the additional inductive codes from patterns on how the digital innovation department progressively transformed its idea management process to better support digital innovation. To identify these transformations, we reviewed our data for changes in the digital innovation department's objective, governance, staffing, management practices, and use of digital technology, as well as significant shifts in idea management process phases and actors. We coded our data in a chronological order, coding the earliest data first and gradually moving forward in time. This enabled us to gain a solid overview of the transformations in idea management. To insure the replicability of our findings, one of the authors and a researcher blind to the study trained themselves on our coding scheme and independently marked relevant ranges of text (i.e. sentences and ranges of text in interview transcripts and secondary data) using MAXQDA coding software. We then checked for adequate inter-rater replicability by computing Cohen's kappa coefficient (Cohen, 1960).

4 Idea management for digital innovation at Globex

When Globex announced its digital transformation strategy in March 2018, it outlined a vision of digital innovation built around five strategic pillars: creativity (e.g. artificial ingredient creation), client (e.g. e-commerce), sustainability (e.g. product traceability), legacy (e.g. operations optimization), and people (e.g. recruiting). New digital technology would help generate new business models and organizational processes in each pillar, optimize existing activities and create new revenue streams. By disconnecting from traditional Research and Development (R&D) and New Product Development (NPD) project management pipelines, the digital innovation initiative could foster internal innovation efforts and tie links with external innovation ecosystems. Leveraging employees' creativity and expertise by exposing them to idea campaigns and workshops was expected to stimulate innovation initiation and to reduce ideas' time to market. The digital innovation department, initially a team of three people that grew into a team of eight between March 2018 and February 2020, was commissioned to help accomplish this audacious vision. The department progressively transformed its idea management process to

specifically support digital innovation efforts. Our findings are structured according to the main idea management process phases identified in Gerlach and Brem's (2017) framework.

4.1 Idea generation phase

Instead of sourcing ideas from the top management or from specialized innovation departments, digital innovation at Globex had to be understood as a collective action of value cocreation among all employees. Practically speaking, Globex had to strengthen its capability for breaking functional silos and developing an innovation community. This represented a significant shift from existing innovation practices that were traditionally grounded in specialized teams (i.e. R&D).

To help foster a mindset of innovation among the entire workforce rather than just a subset of employees in R&D teams, the digital innovation department decided to stimulate idea submission with idea campaigns. The idea challenges driving these idea campaigns were defined by the digital innovation department in consideration of needs that had previously been identified by business leads (e.g. during strategic workshops). To better promote and manage idea campaigns, the department licensed an idea management system and built up a network of internal ambassadors and trained innovation champions to communicate and evangelize idea campaigns throughout the company. With regard to employees, the idea management system was positioned as an internally open platform dedicated to the submission, discussion and tracking of innovative ideas. A lead of the digital innovation department said: *"The idea management platform is not only to collect and incubate ideas, but it's also about community management. It helps us to connect the dots internally, to avoid working in silos and to integrate ideas"* (Lead 1, 13.06.19).

In spring 2019, the innovation department was confronted with tensions arising from the use of idea campaigns to generate ideas specifically for digital innovation. On the one hand, idea campaigns had to be driven by challenges that were broad enough to generate a large quantity of ideas, yet specifically designed to stimulate ideas with digital components at their core. Generating ideas suited to develop into digital innovation turned out to be less-trivial than expected. As a lead of the digital innovation department put it: *"The challenge with innovation is that you don't want to tell ideators: 'focus on the digital'. So, at the beginning, most ideas were not digital, and we somehow had to twist them to add some digital component so that it matched with our mandate"* (Lead 2, 9.07.19).

Globex addressed this by reviewing its definition of digital innovation and clarifying its mission with regards to digital innovation. An important challenge resided in defining digital innovation in a way that was different from innovation that were already performed by other teams at Globex. The same lead said: *"There are a lot of innovation teams across Globex, but they focus on R&D applications. So that's a different mindset. We're digital innovation. Mostly emergent technology in the industry, such as AI, VR, 3D printing, blockchain applications, new methods of how clients are working... Not just*

tools but innovative concepts. That's really where our focus shifted into making sure there's some digital component to it, whether it's exploring a use case or exploring a technology" (Lead 2, 9.07.19).

By end of summer 2019, the department had settled for the mission of developing innovations either enabled by IT or embedded in IT, and it gradually abandoned activities not directly linked to promoting ideas with digital core components (e.g. strategic workshops, general idea campaigns). On the other hand, however, the department was then confronted with ideas that were at times highly technical. Especially ideas that came from employees in operations were very specific and came with a heavy technological frontload. In the words of a lead of the digital innovation department: *"Some people would just come with a technical solution that is so specific sometimes we don't understand what it's for. What problem does it address and is it relevant?"* (Lead 2, 10.10.19).

In order to gain a better understanding of each idea and to verify its match with the department's mandate, the digital innovation department decided in autumn 2019 to decompose each idea into its underlying problem and solution statements. When submitting an idea, ideators were now required to fill out a canvas to describe the solution they envisioned and the problem it would help solving. This enabled the department to better assess the problem's relevance and to make sure that the envisinoned solution had a central digital component. A lead of the digital innovation department explained: *"We needed to take a step back to understand what the underlying need is. We then realized that a lot of ideas addressed the same problem, so we could merge them"* (Lead 2, 10.10.19).

4.2 Idea improvement phase

Beyond the mere generation of ideas, the digital innovation department was mandated to help reduce ideas' time to market. In essence, the ideas that had been collected in the idea management system went through a filtering process in order to assess their expected desirability, feasibility and viability. The digital innovation department opted for a design approach that implied quickly going back and forth between user needs and potential solutions via rapid prototyping and testing with internal and external users. However, breaking away from deeply rooted project management practices created tensions, as highlighted by a member of the digital innovation department: *"As a department, we try to reduce the gap between the innovation process as it should be, that is iterative and sometimes messy, and corporate processes, financial rules and so on, that somehow pervert the proper way to do innovation. Digital technologies can help us reduce this gap. At least for idea management, it enables us to get access at a low cost to a community of people who can provide insights, challenge the topic, so you can somehow continue to iterate on your initial idea while simultaneously convincing people in the company to get more resources"* (Specialist, 22.11.2019).

The department was aware that top-management support is critical for the success of innovation initiatives and that it needed to bring transparency and structure into the chaotic process of innovation. To enable periodic reporting of key metrics to top-management (e.g. number of ongoing idea

campaigns, number of ideas in each phase), a lead of the digital innovation department formalized the idea management process as a stage-gate model that would fit with existing project management practices. The department soon noticed that such a model had the downside of enforcing an outcome focus rather than a process focus on innovation. Essentially, the stage-gate logic made it unattractive for the digital innovation department and ideators to iteratively refine underlying user needs and experiment with alternative solutions. The same member of the digital innovation department highlighted: *"What we are missing is the iterative approach. I mean, do we allow ourselves to redefine an idea and to reconsider the relevance of a problem? That's where it gets stuck"* (Specialist, 22.11.2019).

To help address this first issue, the idea development phase was adapted to enforce first a mock- up stage before moving to the realization of a minimum viable product (MVP). This was expected to encourage ideators to test the assumed need and the envisioned solution early on in the process. However, a second issue arised when the digital innovation department realised that many employees at Globex lacked the necessary technical skills for the rapid development and modification of digital prototypes. Getting timely access to developers for rapid prototyping emerged as a significant challenge. Though Globex employed a number of qualified developers at its headquarters, they were busy with the maintenance of existing systems and required a few weeks' notice to make themselves available for prototyping projects. Punctual collaborations with off-shore developers located in Asia were also difficult because of cultural differences and language barriers. As a result, digital prototyping was too costly in terms of time and money to stimulate rapid iterations. Ideators would refrain from modifying their initial prototypes because they lacked the necessary budget or because it would have considerably slown down the idea development process. In September 2019, the digital innovation department therefore hired an UX/UI designer to support the realization and testing of prototypes. The designer worked with the ideators to understand and validate the initial problem and solution statements, create an appropriate mock-up, and hand it over to a full- stack developer for the realization of a MVP. This significantly reduced the time the full-stack developer had to spend on an MVP, lowering the costs and increasing the speed of prototype development, and making iterations more attractive to ideators.

4.3 Idea evaluation phase

When launching the first set of idea challenges, idea evaluation took the shape of shark tank stype sessions where ideators would pitch their improved idea to top-management. However, the digital innovation department soon discovered that executives lacked experience in evaluating innovative ideas. This was all the more true for innovative ideas with digital components at their core. This evaluation mode thus resulted in the digital innovation department developing a great quantity of ideas with little certainty about management support for turning them into actual business projects. The department's director explained: *"We used to have plenty of ideas in the funnel that had no management*

support. So, there was no point in keeping them. We initially though that having a lot of MVPs is great. But now, if management support is not very strong, and by that I mean that we have a VP or a chief behind it, we kill the idea. Because it hasn't got a chance anyway. And there are so many other opportunities!" (Director, 17.01.20).

Management support and validated user desirability via prototype testing became central criteria to evaluate whether ideators were allowed to continue idea development. Rather than top-management, the business and IS points of contact who were interested in developing the idea into an actual business project decided if the mock-up would be developed further into a MVP and implemented in a project. These decisions heavily relied on prototype tests that occurred all along the idea development process. These tests consisted in decomposing ideas into verifiable assumptions about the underlying need and the envisioned solution, translating these assumptions into prototypes and (in-)validating the hypothesis with users and other stakeholders. Prototyping tests gradually reduced an idea's inherent level of uncertainty, fostered management support, and guided the idea development process. In winter 2019, the department noted that the number of prototyping iterations was a key metric to measure an idea's level of uncertainty in terms of desirability, feasibility, and viability. In the words of department's director: *"This gets us back to the point: what are we, as an innovation team, here for? We manage uncertainty. If you have something with high uncertainty, you come to us. If you have low uncertainty, you start a project. At some point, uncertainty will be low enough to hand the idea over to a project manager"* (Director, 17.01.20).

Beginning of February 2020, the digital innovation department was satisfied with its formalization of the idea management process and planned to launch additional company-wide idea management campaigns specifically focused on digital innovation.

5 Discussion

The Globex case offers important empirical insights into *how idea management is transformed to help seize digital innovation opportunities*, which we now relate to the extant literature. We contribute to the literature on digital innovation management by highlighting that idea management at Globex was transformed into a more fluid process and a more heterogenous collection of actors to help seize digital innovation opportunities. We furthermore contribute to the literature on organisational transformation by highlighting that viewing ideas as co- evolving problem-solution pairs helped Globex overcome its economic and political inertia in the initiation of digital innovation. We first discuss how Globex transformed its practice of idea management with a focus on process phases and actors before we turn to how problem- solution pairs helped Globex to overcome inertia in the initiation of digital innovation.

5.1 A more fluid idea management process

The general consensus views the practice of idea management as a waterfall process consisting of well-defined idea generation, improvement, and evaluation phases (Gerlach & Brem, 2017). Our data shows empirical support for these three phases. However, we identified blurred temporal boundaries between the idea improvement and idea evaluation phases. In the case of Globex, the use of digital technology (e.g. 3D printers, low-code tech) allowed for quick and cheap generation of prototypes (i.e. mock-ups and MVPs) and for their ongoing modification according to stakeholder's feedback (e.g. Rayna & Striukova, 2016). Rapid iterative cycles of prototype development and testing enabled ideators to continuously validate critical assumptions and better assess the potential of their idea (Ries, 2011). This helped them to gain internal stakeholder's support, increase buy-in and release budget for further development. In short, idea improvement and idea evaluation at Globex were intimately linked in order to assess digital innovation opportunities more quickly and more accurately. Our findings thus suggest that Globex transformed its idea management process into a more fluid set of phases to better seize digital innovation opportunities, thereby providing empirical support for theorizations around less-bounded innovation processes in the digital innovation management literature (Nambisan et al., 2017).

5.2 A more heterogenous collection of idea management actors

Our data showed support for the roles of ideator, discussion group, and idea selector, in the idea management process (Gerlach & Brem, 2017). However, our findings suggest that initiating digital innovation calls for a more heterogenous and somewhat unpredictable collection of actors. Specifically, Globex levered its idea management system as an internal crowdsourcing platform (Zuchowski et al., 2016) to enable employees throughout the organization to submit and comment ideas, as well as digital prototyping tools (e.g. Rayna & Striukova, 2016) to allow for feedback collection from internal stakeholders and external users. Globex thereby expanded the role of ideator to include all of its corporate employees and broadened the role of discussion group and idea selector to include an ever-changing collection of internal stakeholders and users. By hiring designers, Globex further increased the heterogeneity of actors in the idea improvement phase. In the innovation literature, the shift towards a wider innovation agency has been referred to as distributed innovation (e.g. Lakhani & Panetta, 2007) and open innovation (Chesbrough, 2003).

While multifunctional team members have been a driver of innovation management since the 1980s (Van de Ven, 1986), the heterogeneity of innovation actors is arguably most critical in developing innovative ideas enabled by or embedded in IT. In fact, digital technology offers greater levels of flexibility in how it can be used (Nan, 2011; Garud et al., 2008) because multiple affordances can cause a given digital technology to be used differently by actors with diverse purposes or in various contexts (Treem & Leonardi, 2013). This generates greater ambiguity in how an idea with a digital core

component should be understood (Nan, 2011; Garud et al., 2008). Rather than being determined by the ideator in isolation (as implied by the ideator role in Gerlach & Brem, 2017), the meaning of a novel idea emerges from the interaction of various social agents who try to understand, share and modify their understanding of the idea (Berente et al., 2011; Hsieh et al., 2011). The case of Globex shows that the inclusion of a more heterogenous collection of actors in the idea management process fosters idea generation and refinement through collective sense-making and enhanced value co-creation. Our findings suggest that Globex transformed its idea management process to include a greater variety of actors, thus validating theorizations around less predefined innovation agencies in the digital innovation management literature (Nambisan et al., 2017).

5.3 Overcoming organisational inertia by viewing ideas as problem-solution pairs

Scholars in digital innovation management have suggested that digital innovations should be viewed as "a sporadic, parallel, and heterogeneous generation, forking, merging, termination, and refinement of problem–solution design pairs" (Nambisan et al., 2017, p.227). Globex moved towards this approach when it imposed the systematic decomposition of ideas into problem and solution statement (Dorst & Cross, 2001). An idea was understood as a problem (i.e. latent user needs) and solution (i.e. processes, products or services enabled by or embedded in IT) pair that could be enriched as ideators gain new insights into user needs and technical feasibility (Von Hippel & Von Krogh, 2015; Maher et al., 1996). As the network of interlinked problems and solutions became too complex to manage (Makkonen & Komulainen, 2018), the digital innovation department broke it down into multiple problem-solution pairs that could be tested via prototypes. A single idea could thus yield multiple problem-solution pairs and the pairs could be tested with users and other stakeholders to further guide idea development and selection. This resulted in enhanced collective sense-making and value co-creation among the heterogenous collection of innovation actors, ultimately leading to a better management of the idea's inherent uncertainty. Instead of approaching ideas as a fixed concept that could either be selected or rejected, problems and solutions were expected to be matched and rematched within the scope of a same idea. As a result, innovation was not restricted to the boundaries of the initial problem and solution space but evolved as new problems and solutions were discovered, consolidated into a network, and again broken down into pairs. This approach can be attributed to collective learning processes, but we argue that it is all the more relevant in a digital innovation context because of the remarquable malleability and ambiguity of IT. Figure 2 in Appendix A provides a visual representation and an illustrative example of how Globex managed ideas as problem-solution pairs to better initiate digital innovation.

We argue that viewing ideas as problem-solution pairs helped Globex to overcome economic and political inertia when transforming its practice of idea management. First, economic inertia refers to rigid patterns of resource allocation between exploitation and exploration processes (Besson & Rowe,

2012). Most notably, the patterns of resources allocation within the IT unit at Globex were heavily tilted towards exploitation rather than exploration processes. Viewing ideas as problem-solution pairs helped Globex to circumvent economic inertia associated with IT's rigid patterns of resource allocation. Specifically, the decomposition of ideas into problem and solution pairs enabled ideators to identify and test core assumptions of their idea with mock-ups that required minimal technical expertise from IT. Ideators were thus encouraged to improve their ideas themselves rather than waiting for IT's costly support. By viewing ideas as problem-solution pairs, the IT department could be involved very late in the process (i.e. once the idea's underlying problem and solution were mostly validated) and the innovation department could avoid wasting time and money in untimely technical development.

Second, political inertia refers to rigid patterns of interests and alliances among stakeholders (Besson & Rowe, 2012). At Globex, defining and testing problem-solution pairs was instrumental to engaging business managers in the idea development process and securing their support in the initiation of digital innovation. It allowed to more clearly communicate ideas with digital core components and illustrate their use cases. This made it possible to involve more stakeholders early on in the idea management process, such as prospective users or business managers, and build alliances to push ideas further. It notably enabled the digital innovation department at Globex to better identify business managers who were interested in implementing an idea into a business project. The decomposition of ideas into problem- solution pairs therefore helped Globex to relax political inertia by building alliances early with business managers and prospective users.

Ultimately, our findings suggest that viewing ideas as problem-solution pairs allowed Globex to overcome economic and political inertia and helped transform its idea management processes to better account for the specificities of *digital* innovation, notably by allowing for more fluidity between phases process and more heterogeneity among process actors.

6 Conclusion

In an era where "digital technology forms an innate part of the new idea and/or its development, diffusion, or assimilation" (Nambisan et al., 2017, p.224), surprisingly little is known about the initiation of digital innovation (Kohli & Melville, 2019). Through a longitudinal case study of one firm, we have identified two ways in which idea management is transformed to help seize digital innovation opportunities: **(1) ideas are managed in a more fluid process and (2) ideas are managed by a more heterogenous collection of actors**. Our empirical findings support theorizations around less-bounded innovation processes and less predefined innovation agencies in the digital innovation management literature (Nambisan et al., 2017). In light of these transformations, we argued that firms must abandon their static and deterministic approach to innovative ideas in favour of a more dynamic approach where the continuous validation of co-evolving problem and solution statements drives idea development and selection. Our main contribution is an awareness of how the systematic decomposition of innovative

ideas into verifiable and co-evolving problem and solution statements can help firms deal with the complexity inherent to digital innovation. Our case study suggests that, given such awareness, incumbent firms can somewhat overcome economic and political inertia with regards to the initiation of digital innovation. We expect these insights to be of value to academics in the field of idea management, digital innovation management and organisational transformation, as well as to practitioners eager to seize digital innovation opportunities.

We recognize limitations in our research design. First, a single organization was studied as a revelatory case of how a large and well-established organization manages bottom-up innovative ideas with digital core components. However, the practice of idea management is context dependent and no two organizations are identical. We acknowledge the fact that digital innovation is an ambiguous term that can be understood differently in other organizations, possibly leading to different conclusions. The reader should keep in mind that the generalizability of our findings depends on the internal and external contextual elements of the focal organization (on generalizability of knowledge claims, see Lee & Baskerville, 2003). Second, while we were deeply engaged with Globex during the period 2019–2020 through participant-observation and interviews, our reporting of how ideas were managed before the digital innovation strategy in March 2018 relied solely on possibly biased retrospective interviews. We accounted for this bias by purposefully interviewing people who were already involved in idea management activities before March 2018 and triangulating findings between multiple sources.

Our contributions pave the way for further research on the initiation of digital innovation and organisational transformation. We see fruitful avenues for future research in investigating the validity of our findings in other organizational contexts. For example, research may highlight how idea management is transformed in other organizational structures or industries to help trigger digital innovation, such as in start-ups or in firms with a digital core business. We believe such research can enrich our findings and help elucidate how organisational transformation links to initiating digital innovation. Moreover, while we have alluded to some challenges linked the initiation of digital innovation, we see great potential in further research which more deeply investigates the tensions and inertia that are associated with the transformation of organisational routines to leverage employees' ideas for *digital* innovation.

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Appendix A of Paper 1a. Idea Management at Globex

Figure 2 presents a visual representation of how the idea management process at Globex as of the end of our case study (February 2020). Below, we explain the process with concrete examples from the Globex case.

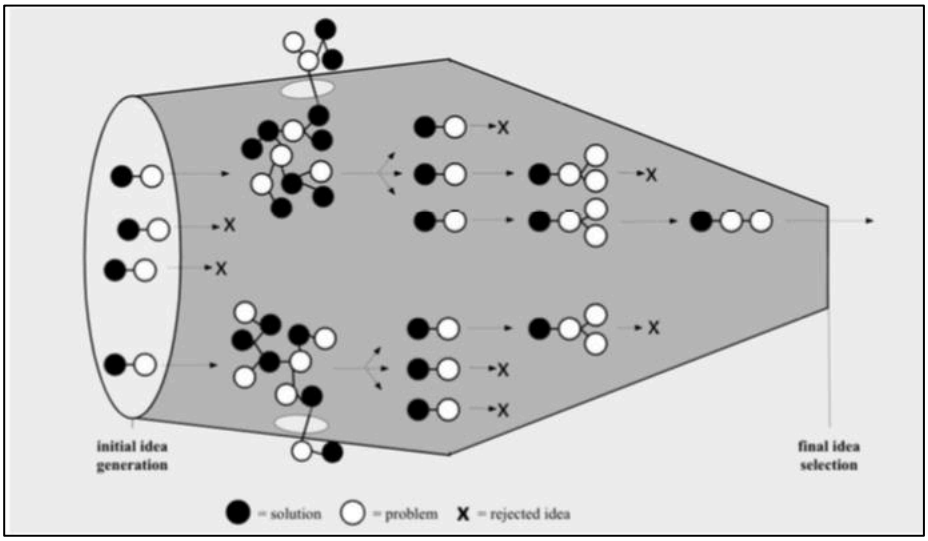

Figure 2. Idea management framework for digital innovation

At Globex, the idea management process was initiated when the idea manager lauched a call for ideas. For example, the idea manager would call for ideas to improve the way employees work in their fragrances and flavors factories. Ideators would respond to this call by generating ideas and submitting ideas to the idea management platform as a problem and a matching solution. An employee might for instance identify the problem that factory workers who have to wear gloves to manipulate ingredients struggle to use electronic keyboards and touchscreens, causing them to put the gloves on and off multiple times a day. The employee might propose as the solution of a voice control system that enables workers to control computers with their voice (i.e. single problem-solution pair on the utter left side of the funnel in Figure 2).

Next, in the idea improvement phase, the ideator and his team would enrich the initial idea with a better understanding of the problem and alternative solutions. With regard to our example, the ideator and his team might discuss with factory workers and their managers in order to understand if a voice control system could provide a desirable and viable solution. They might also speak with people outside of Globex, such as the suppliers for gloves, keyboards, and voice control systems to better understand possible solutions. These discussions might help them come up with alternative solutions, such as a different design for the gloves or keyboard. They might also uncover new problems, such as the sterilisation of keyboards or the comfort of wearing gloves all day (i.e. network of interconnected problem-solution pairs in Figure 2).

The ideator, team, and idea manager would then break down the network of problems and solutions into problem-solution pairs and select the most interesting pairs for further development. For example, they could agree on developing the voice control system and search for adapted technologies (i.e. multiple problem- solution pairs at the widest point of the funnel in Figure 2). They might also want to consider the alternative of specially designed touchscreens. As they gain more insights into related problems and solutions, the number of ideas that need to be managed actually increases at this stage (i.e. the funnel gets wider).

The ideator and team would then prototype and test multiple solutions for the problem of voice control and keyboard for factory workers by trying out different technologies (i.e. multiple problem-solution pairs with multiple sub-solutions in Figure 2). Constraints liked to the technical feasibility, desirability and viability of the solution may be discovered via prototyping and feedback the feedback from users and managers, and problem-solution pairs that are not worth pursing may accordingly be discarded (i.e. the funnel gets narrower). Finally, the ideator and team would decide on the most promising problem-solution pair for final idea selection (i.e. single problem-solution pair with single sub-solution on the utter right side of the funnel in Figure 2).

Appendix B of Paper 1a. Data Collection

We started interacting with Globex in March 2019 and data collection lasted until beginning of February 2020. During this period, we performed six months of participant-observation and conducted 17 semi-structured interviews (approx. 18 hours) with five key members of the digital innovation department and five participants in idea campaigns (see Appendix C for interview list). The interviews followed a simple and flexible guideline centred on the idea management process and idea management system at Globex. We gradually adapted the guideline as we got familiar with the case (see Appendix D for interview guideline). We systematically transcribed all interviews (108 pages) and synthesised the notes of our participant-observation phase in a written report (10 pages). We also gathered a significant amount of secondary data (110 pages) in the form of internal documents produced by the digital innovation department (e.g. formalized idea management process, formalized digital prototyping process) and participants of idea campaigns (i.e. idea pitches, prototypes). Data collection ended upon theoretical saturation.

Data source	Topics covered	Interviewees	Quantity
Participant observation *(March 2019 – August 2019)*	• Idea campaigns/challenges (x5) • Innovation workshops (2x) • Innovation lab (1x)	N/A	10 pages of report
Interviews *(May 2019 – February 2020)*	• Innovation strategy & process • Idea management strategy & process • Idea campaigns & system • Innovation projects status & progress • Prototyping process for digitalisation	○ Digital Innovation Director (4x) ○ Digital Innovation Senior Lead (1x) ○ Digital Innovation Lead Europe (3x) ○ Digital Innovation Lead America (2x) ○ Innovation Specialist (2x) ○ HR Manager (1x) ○ Manufacturing Global Director (1x) ○ Global Creative Director (1x) ○ Fragrance Development Director (1x) ○ Field Support Technician (1x)	Total: 17 interviews (10 respondents, 18 h recording, 108 p transcript)
Data management system	• Community mgmt. (campaign promotion, feedback, rewards) • Idea tracking (pipeline) • Idea patterns (word cloud) • Integration with corporate intranet	N/A	3 pages of notes
Internal documentation	• Digital innovation services (2p) • Idea campaign status slide deck (20p) • Idea campaign program slide deck (18p) • Prototype definition slide deck (4p) • Pitch slide decks (10p) • Prototype slide decks and VR (2p) • Pitch sessions recap and follow-up (40p) • Digital prototyping process (11p) • Assumption/testing cards (1p)	N/A	110 pages of docs

Table 1. Overview of data sources

Appendix C of Paper 1a. Interview list

N°	Role	Unit	Date	Location	Duration	Thematic	Secondary data
I-1	Digital Innovation Director (Director)	IS	10.05.19	On site (old headquarters)	2h	Contextual background: Globex, innovation at Globex, milestones of digital innovation department	Leaflet digital innovation department services; Book on innovation management framework;
I-2	Digital Innovation Director (Director)	IS	31.05.19	On site (old headquarters)	1h45	Digital innovation department activities, governance, idea management process and success factors	Slide decks: idea campaign status, idea campaign program, pitch sessions recap and follow-up, prototype definition
I-3	Digital Innovation Lead Europe (Lead 1)	IS	13.06.19	On site Skype (old headquarters)	1h	Idea management campaigns and system	Intranet; Idea mgmt. system
I-4	HR Manager	HR	26.06.19	On site (new headquarters)	1h	Digital innovation project in HR	
I-5	Innovation Specialist (Specialist)	IS	2.07.19	On site (new headquarters)	2h	Innovation workshops, innovation methodologies	Book on ideation; Book on innovation in incumbent firms
I-6	Digital Innovation Lead America (Lead 2)	IS	9.07.19	On site (new headquarters)	1h30	Prototyping, innovation methodologies	
I-7	Manufacturing Global Perfumery Director	OP	10.07.19	On site (new headquarters)	30min	Participation at idea campaign (sustainability)	
I-8	Global Creative Director	PE	11.07.19	On site Skype (old headquarters)	1h	Participation at idea campaign (perfumery)	Slide deck pitch; Slide deck prototype
I-9	Fragrance Development Director	PE	15.07.19	On site Skype (old headquarters)	45min	Participation at idea campaign (perfumery)	Slide deck pitch
I-10	Field Support Technician	IS	16.07.19	On site Skype (old headquarters)	45min	Participation at idea campaign (IS)	
I-11	Digital Innovation Senior Lead (Senior lead)	IS	23.07.19	On site (new headquarters)	30min	Innovation coaching, innovation methodologies	
I-12	Digital Innovation Director (Director)	IS	30.08.19	On site (new headquarters)	45min	Idea development, UX/UI design	
I-13	Digital Innovation Lead America (Lead 2)	IS	10.10.19	On site (new headquarters)	30min	Prototype selection, idea canvas, hypothesis cards	Assumption/testing cards
I-14	Digital Innovation Lead Europe (Lead 1)	IS	7.11.19	Skype	50min	Prototyping process for digitalization	Slide deck digital prototyping
I-15	Innovation Specialist (Specialist)	IS	22.11.19	On site (new headquarters)	1h30	Idea management transformations (process and actors), problem-solution pairs	
I-16	Digital Innovation Director (Director)	IS	17.01.20	On site (new headquarters)	1h	Idea management transformations (process and actors), problem-solution pairs	Book on idea development and prototyping methods
I-17	Digital Innovation Lead Europe (Lead 1)	IS	3.02.20	Skype	45min	Idea management transformations (process and actors), problem-solution pairs	

Table 2. Interview list

Appendix D of Paper 1a. Interview Guideline

Globex interview guideline	
Themes	Topics
1. Personal information	a. Interviewee name and role b. Professional background c. Years of employment at Globex
2. Idea campaign/challenges	a. Idea generation phase b. Idea development phase (prototyping) c. Idea evaluation phase d. Implementation e. Key success factors f. Idea evaluators & evaluation criteria g. Recognition and rewards
3. Idea management system	a. Communication of campaign b. Idea submission c. Idea commenting d. Idea tracking e. Idea selection and feedback
4. Digital innovation	a. Digital innovation department b. Opportunity identification c. Digital innovation outcome d. Digital innovation process e. Digital innovation actors (internal/external)
5. Organizational culture	a. Digital transformation strategy b. Innovation strategy c. Innovation governance d. Organizational structure e. Organizational capabilities f. Openness to external partners g. Competitive environment

Table 3. Initial interview guide

Appendix E of Paper 1a. Coding scheme

Themes	Codes	Sub-codes
Idea management (Gerlach & Brem, 2017)	Idea	
	Idea manager (role)	
	Idea management system	
	Employee (internal) participation	
	Open (external) participation	
	Success factors	
	Success metrics (KPIs)	
	Organizational culture	
	Organizational environment	
Idea generation (Gerlach & Brem, 2017)	Idea generation phase	
	Ideator (role)	
	Idea challenge/campaign	
	Idea submission form	
	Idea crowdsourcing	
	Idea classification/cluster	
	Idea pre-selection	
Idea improvement (Gerlach & Brem, 2017)	Idea improvement phase	
	Discussion group (role)	
	Workshops	
	Experimentation	
	Digital prototyping	
Idea evaluation (Gerlach & Brem, 2017)	Idea evaluation phase	
	Idea selector (role)	
	Idea selection criteria	
	Rewards/recognition	
	Evaluation feedback	
Digital innovation (Kohli & Melville, 2019)	Opportunities identification/initiation	
	Outcome embedded in IT	
	Outcome enabled by IT	
	Process supported by IT	
Digital innovation management (Nambisan et al., 2017)	Fluid innovation process	Overlapping process phases
		Iterative process phases
	Dynamic innovation actors	Heterogenous actors
		Dynamic actors
Organisational transformation (Besson and Rowe, 2012)	Negative psychology inertia	
	Socio-cognitive inertia	
	Socio-technical inertia	
	Economic inertia	
	Political inertia	

Table 4. Deductive coding scheme

Themes	Codes	Sub-codes
Dynamic approach to ideas (i.e. problem-solution pairs; Dorst & Cross, 2001; Von Hippel & Von Krogh, 2015)	Idea decomposition	Problem/need
		Solution/artefact
		Problem-solution pair
		Assumption/statement
		Collective sense-making
		Uncertainty management
	Idea enrichment	Problem-solution matching
		Problem-solution network
		Assumption validation
		Prototype testing
		Co-creation
		Heterogenous actors
	Idea evolution	Problem-solution co-evolution
		Prototype iteration
		Problem space
		Solution space
		Fluid process

Table 5. Inductive codes from case data

APPENDIX C – RESEARCH PAPER 1B

Idea Management in a Digital World: An Adapted Framework

Research Paper accepted to HICSS 2021

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Abstract

The continuing emergence of new digital technologies, platforms and infrastructure has opened unprecedented possibilities for innovation. Eager to seize these opportunities, many organizations adopt idea management programs to help leverage their employees' ideas for digital innovations. However, we lack an integrated understanding of how the logics of digital innovation affect the practice of idea management. We therefore pose the following research question: "How can idea management programs be conceptualized in light of digital innovation?". Drawing on the disparate yet complementary conceptual building blocks of open innovation and problem-solution pairs, we develop a revised conceptualization of how idea management is practiced in a digital context. Our framework suggests that idea management programs can be used by organizations as orchestration and cognitive sensemaking devices to support the matching, forking, merging and refinement of ideas. These insights shed fresh light on how innovations form and evolve in a pervasively digital world.

1 Introduction

Despite an increasing pressure to apply digital technologies to transform their offerings, many organizations struggle to leverage their employees' full potential in digital innovation efforts [1]. Against this backdrop, organizations are increasingly turning to idea management programs to successfully help source, select and develop their employees' ideas [2]. As a result, the focus of idea management programs has broadened from collecting ideas for local improvements to instigating digital innovation with ordinary employees, causing digital technologies to become increasingly entangled with the practice of idea management [2].

Scholars have repeatedly highlighted that the pervasive use of digital technology in innovation processes and outcomes changes the nature of innovation in such ways that it needs to be studied as a phenomenon that is fundamentally different from traditional innovation [3, 4]. It has for instance been

noted that digital innovation is more generative and convergent in nature, calling into question some of the core assumptions that underlie the traditional innovation management literature [3]. Idea management is a critical sub-process of innovation management that is critically affected by these evolutions [5]. Indeed, the literature is sprinkled with instances of idea management processes and actors being impacted by the pervasive use of digital technology. Yet, state-of-the-art conceptualizations still assume a traditional approach to idea management (i.e. delimited phases and predefined actors [2]) which yields a poor fit with the changing nature of innovation [6], thus warranting a revision. In view of the pressing need for organizations to successfully turn their employees' ideas into digital innovations, we explore the research question:

How can idea management programs be conceptualized in light of digital innovation?

We address our research question in two steps. First, we leverage the conceptual building blocks of open innovation and problem-solution pairs to deductively develop an initial framework of idea management in light of digital innovation. Second, we validate our initial framework against a revelatory case of how idea management programs are used to create digital innovations with employees, and we inductively refine our initial framework by accounting for discrepancies between the framework and the case data. This deductive-inductive approach allows for "contradictory observations to change what we know" [7, p.3] and is therefore a good methodological fit to extend our understanding of idea management in light of digital innovation.

Our main contribution to research and practice is a conceptual framework that integrates disparate yet complementary conceptual lenses (open innovation [8] and problem-solution pairs [9]) and provides a revised understanding of how idea management is practiced in a digital context. Our framework presents three phases of idea development (i.e. matching, forking and merging, refinement) that can serve as a valuable blueprint for practitioners who implement new or adapt existing idea management programs. We start to address calls for understanding how innovations form and evolve in a pervasively digital world [3] by suggesting that idea management programs can act as sensemaking and orchestrating devices when creating digital innovations. This fresh perspective on idea management presents an exciting starting point to guide management practices in the age of digital innovation with revised theoretical models.

This paper is structured as follows: in Section 2, we provide an overview of the idea management literature and propose two conceptual lenses (i.e. open innovation and problem-solution pairs) that help extend our understanding of idea management with regard to digital innovation. Drawing on these conceptual lenses, we present in Section 3 our initial framework of idea management in light of digital innovation. In Section 4, we describe our study design and introduce the case upon which we test and refine our initial framework. In Section 5, we present our findings and propose a refined version of our initial framework. We discuss our findings in Section 6 and conclude in Section 7.

2 Background

Idea management is not historically new and has attracted both practitioners' and researchers' interest for some decades now [10]. Since its inception in the manufacturing industry in the 18th century [11], idea management has crystalized as "one of the most persistent management concepts ever" [12, p.238] by continuously adapting to changes in its economic, social, and technological environment. Idea management programs are a combination of process phases, actors and technological tools that organizations adopt to stimulate the generation of ideas and support their development into valuable outcomes [5]. Owing to shifts in the competitive landscape, the scope of idea management programs has gradually broadened from surfacing ideas for local improvements (e.g. via idea boxes) to empowering corporate employees in their innovation efforts (e.g. via innovation contests). A growing number of organizations leverage idea management programs to empower their employees to create digital innovations specifically [1]. As a result, the use of digital technologies is pervading idea management both in its process and its outcomes. Scholars have repeatedly highlighted that the use of digital technologies in innovation processes and sub-processes challenges our understanding of how innovations form and evolve [3]. The conceptualization of idea management as one such sub-process is most certainly affected by these considerations (Brem & Voigt, 2007) but we as yet have a fragmented understanding of how the new logics of digital innovation alter the management of ideas.

We identify two key trends in how the changing nature of innovation affects the practice of idea management within organizations. First, the malleable nature of digital artefacts and the use of digital prototyping techniques (e.g. 3D printing) make it possible to develop ideas in a more emergent manner with overlapping idea improvement, evaluation and selection phases [13]. Second, the use of digital platforms (e.g. crowdsourcing platforms) allows to involve a more emergent constellation of intra- and extra-organizational actors, (e.g. employees or customers) in the generation, development, and selection of innovative ideas [6, 14]. These two evolutions have been reported somehow disjointedly in the information systems and innovation management literature, yet overall they confirm a general trend towards a more fluid idea development process (i.e. temporal overlaps between phases) involving more dynamic actors (i.e. emergent participation), both triggered by the transition from innovation to digital innovation [3, 4].

Notwithstanding these evolutions, current conceptualizations of idea management still assume a stage-gate process with delimited phases and predefined actors, and thus largely overlook how idea management is impacted by the changing nature of innovation. This is reflected in a recent consolidation of the literature by Gerlach and Brem [2] that depicts idea management as a process with six clearly defined consecutive phases (i.e. preparation, idea generation, improvement, evaluation, implementation, and deployment) each involving a predefined set of actors (i.e. idea manager, ideator, discussion group, and idea selector). While this conceptualization offers valuable insights into the

practice of idea management, it yields a poor fit with the emergent nature of digital innovation processes and actors and provides little guidance in the current context of pervasive digitalization. We thus scan the IS and management literature for additional concepts that reflect the new logics of digital innovation, with a particular focus on concepts that have been used to capture the shift towards fluid processes and dynamic actors when creating digital innovations. We identify open innovation and problem-solution pairs as useful conceptual lenses and justify this choice in the following two sub-sections.

2.1 Open innovation

Open innovation describes "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries" [15, p.17]. The term "open innovation" was first coined to illustrate how the boundaries within which innovation traditionally takes place in organizations are eroding and lead to more distributed models of innovation [8]. The phenomenon has gained considerable attention among scholars and many have highlighted how open knowledge exchange between a firm and its environment, as well as within a firm, can accelerate innovation [16]. Open innovation has notably been linked to users as innovators [17], innovation communities [18] and open source software development [19]. Common to these various innovation-related phenomena is the finding that ideas are a key vehicle for knowledge exchange between various innovation contributors, suggesting that open innovation is a useful conceptual building block to examine the management of ideas. Additionally, open innovation has been highlighted as a powerful lens to investigate employees' role in a more distributed innovation process [3], suggesting its value for the study of idea management in a digital context.

The most common conceptualization of open innovation is a permeable funnel where innovative ideas enter on the wide side and innovative outcomes exit on the narrow side [8]. Knowledge can be sourced into or extracted from the funnel at any point, thus accounting for the "openness" of the innovation process (visually depicted by multiple perforations in the funnel's wall). These knowledge exchanges imply that a greater diversity of an organization's internal and external actors can dynamically join in and retract from the innovation process. Furthermore, the open funnel departs from traditional stage-gate models by acknowledging that dynamic knowledge exchanges cause innovations to evolve in a non-linear manner. To depict these new levels of fluidity, formal stage-gates are substituted for loosely defined phases along the funnel [16].

The open innovation lens has recently been leveraged to highlight the emergent nature of actors developing digital innovations. Some examples are [14] and [20] who draw on open innovation in their exploration of crowdsourcing initiatives and open source digital innovation. While the open innovation lens has proven valuable in exploring the digital innovation process as a whole, it has not yet been leveraged to revise our conceptualization of the critical early phases of digital innovation initiation and the practice of idea management.

2.2 Problem-solution pairs

Problem-solution pairs have their roots in design research where they originally highlight the co-evolution of problem and solution spaces in creative design [21, 22]. The concept has been picked up and further developed in the decision-making literature as "need-solution pairs" [9] and as "problem-solution pairs" in the digital innovation management literature [3]. Problem-solution pairs primarily account for the fact that innovation actors view the initial problem statement as a variable rather than a fixed objective. Consequently, innovations are a constant search not only for the most relevant solution to a given problem but also for the most relevant problem to be solved. This search process can be conducted by individuals within or outside an organization's boundaries [9].

Problem-solution pairs are most commonly conceptualized as dynamic couplings of a problem and a solution that evolve by establishing new and discarding obsolete links with other problems and solutions [23]. Problems refer to latent needs, while solutions refer to artifacts, their features, and functionalities. An innovative idea can be conceptualized as a set, or network, of interlinked problems and solutions. Moreover, it suggests that trial-and-error cycles (e.g. via rapid prototyping methods) are a powerful way to identify the most relevant problem-solution pairs and thus the most promising ideas [9].

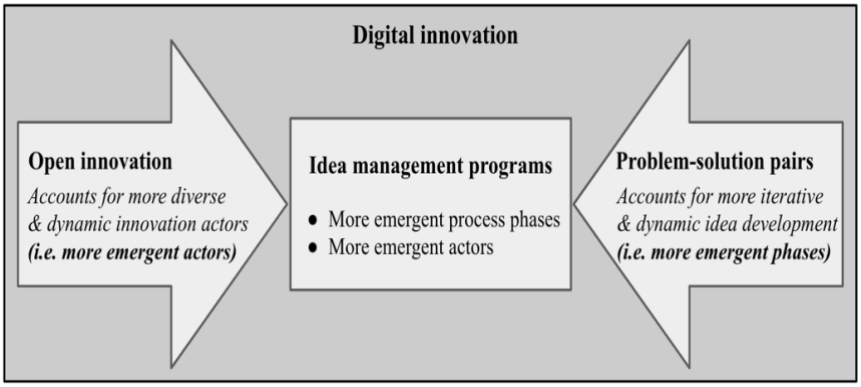

Figure 1. Research approach

The conceptual lens of problem-solution pairs has recently been applied to digital innovation research [23] to capture the dynamic relationship and mutual influence between user needs (i.e. problems) and digitalized artifacts (i.e. solutions) when creating digital innovations. It has notably been noted that digital innovation management and its sub-processes should be studied as "a sporadic, parallel, and heterogeneous generation, forking, merging, termination, and refinement of problem–solution design pairs" [3, p.226], where the concept of problem-solutions pairs helps capturing the dynamic evolution of ideas' underlying components. Digital innovation processes being more emergent in nature, we suggest that problem-solution pairs are a promising conceptual building block for the study of idea management in a digital context.

Considering the above-mentioned merits and shortcomings of the extant literature, we view open innovation and problem-solution pairs as valuable conceptual building blocks to capture the emergent nature of idea management process phases and actors in a digital innovation context (Figure 1).

3 Initial framework

We rely on the existing literature to develop our initial framework of how idea management is practiced in a digital context. Specifically, we leverage the disparate but complementary conceptual building blocks of idea management, open innovation, and problem-solution pairs to account for the trend towards more emergent idea management processes and actors in light of digital innovation.

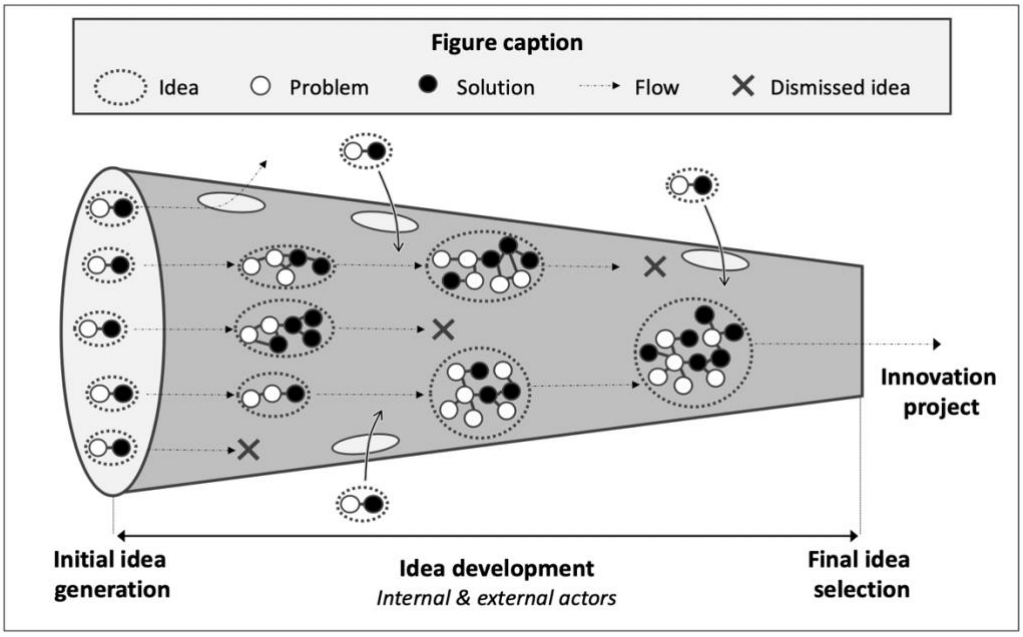

Figure 2. Initial framework

In Figure 2, we draw on the three above-mentioned building blocks in the following ways:

- **Idea management**: An idea management program is represented as a funnel where ideas are generated (i.e. wide end; large number of ideas), developed (i.e. inside the funnel; decreasing number of ideas) and selected for implementation as innovation projects (i.e. narrow end; small number of ideas) by actors taking the roles of ideators, idea managers and idea selectors.
- **Problem-solution pairs**: Ideas (i.e. dotted circles) are represented as matching pairs of problems (i.e. white circles) and solutions (i.e. black circles) that dynamically evolve into networks as new problems and solutions are sporadically discovered or discarded over time.

- **Open innovation**: Perforations in the wall of the funnel are meant to represent that ideas can be sourced from, and outsourced to, actors external to the program (e.g. startups, customers, corporate employees not directly involved in the program) at any time during idea development.

Next, we study an empirical case to guide the refinement of our initial framework. In our case study, we put a strong analytical focus on two aspects of our initial framework: (1) the emergent nature of actor participation (i.e. the punctual involvement of an emerging collection of idea contributors in the idea management process) and (2) the dynamic nature of the idea management process (i.e. the management of ideas as the management of problem-solution pairs that continuously and dynamically evolve into problem-solution networks).

4 Research methodology

Idea management is a complex phenomenon that requires the investigation of a rich data set [24]. We performed an in-depth longitudinal case study of a traditional organization (i.e. Globex; name changed) that had deployed an idea management program to enable and support its employees when creating digital innovations. Considering the large body of literature on how ideas are generated and developed in organizations, we took a deductive-inductive approach [7, 25, 26] that consisted of two steps:

In a first deductive step, we derived an initial framework of idea management from the existing literature by combining the conceptual building blocks of open innovation and problem-solution pairs (i.e. deductive analysis step). In a second inductive step, we looked for contradictions between our initial framework and the Globex case data, and updated our initial framework with missing factors, links, or effect (i.e. inductive analysis step). Our coding scheme thus included both deductive codes aimed at validating the initial framework and inductive codes aimed at refining the initial framework.

The outcome of these two steps is a revised conceptual framework of idea management in the context of digital innovation. This framework integrates existing knowledge about idea management that has been confirmed by our case, while also accounting for new insights that could not be explained by the existing literature.

4.1 Case selection

We selected the case of an incumbent firm in the fragrance industry with approximately 7'000 employees, i.e. Globex (name changed). At the time of the study, Globex had deployed an idea management program to enable and support its employees when they create digital innovations. Importantly, we view our case as a "common" case rather than an "ideal" case of how idea management is performed to spur the creation of digital innovations with employees. Our case selection is thus in line with our research aim, i.e. that of performing an explorative study on an emerging real-world

phenomenon (i.e. idea management for digital innovations) and to capture our insights in an initial descriptive framework.

We gained access to the case through an associate researcher who was employed for a period of six months to support Globex's innovation activities with an assigned a role in the idea management program. Given that an intra-organizational level of analysis (e.g. programs, business units, functional departments) was considered particularly salient in understanding the sources of innovation [27], we chose to focus on Globex's idea management program (in terms of process, actors and technology) as our primary research object.

Globex operates as a leading multinational company in the perfumery market. In recent years, the firm sensed that rapidly changing customer preferences and unprecedented technical possibilities were shaking up the industry of perfume creation and distribution. In particular, heavily digitizing competitors were putting the firm under growing market pressure. In an effort to maintain its dominant position, Globex's executive board decided to sharpen its strategic focus on digital innovation. In 2017, the company set up a digital innovation department directly overseen by the executive board with the primary mission to accelerate the development of ideas into digital innovations. The department was based in the information systems department but acted as a transversal support unit for all organizational departments. As of March 2020, the digital innovation department comprised seven full-time employees.

Upon its creation, the digital innovation department launched an idea management program to encourage corporate employees to create digital innovations (i.e. innovative products, services and processes with digital core components). Previously, Globex was lacking a systematic way to manage employees' ideas, leaving idea management entirely to individual line managers. The department adopted an idea management system to collect, store and track ideas. All employees were given access to the idea management system to view idea campaigns, submit ideas, view status updates and provide feedback on ideas. Overall, ideas were sourced from two channels: internal idea campaigns and workshops. Over the time of our study, the department facilitated three idea campaigns and two dozen innovation workshops, and was managing several hundred ideas for digital innovation throughout the course of this study.

4.2 Data collection

Table 1 provides an overview of our data sources. We started interacting with our case in March 2019. Within one year, we conducted 22 semi-structured interviews with 6 key members of the digital innovation department and 5 stakeholders in idea campaigns (interview details available upon request). All interviews followed a flexible guideline around the practice of idea management and the use of digital technologies in its process and outcome. Additionally, we gathered a significant amount of secondary data from the digital innovation department in the form of internal documents (e.g.

formalizations of the idea management process, lessons-learned, idea campaign project pitches) and field notes. To gain a richer understanding of this data, we attended one full day innovation workshop facilitated by the digital innovation department and took notes during several informal discussions with members of the innovation department before/after formal interviews and observations. We were also granted access to the idea management system that was used to track idea campaigns. This gave us an in-depth view of the types of ideas that had been submitted, who had submitted them and how they were being developed. Moreover, we drew on written reports from, and regular oral debriefings with, the above-mentioned associate researcher who performed six months of participant-observation (February to July 2019) in Globex's digital innovation department.

Source	Type	Total	# pages
Interviews	On site face-to-face	15	135 (23h)
	Remote video calls	7	
Internal documents	C-level briefings	3	110
	Lessons learned	2	
	Idea pitches	2	
Observation	Full day workshop	1	5 (8h)
Field notes	Unstructured notes	4	15
Idea mgmt system	Idea database	1	-
	Participant database	1	-
Participant-observation	Written report	1	10
	Oral debriefings	10	3

Table 1. Data sources

4.3 Data analysis

Following our deductive-inductive research approach [7], we operationalized our initial constructs and derived a coding list of six thematic codes specific to idea management [2] (i.e. idea, phase, actor, funnel, outcome, organizational environment), three thematic codes specific to digital innovation management [3, 4] (i.e. digital technology, temporal fluidity, dynamic participation) and six thematic codes specific to our conceptual building blocks [8, 9] (i.e. problem, solution, problem-solution pair, problem-solution network, ingoing ideas, outgoing ideas). Each thematic code was further derived into multiple sub-codes to guide our analytic focus. Drawing on deductive analysis, we first coded our data top-down according to this coding list [28] and verified for fits and misfits between our initial framework and the data. As a second step, we re-examined the data with a bottom-up inductive coding approach to uncover potential discrepancies between our initial framework and the data. This yielded six additional inductive codes (i.e. idea matching, idea forking, idea merging, idea refinement, single problem/solution, kite-shaped funnel). Finally, we refined our initial framework with the newly emerged factors, links, and effects.

5 Findings and refined framework

In order to make the link between our framework and the case analysis more evident for the reader, we first present our refined framework and highlight how it differs from our initial framework before we turn to the empirical insights that guided its refinement.

5.1 Refined framework

Our refined framework (Figure 3) differs from our initial framework (Figure 2) by acknowledging for: (1) the sourcing of ideas as single problems, single solutions or problem-solution pairs (*initial idea generation*), (2) the sporadic matching, un-matching and re-matching of problems and solutions into pairs and networks in the early stages of the idea management funnel (*matching phase; internal & external actors*), (3) the forking and merging of ideas when problem-solution networks become too complex to manage (*forking and merging phase; internal actors*), (4) the linear refinement of fixed problem-solution pairs in the late stages of the funnel (*refinement phase; internal & external actors*), and (5) the increasing and decreasing number of ideas in the funnel (*kite-shaped funnel*).

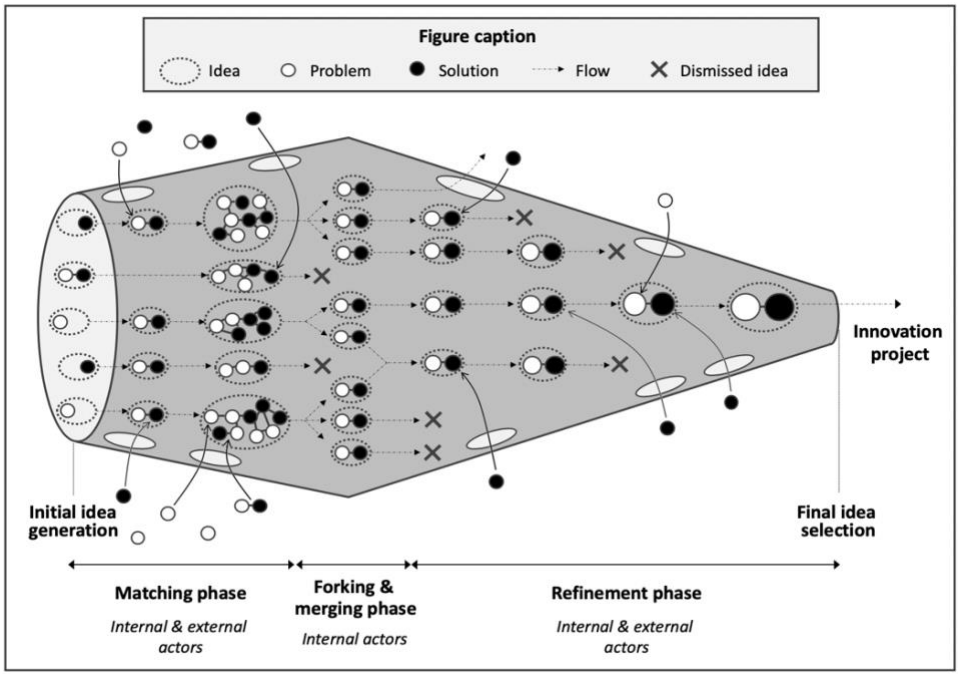

Figure 3. Refined framework

We structured the following sub-sections into key confirming, contradicting, and extending case data that guided the development of our initial framework into our refined framework. We exemplify the key data with direct quotes from our interviewees for a richer narrative of our focal phenomena.

5.2 Key confirming data

We found confirming evidence for the emergent nature of actor participation in idea management programs. Specifically, we observed that the digital innovation department encouraged ideators to collect feedback from colleagues and to have conversations with existing or potential customers, suppliers and partners, to examine the ins and outs of their idea. When asked about the development process of her idea, an employee and idea campaign participant recalled: "*We got out of the office, we went to visit patients, to see doctors and therapists' offices. You learn that there are so many opportunities. We did prototypes to get some ideas in front of these people and get their feedback"* (Creative perfumery director, July 11. 2019).

This loosely connected collection of internal and external actors punctually took on the roles of idea generators, idea contributors and/or idea selectors. Rather than being formally defined in advance, the attribution of roles occurred implicitly and often unpredictably depending on the type of knowledge that each individual could provide. Our findings thus reflect the trend towards an open idea management crowd and confirm the presence of perforations in the idea management funnel.

Moreover, we found confirming evidence for the dynamic nature of the idea management process. Specifically, we observed that ideas were not managed as static self-contained concepts but rather as dynamically evolving couplings of problems and solutions. The idea management program served as a venue to dig deeper into an idea's underlying problem (i.e. latent need) and solution (i.e. digital artifact). We found a strong reliance on prototyping and design thinking techniques to unearth and make sense of ideas' underlying components. A member of the digital innovation department gave an example of how they made an idea evolve by gradually identifying its problem and solution components: *"Since the beginning we were talking to the main stakeholders to understand the idea's scope. We needed to find out the customers' needs and our IS unit's needs. We juggled these two different needs and wondered how we can bring in the technology without making the solution too complex. It's still ongoing, we still need to figure it out. We just went to test our first assumptions"* (Innovation lead America, July 9. 2019).

This continuous enrichment of ideas caused overlaps between traditionally well-bounded and sequential idea management process phases. For instance, a member of the digital innovation department highlighted the temporal overlap between the idea improvement, idea evaluation and idea implementation phase: *"For idea management, digital technologies somehow enable you to keep on refining the need and the solution, while at the same time convincing people in the firm to invest resources"* (Innovation specialist, Nov. 22. 2019).

Overall, our findings thus confirm that ideas for digital innovations can be conceptualized as temporary couplings of problems and solutions that evolve via the punctual involvement of an emerging collection of idea contributors in a loosely bounded process

5.3 Key contradicting data

While our case data confirmed the evolution of ideas' underlying problem-solution components, it contradicted the continuously dynamic nature of this evolution. In our initial framework, we had depicted the development of an idea as the ongoing evolution of a problem-solution pair into a problem-solution network, via the sporadic matching of newly discovered problems and solutions. This implied that ideas are continually reassessed, and that alternative problems and solutions are considered, if not actively looked for, all along the idea development process. However, our case data suggests that ideas do not evolve dynamically throughout the entire idea development process. While we found strong evidence for dynamic problem-solution matching in the early stages of an idea's development, ideas followed a surprisingly linear refinement process as fixed problem-solution pairs in later development stages. A member of the digital innovation department suggested that this duality derived from the way the firm traditionally managed business projects: *"Once you present a promising solution, you've got to deliver something. It's not an option to keep on looking for alternative solutions. You have to show results. On the one hand you have the iterative innovation process, but you also have the decision-making process where everything is oriented towards quickly getting out of this initial phase of uncertainty"* (Innovation specialist, Nov. 22. 2019).

While the idea management program encouraged idea experimentation in the early phases of idea development when time and money investments were low, it pushed for results in the later phases when investments were typically higher. The same interviewee alluded to this shift from a logic of dynamic problem-solution matching to a logic of linear problem-solution refinement in saying: *"At some point, I need to specify my idea: What technology am I going to use? What process changes does it imply? Imagine I've got three options. I test each one of them. I find new connections with other problems and solutions, and this gives me new ideas. At some point, this process needs to stop because we simply don't have the money to develop all possible ideas"* (Innovation specialist, Nov. 22. 2020).

At Globex, the moment when ideators needed to move on from a dynamic matching logic to a linear refinement logic was tightly linked with the creation of minimal viable products (MVPs). Importantly, these prototypes included functional digital components and required the intervention of professional programmers. In a context where IT resources are scarce and expensive, the integration of functional digital components motivated the shift from an exploration to an exploitation logic. In the words of the digital innovation department's director: *"We used to rush into doing MVPs. Now, we spend quite some time in the preceding stages. We spent about 3 months doing workshops, trying to understand and merge ideas. Right now, we're doing mock-ups for these 14 ideas to show them to users. There's no working functionality behind. […] Once we're clear with that, we'll start doing MVPs. Because that's when we start investing money, mostly in developers. And these guys get paid 200'000 a year. Before that, we only invest time"* (Digital innovation director, Jan. 17. 2020).

After the development of an MVP, we found that ideas were managed as fixed problem-solution pairs that were gradually enriched with insights stemming from tests with target users and discussions with business managers. Newly discovered problems or solutions that were relevant but radically different were no longer considered. In this phase, each problem-solution pair linearly grew into a refined version of the same problem-solution pair.

Overall, these findings contradict the ongoing evolution of problem-solution pairs into networks and suggest a more static approach to ideas once a certain threshold of development has been reached. Based on these insights, we enrich our initial framework by noting that ideas evolve into networks of problems and solutions in early stages of dynamic problem-solution matching (*matching phase*) and grow into tangible outcomes in subsequent stages of linear idea refinement (*refinement phase*).

5.4 Key extending data

Beyond confirming and contradicting data, we discovered data that extended our initial framework with fresh insights into the underlying constituents of an idea and the appropriate shape of the idea management funnel. First, we observed that ideas that were sourced into the program weren't necessarily composed of a problem-solution pair but often consisted of a single solution or, conversely, a single problem. The digital innovation department's director explained how these orphan problems and solutions were managed in the program: *"Often people come up with a solution and they don't necessarily know what problem it solves. That's why we need to take a step back and find out the problem each solution tries to address. We recently succeeded in that by systematically asking: 'What is your challenge?'"* (Digital innovation director, Jan. 17. 2020).

We thus enrich our initial framework by noting that ideas sourced into the funnel can be composed either of a single problem, a single solution, or a problem-solution pair. Single problems and solutions are matched with other problems and solutions into problem-solution pairs, and further developed into problem-solution networks as ideas are discussed and tested with internal and external stakeholders.

Second, our case showed that problem-solution networks contain large amounts of valuable information and harbour many innovation opportunities. The abundance of information that is encapsulated in idea networks added substantial complexity to their management. Actors internal to the idea management program (i.e. ideators and members of the digital innovation department) dealt with this complexity in two ways: they decomposed large problem-solution networks into multiple problem-solution pairs (forking) and united similar problem-solution pairs into one (merging). A member of the digital innovation department explained the forking of ideas in the following way: *"An innovation process really is a learning process. You've got an idea and you draw links with other problems that you hadn't seen before, and that's giving you new ideas. You create all these connections. But then you can't manage this complexity, so you break down the idea into smaller parts. You start with one idea and end up with several"* (Innovation specialist, Nov. 22. 2019).

The forking of problem-solution networks meant breaking idea networks down into problem-solution pairs that could more easily be apprehended and more readily discussed with internal and external stakeholders. At this point, some promising pairs were sourced out of the program and taken over by business units for further development. Other pairs had strong similarities in their underlying problem and/or solution components, triggering their merging into a single idea. The director of the digital innovation department explained: *"We happened to have two ideas dealing with the same problem. We often merged them. Because we realized that a lot of ideas are actually tackling the same pain point"* (Digital innovation director, Jan. 17. 2020)

We thus enrich our initial framework by noting that the early phase of dynamic problem-solution matching and late phase of linear problem-solution refinement are linked by an intermediary phase of forking and merging where problem-solution networks are decomposed and/or merged into promising problem-solution pairs. During this intermediary phase the number of ideas increases but decreases again in the subsequent phase, therefore suggesting a kite-shaped funnel. We discuss the overall implications of our refined framework in the next section.

6 Discussion and outlook

Our primary aim with this paper was to expand our understanding of idea management in a digital context. We worked towards this goal on several levels. First, we acknowledged the merits and pointed out some shortcomings of the extant literature on idea management with regard to the creation of digital innovations. Second, we proposed two conceptual lenses to help capture the emergent nature of digital innovation processes and actors and leveraged them to build our initial framework of idea management in light of digital innovation. Third, we presented a case of an organization that uses idea management programs to create digital innovations with employees. Guided by the empirical insights we gained from this case, we refined our initial framework. We view the resulting refined framework as our key contribution and as a valuable steppingstone for further research into how digital innovations form and evolve.

Our findings have two main implications for future research. First, our revised framework reveals that idea management is a constant exploration of ideas' underlying problem and solution components that is guided by sporadic feedback from a loosely connected crowd of idea contributors. In helping ideators understand the underlying constituents of their idea, these contributors punctually, and more often than not unconsciously, take on the roles of co-ideators and idea selectors. This collective sensemaking approach is particularly salient in a context where digital solutions can span multiple traditional product categories and where individuals often struggle to understand their underlying purpose [29, 30]. In this context, the meaning of a novel idea is not determined solely by the ideator but rather emerges from the interaction of various social agents who try to understand, share and modify their understanding according to their existing knowledge of similar problems and solutions. Considering the emergent and

collective nature of value creation in digital innovation efforts, ideas should be managed in a way that provides venues for punctual comments and feedback among the crowd of idea contributors. In our revised framework, and especially in its matching phase, the idea management program presents such a venue for "open" idea development. Firms can use idea management programs as a device for socio-cognitive sensemaking [3] that encourages employees to interact with internal (especially during forking and merging phase) and external stakeholders (especially during matching phase) to more deeply engage with their idea and thoroughly assess its underlying problem and solution components.

Second, our revised framework views ideas as evolving couplings of problems and/or solutions that wait to be revealed by an idea contributor and temporarily matched [9]. The dynamic evolution of ideas causes temporal overlaps in traditional innovation process phases that practitioners must learn to deal with. It has for instance been suggested that digital technologies and/or people can be mobilized to serve as brokers between the numerous problem and solution [31]. In our revised framework, the idea management program takes on this intermediary role, most remarkably in its matching phase and its forking and merging phase. We thus propose that firms can use idea management programs as an orchestration device [3] to match the right problem with an available solution, or the right solution with a known problem. We suggest that idea management programs can help firms to better manage temporal overlaps between traditional innovation process phases, since the orchestrating of problem-solution pairs allows for parallel episodes of idea generation, development, and selection.

Based on these two main implications, we see fruitful research opportunities in examining in more depth how idea management programs can serve as venues for socio-cognitive sensemaking and orchestration devices and how they foster the development of ideas into digital innovations.

We recognize several limitations in our research design. First, we studied a single organization as a revelatory case of how incumbent organizations manage ideas in the context of digital innovation. However, idea management programs might be implemented differently in other organizations, possibly leading to a different conceptualisation [32]. We thus invite our fellow scholars to examine the generalisability of our conceptual framework to other empirical cases. Second, there are complementary approaches to study our focal phenomenon. For instance, studying a single idea as the primary research object for an in-depth investigation of how problem-solution pairs form and evolve in idea management programs, or studying the end-to-end digital innovation process for a more holistic understanding of ideas' evolution. For the purpose of this paper, we deliberately focused on idea management programs as an increasingly prevalent tool and an exciting lever for creating digital innovations with employees. However, we strongly encourage researchers in innovation management and information systems to investigate these alternative approaches to build upon, refute or amend our framework and better capture the critical phenomenon of digital innovation.

7 Conclusion

In today's hypercompetitive world, organizations are pressured to harness the innovation potential slumbering in their employees' minds. The lack of clear guidance on the matter led us to reassess the conceptualization of idea management programs. We asked the following research question: "How can idea management programs be conceptualized in light of digital innovation?". Drawing on idea management, open innovation, and problem-solution pairs as conceptual building blocks, we perform an in-depth case study of how ideas for digital innovation are managed. Our findings suggest that idea management programs can be used as orchestration and cognitive sensemaking devices to help organizations match, fork and merge, and refine ideas to better meet the digital imperative. Our main contributions are a revised understanding of idea management and a fresh perspective on how innovations form and evolve in a pervasively digital world.

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APPENDIX D – RESEARCH PAPER 2

Innovating with Employees: An Exploratory Study of Idea Development on Low-Code Development Platforms

Research Paper accepted to ECIS 2021

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Abstract

In their struggle to deliver new products and enhance internal processes, organisations cannot ignore the innovative potential of employees. A central promise behind low-code development platforms (LCDPs) is the ability for organisations to efficiently involve employees in innovation initiation and have them develop ideas for innovative software applications themselves. In light of the growing need for digital innovation, we undertake an exploratory study of idea development on LCDPs. Guided by an idea management lens, we highlight similarities and differences in stakeholders, roles and process phases between idea development on LCDPs and idea management programs. We find that LCDPs empower employees to navigate the initiation of innovation with more flexibility and autonomy. Organisations in turn benefit from having employees drive idea development on LCDPs if they have adopted adequate LCDP support factors. Overall, our findings suggest that LCDPs constitute a promising avenue to initiate digital innovation with employees across an organisation.

1 Introduction

Organisations are under increasing pressure to innovatively adapt their products and processes to more demanding customers in more competitive marketplaces (Kohli and Melville, 2019). In recent years, combining innovative ideas with digital technologies has become a prominent strategy to cope with these new market demands. At the same time, many organisations have not yet aligned their resources to the growing need for digital exploration, hindering a successful response to digital trends (Nambisan et al., 2017). As observed by digital innovation scholars, IT department are generally held responsible for creating innovative software and hardware, yet at the same time they often lack adequate skills to ensure both the exploitation of existing systems and the exploration of new technologies and use cases

(Lee et al., 2015). This observation have led to intensified research on employee-driven innovation, with both practitioners and scholars increasingly considering ordinary employees as potent drivers to quickly build up digital innovation capabilities (Opland et al., 2020).

Efficiently harnessing the innovative potential of employees has been a long-standing challenge for organisations. While innovation has traditionally been the sole responsibility of highly-skilled R&D departments, organisations have come to recognise that innovative resources are in fact scattered throughout departments (Neyer et al., 2009). Over the last decades, managers have tapped into the innovation potential of non-R&D employees by leveraging various tools such as total quality management, continuous improvement and idea management, with varying degrees of success (Gerlach and Brem, 2017; Haapasaari et al., 2018). Taking this one step further, recent years have seen non-IT employees being increasingly involved in digital innovation, notably via digital platforms (Opland et al., 2020). Especially low-code development platforms (LCDPs) are gaining momentum among practitioners for its possibilities of rapid software application development and minimal need for manual coding (Rymer, 2017). LCDPs promise to put digital innovation within the reach of employees with little coding experience but rich business knowledge, potentially triggering radical changes in the innovation process. Investigating how digital platforms transform the ways in which ideas form, evolve and eventually result in successful innovation is of great interest to digital innovation scholars and the IS field at large (Nambisan et al. 2017). Yet despite growing prominence among practitioners, LCDPs have received scant academic attention. We therefore pose the following research question:

How are innovative ideas developed on low-code development platforms?

We address our research question with an exploratory study of LCDP use within organisations. We leverage idea management as our guiding lens and put our analytical focus on the stakeholders, roles and process phases of idea development on LCDPs. Drawing on a rich dataset of both interviews and archival data from LCDP developers, vendors, analysts and users, we investigate the involvement of ordinary employees in the idea development process, which we then compare to traditional idea management programs. Our main contribution is an initial set of stakeholders, roles and process phases of idea development on LCDPs, along with four support factors that can help organisations overcome challenges that emerge when ordinary employees drive idea development on the platform. Our initial insights into innovative idea development on LCDPs contribute to the literature on digital innovation management, idea management and the nascent stream of LCDPs. We also provide practitioner guidance by discussing the platforms' potential with regard to idea management programs.

2 Background

2.1 Idea management

For almost five decades, idea management scholars have been constructing knowledge about how firms can capture and harness their employees' ideas to improve corporate products and processes (Thom, 1990). The importance of idea management, as "a sub process of innovation management with the goals of effective and efficient idea generation, evaluation and selection" (Brem and Voigt, 2007, p.306), is increasingly recognised for its ability to help generate innovations within organisations. The adequate management of innovation's early phases is indeed critical to an organisation's success (Thom, 2015). With this in mind, many organisations have been implementing idea management programs to guide the development of innovative ideas.

Idea management programs can be understood as formal programs whose objective is to source new ideas among employees, evaluate and select those with the most value-adding potential, and turn them into innovative outputs. The central tenet behind idea management programs is that employees are knowledgeable experts of their day-to-day work and are therefore particularly suited to generate ideas for new products, services and processes (Kesting and Ulhøi, 2010). In a recent review of the literature, Gerlach and Brem (2017) condense the state-of-the-art knowledge on idea management programs in a conceptual framework. The framework describes the programs' typical process phases, main stakeholders and key roles. In line with other studies in idea management (Bakker et al., 2006; Brem, 2011; Frese et al., 1999; Thom, 2015; Westerski et al., 2011), six stakeholders are identified, playing each one key role in one out of six consecutive process phases. They are the program manager (role: idea manager, phase: prepare), employee (role: ideator, phase: generate), domain expert (role: discussion group, phase: improve), decision maker (role: idea selector, phase: evaluate), IT developer (role: development team, phase: implement), and business manager (role: deployment team, phase: deploy).

While remaining open for adaptation to the specific organisational context, stakeholders, roles, and process phases form the basic building blocks of idea management programs at large. As such, they help organisations structure and optimise their approach to innovative idea development, notably by framing stakeholder interactions (via roles) and streamlining activity flows (via process phases) (Brem and Voigt, 2007; Fairbank et al., 2003). These clear-cut guidelines however come at the cost of increased rigidities that can result in slow and expensive idea development. For instance, idea management programs constrain the extent to which ordinary employees can actively contribute to idea development, with their role being commonly limited to ideation (Gerlach and Brem, 2017). In fewer cases, ordinary employees are involved in later phases of idea development, yet they remain under tight managerial supervision and need to act according to the program's predefined process flow. This in turn

can undermine successful idea implementation and reduce the overall attractiveness of idea management programs for employees (Neyer et al., 2009).

Organisations have been trying to address these challenges by leveraging digital tools in idea management programs. Prominent examples are idea management systems (Westerski et al., 2011), idea management platforms (Benbya and Leidner, 2018) and crowdsourcing platforms (Blohm et al., 2013). Although it is now widely recognised that digital tools can support innovation (Nambisan et al., 2017; Neyer et al., 2009), few organisations have supplemented their idea management programs with employee-specific tools that reach beyond idea generation (Benbya and Leidner, 2018). Outside these formal programs however, organisations have been adopting digital tools that directly or indirectly support ordinary employees beyond the generation of ideas (Opland et al., 2020). As it has been pointed out in the employee-driven innovation literature, digital tools can be useful in helping employees more actively contribute to the initiation of digital innovation (Laviolette et al., 2016). Some organisations have notably started using digital platforms to unlock the potential of employees in the end-to-end innovation process (Mueller and Renken, 2017). Due to the emergence of the phenomenon however, it is not clear how the use of digital platforms – such as LCDPs – transforms idea development, thus limiting our ability to assess their full potential for the initiation of digital innovations with employees.

Overall, the idea management literature offers a rich starting point to investigate innovative idea development. While idea management programs are generally deployed on an organisational level, its underlying components (i.e. stakeholders, roles and process phases) reflect attributes and activities that can be transferred to the individual level of analysis. For lack of a thorough theoretical understanding of how individual create digital innovations (Kohli and Melville, 2019), we use idea management as a sensitising device to investigate idea development on LCDPs. The importance of idea management as a long-standing managerial tool and a coherent academic construct is increasingly recognised, and its underlying components enjoy wide consensus support by the innovation management literature (Van den Ende, 2014). In addition to idea management's overall conceptual fit with the phenomenon at hand, its building blocks can serve as a scaffold for analysing not only the initiation phase of digital innovation, but also the evolving temporal linkage between innovation initiation, development, implementation and exploitation (Sandström and Björk, 2010). Reshuffling of and temporal overlaps between traditionally distinct and consecutive innovation phases have indeed been highlighted in the digital innovation management literature, and we expect idea management's building blocks to offer the appropriate level of granularity to capture these evolutions (Nambisan et al. 2017). Furthermore, idea management programs are a prominent approach among practitioners for supporting employees when they create digital innovation (Benbya and Leidner, 2018; Kesting and Ulhøi, 2010; Opland et al. 2020), therefore increasing the relevance of this study outside of academia.

2.2 Low-code development platforms

Low-code development platforms have been drawing the attention of practitioners since 2014, yet without awakening significative academic interest. The term itself was first coined by the analyst firm Forrester to describe "platforms that enable rapid application delivery with a minimum of hand- coding, and quick setup and deployment" (Richardson and Rymer, 2014, p.2). As their distinctive characteristic, LCDPs feature a visual editor where users can quickly and easily combine and recombine pre-programmed components into a functional software application. Decomplexifying the application development process has been a running theme through the history of programming (Gaggioli, 2017) and low-code development cannot be considered a new phenomenon as such. Most notably, LCDPs draw close parallels with rapid application development methods intended for fast and iterative development, sharing key characteristics such as high user engagement and re-use of software components (Ismail, 2017; Vincent, 2019).

LCDPs are however distinct in their aim of empowering users from across the organisation to perform application development activities. These users, mostly based in non-IT business units, possessing little development experience and basic technical skills, are commonly referred to as citizen developers (Rymer, 2017). Using the platform's visual user interface, they may add and discard features and functionalities quickly to kickstart developing their ideas without the help of a developer or significant upfront investment (Richardson and Rymer, 2016). This makes LCDPs a promising tool for the development of innovative ideas, since the platform is particularly suited for testing and refining ideas in iterative cycles of experimentation (Richardson and Rymer, 2014; Rymer and Seguin, 2019). As of yet, innovative idea development on LCDPs is still a nascent phenomenon with few organisations using it as their primary development platform. Against a background of resource-strapped IT units and increasing demands for digital innovations however, idea development on LCDPs is predicted to become more commonplace as platform offerings mature (Rymer, 2017).

As such, LCDPs can be seen as a technology whose distinct characteristics (i.e. pre-coded components, visual interface, central platform) have the potential to transform the early stages of the innovation process, that is how ideas are captured and turned into functional applications. While the use of digital tools has substantial potential for involving ordinary employees in digital innovation development, they also bring about new challenges that can cause organisations to experience a decline in involvement and engagement from employees over time (Opland et al., 2020). Research on employee-driven digital innovation has pointed out that this can notably happen if the tool supports some phases in the innovation process, typically idea generation and evaluation, while leaving others, such as idea improvement, implementation and deployment, unaddressed (ibid). This observation, along with the scarcity of literature on LCDPs and digital innovation development with ordinary employees, inspired

us to conduct a study of LCDPs to empirically understand and conceptually guide innovative idea development on these platforms.

3 Methodology

An exploratory study of an emerging phenomenon requires the analysis of a rich dataset (Yin, 2014). As with other emergent phenomena however, access to real-world data about idea development on LCDPs is limited, with few organisations using LCDPs to extensively encourage innovation among their employees (Rymer, 2017). We therefore decided to build a rich dataset by combining data from multiple sources that shed light on idea development on LCDPs from different perspectives. As summarised in Table 1, we collected our data from three sources: (1) expert interviews at an LCDP vendor, (2) analyst reports and LCDP vendors documentation, and (3) LCDP user reviews.

3.1 Data collection

In a first step (1), we performed expert interviews at an LCDP vendor firm to gain an initial understanding of LCDP motivations and use cases. Access was obtained through a professional colleague of the authors and co-founder of the firm. Founded in Switzerland in 2015, the firm offered the LCDP product and low-code application development services and employed approximately 30 people at the time of the study. As part of a larger research project, we conducted 10 interviews with executives and employees to understand LCDP motivations and obtain an overview on the variety of use cases at client organisations. We interviewed individuals having a variety of roles: the firm's CEO and COO, the Executive VP of Sales, a Senior Developer, a Lead Developer, two Platform Developers, a Project Manager, an Account Manager and a Product Manager. Each interview was carried out in person at the vendor's office. The interviews were semi-structured, with the interview guideline adapted as we became more familiar with the topic (Yin, 2014). All interviews were recorded and transcribed to allow for systematic analysis. The insights gained from this first step led to the identification of our research question and motivated further data collection.

In a second step (2), we narrowed our research scope to LCDP use by ordinary employees to enrich our initial understanding of innovative idea development on the platforms. We draw on an LCDP product analysis by Forrester to guide our selection of appropriate secondary data (Rymer, 2017). Specifically, the analysis classifies LCDPs based on their target user group being either citizen developers (ordinary employees) or professional developers (IT employees). As our primary focus is on LCDPs' ability to support employees across an organisation when they work on their ideas, we chose to select the citizen developer oriented LCDPs as our cases. This resulted in the selection of 12 LCDPs: Airtable, AppSheet, Betty Blocks, Caspio, FileMaker, Kinton, Kissflow, QuickBase, Scopeland, TIBCO, TrackVia and Zudy. Following a first scan of publicly available data, we excluded platforms with no or insufficient data and searched for additional wide-spread LCDPs targeting citizen developers. This led to the

exclusion of Scopeland and the inclusion of OutSystems, resulting in a total of 12 platforms. For the selected LCDPs, we collected archival data from 2014 on, which is the first time the term low-code development platform was coined. The archival data came from two sources: analysts, such as Forrester and Gartner, and the LCDP vendors themselves. For the former, we selected survey reports and analysis that gave insight into the motivations, characteristics and general use cases of LCDPs. For the latter, our focus was on customer stories, survey reports, white papers and blog posts that provided detailed insights into the platforms' uses within specific organisational contexts. The data collected in this second step revealed the vendors' shared ambition to position LCDPs as enablers for digital innovation across organisations, therefore validating the relevance of our research question.

In a third and last step (3), we further enriched our dataset with LCDP user reviews. As we expected the previously collected vendor documentation to be biased towards painting an overly optimistic picture of LCDP use, we collected user reviews relating to the same 12 platforms to nuance benefits and capture real-world challenges (salient differences between data sources are highlighted in our findings). We collected a total of 953 reviews from a certified user review platform by analyst firm Gartner (Gartner Peer Insights, 2020). To ensure currency of the thereby collected insights, we selected reviews dating from November 2019 to November 2020. The portal's reviews are written on a voluntary basis and include details of the reviewer's role, industry, LCDP usage frequency and years of experience with the platform. Every user review undergoes a rigorous verification process for authenticity, relevance, completeness and legitimacy before being published on the platform. While the length and quality of reviews varies, each review contains an overall comment about the platform and a free-text about positive and negative aspects of LCDP use along with a rating. Most reviews featured additional elements such as purchase motivation, relationship with vendor and recommendations to potential users. By combining the data collected in these three steps (see Table 1), we were able to build a rich dataset on which to base our examination of idea development on LCDPs.

Expert interviews (1)	**Analysts & vendor documents (2)**	**User reviews (3)**
Performed between May 2019 – July 2019	Data dating from 2014 – 2020	Data dating from Nov. 2019 – Nov. 2020
10 interviews 114 pages transcript	56 documents 509 pages	953 reviews 667 pages
• Gain initial understanding of motivations and use cases • Gain initial understanding of roles and process phases • Identify research question	• Enrich understanding of motivations and use cases • Enrich understanding of roles and process phases • Validate relevance of research question	• Nuance understanding of motivations and use cases • Nuance understanding of roles and process phases • Highlight experienced benefits and challenges

Table 1. Data sources

3.2 Data analysis

We analysed our data in the same order it was collected, starting with the interview data, then the analyst reports and vendor documents, and finally the user reviews. We followed an iterative approach, moving back and forth between the literature and our data. Our top-down code list was guided by the idea management framework as described by Gerlach and Brem (2017) with its building blocks being the stakeholders, roles, and process phases (i.e. content and temporal linkage). For a richer contextualisation of our focal phenomenon, we added codes pertaining to the LCDP literature, notably distinctive characteristics of the technology such as "pre-coded components", "visual interface" and "central platform", and generic use cases such as "process automation", "operational innovation", and "customer-facing innovation". We further added contextual codes such as "organisation size" and "industry".

Two of the authors independently coded the data using the MAXQDA software. During the coding, we also generated codes bottom-up to reflect specificities of the LCDP context. In essence, the bottom-up codes helped us transpose stakeholders, roles, and process phases of idea management programs to a context where ideas are developed on LCDPs. We found emerging codes for stakeholders such as "ordinary employee", "business manager", "end-user", "IT developer" and "platform vendor", and nuanced existing codes such as "deployment team" by splitting it into "deployment team (business)" and "deployment team (technical)", and by splitting "deployment phase" into "deployment phase (business)" and "deployment phase (technical)".

With these new codes in mind, employee empowerment emerged as a recurring underlying theme. We notably found "autonomy", "flexibility" and "freedom" to be related emerging codes. Moreover, a set of support factors for successful employee empowerment on LCDPs was consistently and prominently mentioned across all three data sources. We coded them as "innovation culture", "vendor support", "IT support" and "IT governance". At the end of each one of three coding rounds, we randomly selected one expert interview transcript, one analyst document, one vendor document and one user review to compare our coding results. We discussed discrepancies and refined the codes accordingly. By the third round, no major discrepancies were found, putting an end to the iterative coding process.

4 Findings

Our main objective is to understand how innovative ideas are developed on low-code development platforms. We structure our findings in three parts. We first describe five prominent stakeholders involved in idea development on LCDPs along with their roles. We then describe the idea development process on LCDPs and explain its constituent phases. Finally, we highlight a set of support factors that organisations can apply to successfully harness the innovative potential of LCDPs. Table 2 at the end of this section provides an overview of our findings.

4.1 Stakeholders

We found five main stakeholders to be involved in idea development on LCDPs. We now describe each stakeholder, specify their key role(s) and highlight prominent differences with idea development in traditional idea management programs.

- **Ordinary employee**. We found that idea development on LCDPs is heavily driven by ordinary employees. In contrast to traditional idea management programs where employees are mostly limited to reactive idea generation, LCDPs enable them to take on proactive roles in the entire idea development process. Due to LCDPs' low technical complexity, application development becomes accessible to individuals outside IT and ordinary employees become a driving force over the entire idea development process. Specifically, employees take on the roles of idea managers, discussion group, idea selector, member of the development team and deployment team (refer to Table 2). An interviewee at the LCDP vendor stressed that consequently idea development costs plunge, and innovation can blossom: *"You [i.e. ordinary employee] can try your stuff on your own, and you know, you don't even have to be a developer for that. So, you have a need, you have the tools to solve the problem. Innovation will happen in that way, because people will be able to work on their ideas without having to involve 3/4 of the company to get the resources that they need to do that"* (interview 6, platform developer). Next to ordinary employees, a number of other stakeholders are punctually involved in idea development on LCDPs. These stakeholders are not restricted to a single key role as with traditional idea management programs but, similarly to employees, participate in idea development at multiple points in time with different roles.
- **IT developer**. We found the most prominent stakeholder beside the ordinary employee to be the IT developer. Even though LCDPs aim to democratise technical application development as far as possible, professional developers are still needed to support employees when discussing the idea's underlying technical assumptions, developing, and evaluating its application prototypes and most critically when deploying the resulting application in the productive environment. A Betty Blocks user recommended: *"Application development is very easy although it is good to have a mix of developers, because some integrations need coding or at least experience with various coding languages"*.
- **LCDP vendor**. In a similar vein, we found the LCDP vendor to be an important stakeholder during idea development and deployment. While this stakeholder is inexistent in traditional idea management programs, the LCDP vendor takes on a critical role in guiding the employee when implementing ideas on the platform and in collaborating with the IT unit when deploying the resulting application on the existing IT landscape. This new stakeholder is particularly vital in organisations where resource- strapped and exploitation-oriented IT units struggle to handle questions and requests coming from employees. As a Betty Blocks user reported, LCDP vendors

become part of the improvement and implementation team: *"[I would recommend to] develop a prototype on the platform and engage the vendor to provide support to accelerate the learning curve. While the learning curve for low-code platforms is by definition a lot flatter, having the vendor guide you with best practices is the best approach"*.

- **End-user**. Another stakeholder who is actively involved in idea development on LCDPs are the future end-users of the envisioned innovative application. While traditional programs often struggle to include end-users in their processes, functional LCDP applications can be put in their hands quickly and easily so they can contribute to improvement and evaluation with contextualised feedback. This is reflected in user reviews such as: *"We are currently starting to use Outsystems in our company to develop internal applications. We noticed that is very useful to start a project in minutes, and give us the availability to reduce the time until we are able to present a functional prototype to the user"*. Even though end-users are not directly involved in the decision of whether ideas will be deployed in the productive environment or not, they considerably guide their evolution on the platform. This has the positive effect that the resulting applications fit their needs and they are often inclined to adopt and promote them once deployed.
- **Business manager**. LCDPs are not (yet) part of formal idea management programs within organisations. As such, there are no formal program managers who guide idea development with an imposed stage-gate process punctuated by meetings with key stakeholders. Rather, employees are given access to the platform by individual business managers who wish to provide a way for them to autonomously test and implement their ideas. To a certain extent, these business managers take on the role of formal idea managers, notably in that they encourage their team to develop ideas on the platform, keep track of progress, provide support, and promote the resulting low-code application among target users. A business manager noted about AirTable: *"I can check what each of my team members is doing and they can leave comments on particular issues they wish me to address. It has facilitated tremendously communication between teams in different continents and promotes transparency"*.

4.2 Process phases

We found that idea development on LCDPs consists of similar process phases as traditional idea management programs. We now describe each phase, indicate which stakeholders are chiefly involved and, as we have done in the previous sub-section, highlight prominent differences with idea development in traditional idea management programs. Figure 1 provides a detailed view of the idea development process on LCDPs.

- **Preparation phase**. While defining the central problem or topic for idea generation, deciding on the pool of participants, identifying adequate domain experts, and promoting participation are

critical for traditional idea management programs, we hardly found any reference to such a preparation phase on LCDPs. This observation is in line with the absence of formal idea managers when developing ideas on LCDPs. We found that LCDPs mostly rely on employees' intrinsic motivation for working on their idea and quickly building functional applications. However, LCDP adopters still recommend guiding employees in their first steps on the platform, suggesting there might be benefits in adopting some aspects of formal idea management programs, such as problem scoping and innovation promotion. For instance, an AppSheet user recommended to other business managers: *"Start with a simple but troublesome problem first. Get a core group of users excited about the app and be ready to implement suggestions quickly to keep up the enthusiasm"*.

- **Generation phase**. We found that ideas that are developed on LCDPs are triggered by employees' daily work practices. This is in contrast to traditional idea management programs where idea generation is mostly motivated by an imposed challenge which may or may not be linked to employees' day-to-day work. By their daily work, employees are knowledgeable about their work domain and can have valuable ideas for enhancing the way they perform their job. In most cases, idea generation happens "off-LCDP" when employees work with other organisational systems, and the idea is then moved "on" the platform for rapid development. However, we found that the platform itself can also trigger ideas. This is for instance the case when LCDPs' novel features inspire unsuspected use cases. An OutSystem reviewer alluded to the way LCDPs can trigger new ideas via its feature updates: *"The platform is continuously evolving so you are able to explore new features (AI, robotics, etc)"*. Similarly, an AirTable reviewer mentioned the platforms' automatically generated suggestions for features as a source for new ideas: *"They have automatic built in APP functions that are generated. So, in other words, you may not know you wanted a feature, but Appsheet will auto generate it for you. You do not have to use it, but it knows you probably want it"*.
- **Improvement and implementation phases**. In contrast to traditional idea management programs where each idea development phase is clearly defined, LCDPs blur the boundaries of idea improvement and implementation phases and cause temporal overlaps in the idea development process. The entanglement of improvement and implementation activities can be traced back to the pre-coded components that enable ordinary employees to quickly implement a functional version of their idea, test it with potential users and modify it as new insights are gained. This emerged as a major benefit for users, as noted by a Betty Blocks user: *"[I like] the speed and ease of development of ideas to working functionality. We can test customer behaviour much faster. It also helps achieve our innovation department's goals in a way that wasn't possible with our existing IT systems. And the fact that we (as mostly business, not IT minded people) can build software ourselves is a great bonus"*.

- **Evaluation phase**. In traditional idea management programs, the evaluation phase refers to one or several meetings where domain experts and top-management decide upon the continuation or the abandonment of ideas. The decision to continue idea development in such programs usually implies considerable investment to fund prototypes, technical proof-of-concepts and final applications realised by IT professionals. On LCDPs, the evaluation phase seems to happen in a more implicitly later on in the idea development process. For instance, we did not find any reference to formal meetings with decision makers to decide upon ideas' fate. However, we found hints that an evaluation phase takes place between the improvement and implementation of ideas and their deployment when business managers decide whether the low-code application is worth deploying in the existing IT landscape by professional developers. Similarly, professional developers evaluate if the idea can be implemented in the IT landscape without major misfits between the existing system and the new application. In comparison to idea management programs, we found that ordinary employee can more easily express their point of view and make their voice heard during this evaluation phase, as their arguments are backed up by functional low-code prototypes and early user insights. This was reflected in a review where an AppSheet user warned: *"Include IT at some point, but don't let them squash your dreams. Developers tend to think of no-code as 'cute' and not as powerful, which is not always the case. Even if you hit a wall with AppSheet, using it for wire framing and proof of concepts is incredibly valuable"*.
- **Deployment phase (business)**. State-of-the-art conceptualisations of idea management views idea deployment primarily as a phase of promotion or selling of the new product to clients and business partners. This is in contrast to idea deployment on LCDPs, which encompasses both strong business and technical aspects. We therefore decided to split this phase into a "business" deployment phase (i.e. promotion among target group) and a "technical" deployment phase (i.e. integration into existing IT landscape) to allow for a richer analysis. With regard to the business deployment, we found that idea promotion starts early on in the development process, with target users being already involved during idea implementation and improvement. An AirTable review highlighted the visual interface of the platform as a central enabler to promote the application to future users: *"Airtable has a built-in system for the use of shared screens, with which you can select one or more sections of the screen to show web users attached to our session. It is very oriented towards customer management, so it is good to communicate with them at all times"*.
- **Deployment phase (technical)**. The technical deployment of low-code applications on the productive environment is a critical step that brings along a number of performance and security risks. We found that LCDPs can help speed up deployment as it enforces a number of rules through its pre-coded components. This allows employees' low-code applications to more easily be deployed on the existing IT landscape. However, while LCDP vendors often advertise with entirely putting idea development in the hands of ordinary employees, we found that the technical

deployment of low-code applications outside the platform cannot be done by ordinary employees without substantial IT support, if employees are involved at all. Some users criticise the dependence on IT staff for technical deployment, as this Outsystems review illustrates: *"In theory it works beautifully, but the implementation is done by developers only, which makes a mess. [...] And nobody from business is able to check because it's too technical for them"*.

- **Iteration**. With traditional idea management programs, deployed ideas are handed over to business managers to enter the project pipeline. This means that ideas that successfully leave the program are affected to a project management team who takes care of adapting and scaling the new product to ensure maximal profitability. With LCDPs, we found that employees often stay in charge of their idea and work on further improvements by implementing and deploying changes on the platform. A FileMaker user highlights the temporal overlaps between idea implementation and its iterative improvement and deployment in the following words: *"You also can apply changes on production on the fly without stopping the platform to deploy changes"*.

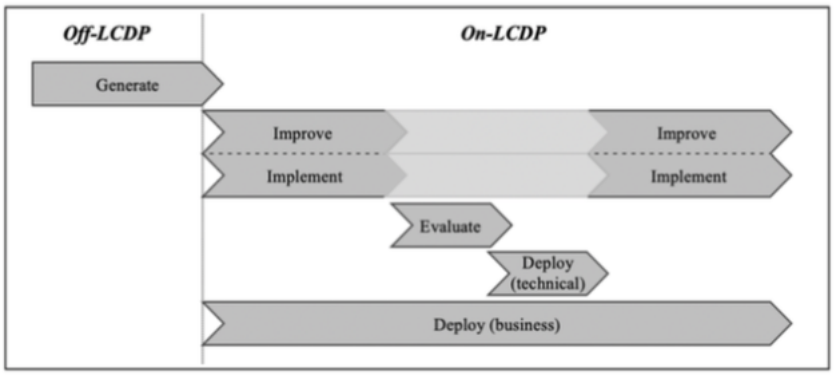

Figure 1. Process phases when developing ideas on LCDPs

4.3 Support factors

Finally, we found four support factors for idea development on LCDPs to be consistently and prominently highlighted across all our data sources. Organisations can apply these support factors to address new challenges that arise when empowering ordinary employees to develop their ideas on LCDPs. These challenges notably reflect the drawbacks of not having a formal program to support ad guide employees in the initiation of innovation.

- **Innovation culture**. We have identified an organisational culture that promotes exploration, learning and tolerance of failure as the most prominent support factors when developing ideas of LCDPs. This is best summarised in a comment made by a Betty Blocks user: *"This is a rapidly changing technology area, be prepared for constant changes, and the amount of cultural change this type of platforms cause is tremendous. You can [implement] a whole platform in 90 days, but*

your organisation may take 18 months to assimilate it". As employees may not be used to actively participating in digital innovation development, an innovation culture is central to promote the exploration of the platforms' features and use cases. Without a formal idea manager responsible to foster such a culture, giving employees the time and freedom to experiment with the platform is particularly critical, as the following user recommendation illustrates: *"Give yourself time to play with the software and don't get discouraged if it takes a little time to figure everything out"*.

- **IT training**. Next to building a strong innovation culture, our data suggests that IT training is another central support factor for idea development on LCDPs. This support factor is related to power shifts between stakeholders traditionally involved in the initiation of digital innovation. Most prominently, LCDPs cause changes in power distribution among professional developers and ordinary employees as IT units no longer have the sole monopoly over application development. In contrast to traditional idea management programs where program managers punctually involve professional developers for the tasks of application development and deployment, LCDPs enable ordinary employees to perform most of the technical development by themselves. However, providing ordinary employees with direct access to application development activities comes at the cost of reduced quality control over the end product. While vendor documentation and tutorials can provide some guidance, users mentioned a need for more thorough training on how to efficiently use the platform and for an overall sensibilisation to IT architecture, coding languages and database logics. A QuickBase user warns: *"Despite the simplicity of the app, business users created ineffective data structures that were only marginally better than Excel. Do not let the ease of use lull the organisation into a false sense of security. A 'citizen developer,' a term QuickBase markets, still must understand not only the business need but rudimentary database design techniques"*.
- **IT governance**. We identified IT governance as being an important support factor to counteract the vanishing involvement of formal idea managers in a context of innovative application development on LCDPs. Echoing program managers' task in traditional idea management programs, a governance framework for LCDPs can help clarify how to manage idea development in order to avoid application duplicates, incompatibilities, and inefficiencies. A QuickBase user recommends: *"The tool is very flexible and is a strong low code option, however, management of the created applications can get out of hand quickly. [...] I would put in strong guidelines to manage the use of the QuickBase tool to ensure that use is intentional with awareness of ultimate scalability"*.
- **Vendor support**. The last support factor that featured prominently in our data is technical support on the part of the LCDP vendor. Beyond ordinary employees counting on the vendor for help during application development, internal IT units at times need to collaborate with the vendor when deploying low-code applications on the existing IT landscape or requesting new pre-coded

components. Moreover, the organisation relies on the vendor for platform maintenance and upgrades. This review by a QuickBase user illustrates the increased dependence on the LCDP vendor: "We have exactly one person at our company who knows how to deal with the program if something goes wrong - this speaks for the many mysteries of QuickBase. No one else can troubleshoot, and it is difficult to obtain adequate and timely customer service from [the vendor]."

Overall, our findings were consistent across the three data sources. Expert interviews, analyst and vendor documents, and user reviews offered a congruent view on process phases and stakeholders, the most significant differences being found in our analysis of the support factors. While every data source mentioned all factors in at least some extent, we found IT governance and IT training to be most heavily emphasised in expert interviews, and innovation culture and vendor support to be most salient in user reviews. We suspect these discrepancies to be mostly linked to differences in individual roles; our interviewees were mostly on the technical side and thus more sensitive to technical issues that would concern system implementation and maintenance, whereas users were mostly on the business side and thus more likely to notice cultural misalignments and product support shortcomings that would impede quick and efficient platform use. Analysts and vendor documents, on the other hand, offered balanced evidence for all support factors, warning against adopting LCDPs without careful integration in the existing technological, cultural and skills landscape (unsurprisingly, vendors systematically positioned themselves as the best option to meet the vendor support success factor, whereas analysts proposed vendor rankings).

		Roles in idea development[1]						
		Ideator	Idea manager	Discussion group	Development team	Idea selector	Deployment team (bus)	Deployment team (tech)
LCDP stakeholders	Ordinary employee	X	X	X	X	X	X	
	Business manager		X			X	X	
	End-user			X			X	
	IT developer			X	X	X		X
	LCDP vendor				X			X
Process phases[2]		Generate	Improve & Implement			Evaluate	Deploy	
Support factors		• Innovation culture • IT training • IT governance • Vendor support						

Table 2. Stakeholders, roles, phases, and support factors for idea development on LCDPs

5 Discussion

In the previous findings section, we have described stakeholders, roles and process phases that constitute idea development on LCDPs, along with a set of support factors. Additionally, we have shed light on a number of similarities and differences between idea development on LCDPs and traditional idea management programs. We now highlight salient differences in stakeholders and roles first and in process phases second, and discuss how they relate to the empowerment of ordinary employees. Overall, our findings suggest that LCDPs increase employees' flexibility and autonomy in the initiation of innovations and thus help organisations better harness their innovative potential.

Regarding differences in stakeholders and roles on the one hand, we have highlighted that LCDPs enable ordinary employees to play the leading role in every phase of the idea development process. They proactively take ownership of a number of tasks that traditionally belong to a variety of stakeholders across organisational departments. Rather than being assigned a predefined role, they flexibly switch between roles as they see fit. This increase in functional flexibility can notably be traced back to LCDPs' ability to support multi-skilling with employees taking on business-, R&D- and IT-related activities, and to promote the deskilling of software development activities via its low levels of technical complexity (Benders, 1990). In other words, LCDPs increase employees' flexibility by empowering them to perform a variety of decomplexified tasks across traditionally distinct organisational boundaries. Prior research into the drivers of employee innovativeness had already highlighted that employee flexibility is an important area of focus when fostering innovation (De Spiegelaere et al., 2014). This has been echoed in the digital innovation management literature, where scholars have highlighted the emergent nature of participation in the initiation of innovations with digital core components (Nambisan et al., 2017). LCDPs hold potential to provide greater levels of flexibility during idea development, ultimately enabling organisations to better allocate their personnel resources for digital innovation (De Spiegelaere et al., 2014).

Regarding differences in process phases on the other hand, we have highlighted that the flow of activities on LCDPs is no longer dictated by a formal program but can be adapted to employees' needs as they develop ideas on the platform. Rather than having to formally validate the outcome of each process phases as they would in traditional idea management programs, employees can autonomously move between phases of idea improvement, implementation, evaluation and deployment by instantly adding, discarding and changing pre-coded components in their functional low-code application. Because idea development on LCDPs requires few resources in addition to the employee, they are freed from many of the traditional constraints related to budget and resource allocation (Bäckström and Lindberg, 2019). This in turn enables them to decide on the sequence and speed of idea development activities on their own. Empowering employees with freedom and independence in how to proceed, and giving them authority and responsibility to act alone in idea development can favour more valuable

contributions to innovation efforts (Amabile et al., 1996). More generally, supporting employees' self-determination with respect to work procedures, goals, and priorities has been identified as a key area of focus when initiating innovation (Durcikova et al., 2011). As autonomous employees are assumed to have more needs for innovative solutions and enjoy more freedom to develop them (Amabile et al., 1996), organisations are well advised to leverage LCDPs to encourage innovative behaviour among the entire workforces.

Overall, our findings suggest that LCDPs contribute to democratising idea development within organisations in three ways (Laviolette et al., 2016): by making application development more accessible to ordinary employees via pre-coded components, by helping them express their points of view more clearly via low-code application prototypes, and by letting their voices be better heard in decision-making via real-world user feedback (Kristiansen and Bloch-Poulsen, 2010). Consequently, we align with the view that digital technologies, such as LCDPs, can help organisations unlock innovative potential on the individual level (Mueller and Renken, 2017) and enable new individual innovation practices within organisations (Ciriello et al., 2019). We further corroborate with the view that although digital tools can help involve employees in the innovation process, they also bring along new challenges that need to be understood and overcome (Opland et al., 2020). Our data notably suggests a set of support factors that organisations can apply to ease the transition towards using the platform for innovative idea development. These support factors echo the findings of other studies in the employee-driven innovation literature (Bäckström and Lindberg, 2019; Kesting and Ulhøi, 2010), corroborating with the view that people, processes, and tools must be well-integrated to enable successful innovation (Gressgård et al., 2014).

Our findings have a number of important implications for idea management programs. As for now, idea management practitioners have primarily been leveraging digital tools to support the submission and evaluation of ideas and facilitate their follow-up during development (Gerlach and Brem, 2017). LCDPs open up new perspectives in this regard. Our study shows that the development of innovative ideas can be practiced on an individual level on LCDPs with employees taking ownership of idea development tasks and actively driving the innovation process. For innovation practitioners, this poses the question of whether LCDPs should be integrated to idea management programs as supportive tools or whether they should be regarded as alternatives to these formal programs. In other words, if employees can develop their innovative ideas by themselves on the platform, to what extent do traditional idea management programs remain relevant?

In this regard, the support factors we have identified seem to suggest that integrating LCDPs in formal programs as a supportive tool or pre- process might be more valuable than using the platform as a stand-alone alternative. Another practical implication concerns the more active involvement of ordinary employees in digital innovation and the resulting shifts in power distribution among stakeholders (Bäckström and Lindberg, 2019; Kristiansen and Bloch-Poulsen, 2010). Arguably, employees gain in

power because they have more flexibility and autonomy in idea development on LCDPs, while IT units lose some power because they no longer hold the monopoly for innovative application development. In light of the differences in stakeholders, roles and process phases between traditional idea management programs and LCDPs, organisations may have to reassess the governance rules that underlie idea development to successfully integrate ordinary employees in the innovation process (Neyer et al., 2009).

6 Limitations and conclusion

A central promise behind LCDPs is the ability for organisations to efficiently involve ordinary employees in digital innovation development. While LCDPs indeed show potential in lowering the barrier for innovative application development, they also bring along new challenges that can cause organisations to experience low-quality innovation outcomes and a decline in involvement and engagement from employees over time. This observation inspired us to conduct an exploratory study of LCDPs to empirically understand and conceptually guide idea development on these platforms. Drawing on a rich dataset of both interviews and archival data, we analysed how innovative ideas are developed on the platform. We found that ordinary employees gain in autonomy and flexibility when developing their ideas on LCDPs, thereby becoming the driving force behind digital innovation.

This exploratory study is meant as a first step towards understanding the potential of LCDPs for empowering employees in the early phases of digital innovation management. While we have been able to provide initial insights into idea development on LCDPs in terms of stakeholders, roles, process phases, and support factors, we acknowledge a number of limitations to our study. Most prominently, because of the emergent nature of the studied phenomenon, access to gather rich primary data on LCDP use is limited. We therefore built our dataset by combining primary and secondary data from a broad set of LCDP stakeholders, including LCDP developers, vendors, analysts and end-users. This allowed us to gain a particularly holistic view on the platforms' technical and social components and their interdependences, as we gathered rich data about their motivations and use cases from both business- and technology-oriented actors.

Our approach leaves room for further validation and enrichment through an in-depth study of organisations having adopted business-oriented LCDPs (i.e. the focus of the current study) and organisations having adopted IT-oriented LCDPs, to achieve a comprehensive understanding of LCDPs' potential for both radical and incremental innovation. Our findings hinted towards LCDPs being better suited for incremental innovation, yet more research is needed to determine its most effective use cases. We see another fruitful avenue for research in focusing on LCDP use on an individual level and examining how new and existent innovation practices are supported by the platform (Ciriello et al., 2019). An understanding of individual practices on LCDPs can help uncover "the twofold role of digital artifacts as means and end" (Ciriello et al., 2018) in the digital innovation process,

which in turn can shed light on the nature of digital innovation and guide the design of technical and managerial tools (Nambisan et al., 2017).

Tackling the challenge of generating digital innovation with ordinary employees from a different perspective, we see substantial potential in studying whether and how LCDPs can help organisations adapt their idea management program to the new reality of digital innovation. Scholars have indeed pointed out that idea management programs will continue to enhance organisational performance only if they adapt to prevailing trends, such as the growing entanglement of ideas and digital technology (Thom, 2015). However, it seems that organisations are hesitant about investing in complementary or alternative approaches to traditional idea management programs (Neyer et al., 2009). Finding firms that have adopted LCDPs in the scope of their idea management programs and studying how ideas for digital innovations form and evolve in such a context can therefore constitute a valuable contribution to both scholarship and practice (Nambisan et al., 2017). In light of their ability to help unlock the innovative potential of ordinary employees to quickly build up digital capabilities, we strongly encourage researchers in employee-driven innovation, digital innovation management and the IS field in general to further explore the promising avenue of LCDPs.

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APPENDIX E – RESEARCH PAPER 3

A Case Study of Enterprise-Wide Digital Innovation: Involving Non-IT Employees

Research paper accepted to ECIS 2022

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Abstract

Today's incumbent organisations are under pressure to proactively leverage their resources for digital innovation. Enterprise-wide initiatives hold potential in this regard by enabling employees across departments to contribute their knowledge, skills, and creativity towards digital innovation. However, IT units often struggle to transfer the ideas of non-IT employees into marketable digital solutions. Our understanding of how organisations coordinate and integrate employees' contributions to digital innovation is limited, yet critical to their survival and growth. Taking a resource-based approach, we identify three complementary competences –orchestration, self-orchestration, and choreography– that support enterprise-wide digital innovation. Specifically, we report how these competences helped an incumbent organisation initiate digital innovation with its non-IT employees while making efficient use of its IT resources. Our study further shows that building these competences requires the strategic use of digital artefacts and their multiple roles in the innovation process.

1 Introduction

In today's highly competitive and dynamic environments, successful organisations leverage digital technology to continuously renew and transform their work routines, processes, and business models (Legner et al., 2017). The growing pressure for digital innovation has transformed the demands placed on employees (Peppard, 2018), especially in incumbent organisations (Svahn et al., 2017). On the one hand, IT employees, whose primary role pertains to maintaining the existing technology landscape, are now also required to apply their technical skills and knowledge to develop innovative ideas into marketable digital solutions (Urbach et al., 2017). On the other hand, non-IT employees, whose primary role revolves around business processes and customer needs, are expected to generate innovative ideas

through their day-to-day use of digital technology (Shao et al., 2021). While IT employees are readily understood as core digital innovators, non-IT employees generally sit at the periphery of digital innovation activities (Opland et al., 2021) where they "are assumed to innovate without being supported by well-designed innovation practices" (Neyer et al., 2009, p.415). Enterprise-wide initiatives can help unlock non-IT employees' neglected potential for the initiation of digital innovation and combine the complementarity contributions of IT and non-IT employees (Opland et al., 2020).

Enterprise-wide initiatives for digital innovation, such as internal crowdsourcing contests and idea campaigns, aim to involve employees across functional departments in the rapid development of marketable digital solutions (Zuchowski et al., 2016; Reibenspiess et al. 2020). Tapping into the wealth of knowledge that non-IT employees hold can, however, result in diverse, emergent, and ill-defined contributions that IT units struggle to act upon. This challenge is exacerbated by the inherent ambiguity of digital technology, coupled with the limited digital expertise of non-IT employees, and the highly iterative nature of innovation development (Arvidsson and Monsted, 2018). Failing to adequately coordinate and integrate employees' contributions can trigger inefficiencies in the use of IT resources, notably when ideas are to be transferred into marketable digital solutions by IT staff (Ciriello et al., 2019). Such inefficiencies can undermine the success of the enterprise-wide initiatives and ultimately hamper incumbents' ability to respond to digital trends (Kohli and Melville, 2019).

As digital innovation continues to be generated primarily within organisational boundaries (Mamonov and Peterson, 2021), understanding how employees can contribute their knowledge, skills, and creativity is essential to incumbents' survival and growth (Peppard and Ward, 2004; Peppard, 2018). Despite recent studies into how employees navigate the digital innovation process (Arvidsson and Monsted, 2018; Svahn et al., 2017), research on the initiation of digital innovation remains scarce (Kohli and Melville, 2019). Similarly, research on non-IT employees' involvement in digital innovation is still in its infancy (Opland et al., 2020). To better understand how incumbents generate digital innovation and strengthen their competitive advantage with internally available resources, we ask:

How can incumbent organisations coordinate and integrate their employees' contributions to digital innovation?

We address our research question with a case study of digital innovation at an incumbent organisation in the fragrance industry. Specifically, we study its organisational initiatives that aim at initiating digital innovation with employees across functional departments. At the time of the study, the case organisation employed roughly 7'000 employees worldwide in its main business units (i.e. fragrances and flavours) and transversal support units (i.e. human resources and information systems). The case constitutes a revelatory example of how well-established and traditionally structured organisations, whose core business is not historically built around digital technologies, involve non-IT employees to seize digital innovation opportunities. The digital innovation initiatives we studied derived from the case's overall

strategy for digital transformation and thus benefited from strong top-management support. This support provided the newly created department for digital innovation with freedom to gradually refine how contributions had to be coordinated and integrated. This in turn enabled the organisation to develop three competences for enterprise-wide digital innovation: orchestration, self-orchestration, and choreography. The organisation further learnt that harnessing the different roles that digital artefacts enact in the innovation process is key for these competences to take shape and grow. We view the identification of these three organisational competences and supporting role of digital artefacts as our main research contributions.

This paper is structured as follows. We first review the capabilities literature for enterprise-wide digital innovation and articulate orchestration as our analytical lens. We then outline our methodological approach and demonstrate how our case developed three competences to coordinate and integrate employees' contributions to digital innovation while making efficient use of its IT resources. We further show how developing these competences critically relied upon the strategic use of digital artefacts in the innovation process. We conclude by discussing theoretical implications for digital innovation and IS strategy research and practical implications for managers who wish to foster digital innovation in an enterprise-wide manner.

2 Background

2.1 Building enterprise-wide capability for digital innovation

The resource-based view and capabilities literature have established themselves as the most widely used theoretical frameworks for the study of digital innovation within the Information Systems (IS) discipline (Mamonov and Peterson, 2021). Anchored in the field of strategic management (Mahoney and Pandian, 1992), the resource-based view argues that competitive advantage derives not primarily from industry characteristics but from the valuable and rare resources that organisations possess and that are difficult for competitors to substitute or imitate (Wade and Hulland, 2004). The capabilities literature adds that it is not the mere possession of such resources but their strategic use that leads to superior performance (Eisenhardt and Martin, 2000; Teece et al., 1997). Accordingly, organisational capabilities are generally defined as organisations' ability to generate value by leveraging skills, technologies, and processes for strategic differentiation (Wade and Hulland, 2004). As such, they tie together a set of interrelated organisational competencies. In the IS discipline, organisational competencies have been defined as organisations' ability to deploy valuable resources (i.e. information, systems and technology, knowledge, and skills) via dedicated processes, roles, and structures (Peppard and Ward, 2004). The concepts of capabilities, competences, resources, and the relationship between them, offer a coherent framework to understand how organisations can leverage their resources for digital innovation and competitive advantage (Peppard, 2018).

The capabilities literature shows growing consensus that non-IT resources critically contribute to sustainable competitive advantage, particularly in contexts of fast-paced digital innovation (Kohli and Melville, 2019). Early studies in IS had already reported that digital technology by itself cannot yield a sustainable competitive advantage (Clemons and Row, 1991). Just as little can the IT unit possess all the necessary resources for digital innovation (Peppard and Ward, 2004). Indeed, managerial skills (Mata et al. 1995), business resources (Powell and Dent-Micallef, 1997), and business vision (Feeny and Willcocks, 1998) are recognised non-IT variables for IT-driven competitive advantage. More recent work reported on how non-IT employees, that is employees acting outside a formal IT role, critically contribute to developing digital innovation as ideators (Shao et al., 2020), corporate entrepreneurs (Arvidsson and Mønsted, 2018), and subject matter experts (Svahn et al., 2017). Fostering such an enterprise-wide approach to digital innovation calls for organisational capabilities that support employees' efforts beyond the boundaries of the IT unit (Opland et al., 2020).

Existing research into the capabilities for digital innovation has provided valuable insights in this regard, yet from a remarkably high level of abstraction and with limited attention to contributing actors (Mamonov and Peterson, 2021). The dominant focus on a general and high-level digital capability may help explain current misalignments between market demands and organisational capabilities for digital innovation (Kohli and Melville, 2019) and incumbents' failure to respond to digital trends (Kane et al., 2015). High-level abstractions seem to offer only limited guidance to practitioners, and we focus instead on the competences that help organisations leverage their internal resources for digital innovation. More specifically, we focus on non-IT employees and how their knowledge, skills, and creativity can contribute to digital innovation (Shao et al., 2020). Moreover, we consider the coordination and integration of non-IT employees' contributions with the IT unit, since IT employees generally transfer ideas into marketable digital solutions (Ciriello et al., 2019). In our quest for more granular insights into the competences that support enterprise-wide digital innovation, we next turn to orchestration as a potential lens to study the integration and coordination of employees' contributions to digital innovation.

2.2 Orchestrating contributions to digital innovation

Leading scholars in innovation management have pointed at orchestration as a potent conceptual lens to capture the coordination and integration of value co-creation in collective innovation efforts (Dhanaraj and Parkhe, 2006; Nambisan and Sawhney, 2011; Nambisan et al., 2017; Wind et al., 2009). While its conceptual roots can be traced back to musical performance (Adler, 2016), orchestration first found its way into the IS literature in studies of service architecture (Daniel and Pernici, 2016) and more recently gained momentum in digital innovation management research (Vega and Chiasson, 2019). Considering its inherent focus on the coordination and integration of heterogenous and dynamic contributions, orchestration may provide a valuable lens to investigate how digital innovation forms

and evolves with distributed innovation agencies (Lyytinen et al., 2016; Yoo et al., 2010). Specifically, there have been calls to study how orchestration unfolds in the context of digital innovation, how organisations can organise for it, and what role digital artefacts play in shaping, enabling, and constraining orchestration (Nambisan et al., 2017).

Orchestration has already proven useful to the study of a broad range of phenomena related to the management of digital innovation, such as (1) innovation networks (e.g. Dhanaraj and Parkhe, 2006), (2) problem-solving organisations (e.g. Nambisan and Sawhney, 2011), and (3) employee-driven innovation (e.g. Opland et al., 2020). The study of innovation networks (1) approaches orchestration predominantly from an inter-firm perspective, with scholars investigating how "hub firms" centrally coordinate and integrate organisational contributions in innovation networks. Dhanaraj and Parkhe (2006) for instance define network orchestration as "the set of deliberate, purposeful actions undertaken by the hub firm as it seeks to create value (expand the pie) and extract value (gain a larger slice of the pie) from the network" (p.659). Accordingly, orchestration is concerned with how distributed innovation agencies can be governed (Nambisan and Sawhney, 2011) for their diverse knowledge to be successfully integrated (Dhanaraj and Parkhe, 2006). Wind et al. (2009) notably find that effective orchestration requires a delicate balance between control and empowerment of firms within the innovation network.

While innovation networks approach orchestration from an inter-firm perspective, research on problem-solving organisations (2) takes both an intra- and inter-firm approach to the study of orchestration (Afuah and Tucci, 2012; Urbinati et al., 2021). It primarily conceives of orchestration as the matching of contributions from various actors located within or outside the firm. Nambisan et al. (2017) argue that "in problem-solving organisations, a loosely connected crowd of 'contributors' can be identified and mobilised by a digital technology or person serving—either temporarily or more permanently—to orchestrate the crowd" (p.230). The orchestrating entity integrates and coordinates contributions from a distributed innovation agency whose actors traditionally operate separately from each other (von Hippel and von Krogh, 2015). To do so, it must establish a common understanding of problems and solutions among actors with diverse backgrounds and areas of expertise (Dorst and Cross, 2001). Urbinati et al. (2021) note how adopting and leveraging digital technologies in the innovation process can help start, sustain, and shape collaboration between actors who typically show little cross-collaboration.

Finally, the intra-firm perspective of orchestration (3) finds increasing resonance in the study of employee-driven digital innovation (Opland et al., 2020, 2022), digital entrepreneurship (Nambisan, 2017) and corporate entrepreneurship (Arvidsson and Monsted, 2018). Research efforts in these fields revealed that innovative ideas with digital core components have greater levels of inherent ambiguity, making it difficult to communicate them clearly (von Briel, 2018). As a result, it is often challenging to efficiently develop and extract business value from employees' ideas for digital innovation (Blohm et

al., 2013). A balanced approach between top-down and bottom-up initiatives is often needed to successfully harness employees' digital innovation potential (Svahn et al., 2017). Organisational initiatives such as idea campaigns can for instance help organisations manage innovation activities in a sub-process that is somewhat sheltered from surrounding organisational processes (Krejci and Missonier, 2020). This temporary decoupling from rigid organisational processes is essential to enable employees to iterate on their ideas before attempting to scale (Arvidsson and Monsted, 2018). Digital artefacts, that is underspecified representations of an envisaged digital solution (e.g. PowerPoint slides, software application prototypes), can support the decoupling from and recoupling to organisational processes and thereby optimise the use of IT resources for digital innovation (Ciriello et al., 2019).

To synthesise our literature overview, extant research into organisational capabilities and digital innovation has mostly overlooked the growing participation of non-IT employees in the initiation of digital innovation and the associated coordination and integration challenges. Research on orchestration provides insights in this regard by investigating how a central entity can coordinate and integrate contributions to innovation with distributed actors. It has notably highlighted the challenge of knowledge integration between actors who traditionally operate separately and the potential of digital artefacts to support such cross-boundary collaboration. It has also pointed out difficulties to align the efforts of distributed innovation actors because of their conflicting needs for empowerment and control when generating digital innovation. However, the literature remains silent on how this applies to enterprise-wide digital innovation within incumbent organisations. This gap is especially problematic as digital innovation is primarily developed within organisational boundaries, where only a minority of ideas achieving commercial success (Mamonov and Peterson, 2021; KPMG, 2020). We build on the capabilities and orchestration literature to further investigate how incumbents integrate and coordinate employees' contributions to digital innovation.

3 Methodology

3.1 Data collection

Our overall aim with this paper is to shed light on the organisational competences that firms must possess to turn their employees' digital innovation potential into a sustainable competitive advantage. Exploring such a complex and emergent phenomenon calls for an in-depth understanding of social and technological interactions in a real-life context (Yin, 2014). We thus settled for a qualitative research approach based primarily on participant-observation and semi-structured in-depth interviews at our case organisation, and further complemented by expert interviews and secondary data for triangulation (Wynn & Williams, 2012). This work is part of a larger research project aimed at understanding organisational initiatives, processes, and competences for digital innovation. When we first established contact with the case organisation in January 2019, it had set up structures (i.e. digital innovation

department) and deployed initiatives (i.e. idea management programme with multiple ongoing idea campaigns, digital showroom, digital innovation workshops) specifically dedicated to generating digital innovation with its employees.

Date	Role of respondent	Duration (#minutes)
2019-05-10	Digital Innovation Director	120
2019-05-31	Digital Innovation Director	105
2019-06-13	Digital Innovation Lead EU	60
2019-06-26	HR Manager (idea campaign/workshop participant)	60
2019-07-02	Innovation Specialist	120
2019-07-09	Digital Innovation Lead AM	90
2019-07-10	Manufacturing Global Director (idea campaign participant)	30
2019-07-11	Global Creative Director (idea campaign/workshop participant)	60
2019-07-15	Product Development Director (idea campaign/workshop participant)	45
2019-07-16	Field Support Technician (idea campaign participant)	45
2019-07-23	Digital Innovation Senior Lead	30
2019-08-30	Digital Innovation Director	45
2019-10-10	Digital Innovation Lead AM	30
2019-11-07	Digital Innovation Lead EU	50
2019-11-22	Innovation Specialist	90
2020-01-17	Digital Innovation Director	60
2020-02-03	Digital Innovation Lead EU	45
2020-04-30	Innovation Specialist	60

Table 1. Overview of semi-structured in-depth interviews

We collected our case study data between March 2019 and May 2020. In a first step, one author performed six months of participant-observation in the digital innovation department, collecting internal documents (i.e. strategy roadmaps and reports, meeting memos) and interacting with the department's digital infrastructure (i.e. intranet, idea management system, prototyping software). After having spent the first two months on site familiarising with the company's overall structure and the department's history, mission, and main activities, we acknowledged a strong fit between the case and our research interests. While participant-observation was still ongoing, a second author was therefore introduced to the case to conduct semi-structured interviews with members of the digital innovation department and employees who participated in idea campaigns and digital innovation workshops. The familiarity we had acquired with the case up to that point was highly valuable in identifying suitable interviewees, locating additional information, and contextualising emerging insights.

Over approximately one year, we performed a total of 18 interviews ranging from 30 minutes to two hours (see Table 1). We used a flexible interview guideline with an initial focus on idea development, which we gradually adapted to capture how our case coordinated and integrated employees' contributions to digital innovation in its enterprise-wide initiatives. Next to the interviews, the second authors further engaged with the case by visiting the internal showroom dedicated to emergent

prototyping technologies and inhouse digital innovation projects, and by participating in a full-day workshop designed to develop innovative e-commerce solutions with employees. Both the showroom and workshop allowed for rich and informal interaction with members of the digital innovation department, employees from business and IT departments, and externally mandated designers, and offered complementary insights into our case's initiatives for enterprise-wide digital innovation. We transcribed the interviews and synthesised key insights from the participant-observations in a research report.

3.2 Data analysis

We analysed the data in the same order it was collected. We developed our initial coding scheme based on our synthesis of the digital capabilities and orchestration literature. This initial code set focused our analytic attention on competences, processes, practices, and resources that underlie the initiation of digital innovation. We allowed our initial code set to evolve and shift to account more explicitly for the involvement of non-IT employees and their use of digital artefacts in the innovation process. This enabled us to deeply explore how IT and non-IT employees' contributions were coordinated and integrated in our case's digital innovation initiatives. Specifically, we gradually added a set of inductive codes to capture how self-orchestration and choreography competences emerged from our data. We notably captured with codes how the coordination and integration of employees' contributions was critically supported by digital innovation practices performed at the level of individual employees. We further coded how digital technology, and more specifically digital artefacts, supported these individual practices, which led us to surface tensions between employee empowerment and control. Finally, we favoured a rich analysis by adding codes about our case's competitive environment, corporate structure, and strategy. We added the inductive codes as our analysis progressed and we regularly went back and forth between the literature and our data to check for existing scholarly knowledge.

Two authors coded the data using the MAXQDA coding software. They started by discussing the initial coding scheme to reach a common understanding of the deductive codes and then frequently met to discuss new insights and resolve discrepancies in their understanding of the emerging codes. Next, we organise our findings according to salient managerial interventions that enabled our case to deploy and refine its enterprise-wide initiatives for digital innovation (i.e. its idea management programme, digital showroom, and digital innovation workshops). We show how these interventions were instrumental in developing three organisational competences (i.e. orchestration, self-orchestration, choreography) and strengthening our case's capabilities for digital innovation.

4 Building enterprise-wide digital innovation

Innovation at our case was historically driven by R&D activities. Like other firms in the perfumery industry, it had emphasised operational optimisation over radical rethinking of product lines. Outside

of R&D, managers would oversee innovation as they saw fit. Due to tight schedules, business units would rarely act upon bold new ideas, especially when they included digital components. With the IT unit focused on maintaining the existing technology landscape, digital technology exploration largely boiled down to handling business request for software applications and data integration. Yet at the same time, digital-savvy new entrants caused turbulence in the historically stable perfumery industry. Threatened by the disruptive potential of artificial intelligence and mass customisation, major players were merging or formed alliances with technology giants in hope of fruitful partnerships. Our case's traditional corporate culture and long history of organic growth, however, prohibited such an approach. Instead, the growing competitive pressure led our case to deploy enterprise-wide initiatives for digital innovation.

4.1 Launching digital innovation initiatives

When our case announced its digital transformation strategy in March 2018, it outlined a vision for digital innovation built around five pillars: creativity (workstations), clients (e-commerce), sustainability (traceability), legacy (operations), and people (recruiting). Overall, the strategy aimed at renewing and transforming existing processes, work routines, and business models using digital technology. By disconnecting innovation from traditional R&D pipelines, it was further meant to accelerate ideas' time to market to keep pace with the competitive landscape. Until that point, there had not been a systematic approach to innovation outside of R&D departments, nor to digital innovation outside the IT unit. To help implement this digital transformation strategy, our case consolidated its team of "innovation mavericks" into a formal department for digital innovation. The department's primary mission was to marshal internal resources and apply them to digital innovation. To help fulfil this mission, it implemented enterprise-wide initiatives that would help locate such resources, before coordinating and integrating them for value creation. Most prominently, the department decided to leverage initiatives to harness non-IT employees' largely untapped potential for digital innovation. This is not to say that the initiatives were deployed as initially planned. The department indeed faced unexpected hurdles due to the diverse, emergent, and ill-defined nature of employees' contributions to digital innovation. These challenges were addressed by iterative refinements in how the initiatives were carried out, which in turn allowed for three competences to form and develop: orchestration, self-orchestration, and choreography. Labels in italic and brackets refer to Table 2 in the next section.

4.2 Structuring the digital innovation process

Upon its formation in March 2018, the digital innovation department assessed what initiatives would best support the organisation's overall digital transformation strategy. The growing trend towards co-creating innovation in other organisations suggested that internal open calls for ideas could tap into employees' business knowledge, skills, and creativity across functional departments. Various idea

campaigns and an underlying idea management system indeed allowed the department to centrally harness internal efforts for digital innovation (*orchestration – marshal*). However, such an enterprise-wide approach represented a dramatic shift from how our case had traditionally practiced innovation. Specifically, innovation was no longer performed by specialised teams only but by distributed employees with a variety of functional backgrounds. Practically speaking, our case had to strengthen its ability to break functional silos, especially between business units and IT staff. The department played a key role in this regard: *"Our mission is to connect the dots internally, avoid working in silos, and integrate ideas"* – Digital Innovation Lead EU. To help coordinate and integrate contributions to digital innovation, the department structured idea development activities into a stage-gate process with predefined phases, actors, and roles. The process defined the level of involvement of non-IT employees and IT staff, with non-IT employees' involvement being strongest in the early phases of idea generation while IT involvement peaked in later phases of technical development. Furthermore, each phase was punctuated by a mandatory and scheduled stage-gate where employees pitched their ideas to managers and IT staff. The stage-gate presentations provided an opportunity to merge similar ideas, split complex ideas into multiple projects, reassign unrelated ideas to a different campaign, and discard ideas with low potential (*orchestration – channel*). The ability to successfully channel employees' contributions was strongly dependent on how well the department, managers, and IT staff would understand its conceptual and technical underpinnings. Employees were therefore strongly encouraged to illustrate their ideas with digital artefacts in stage-gate presentations. However, it turned out that employees did not use digital artefacts as initially planned: *"Employees come to the pitch saying: 'So, I've made some good progress, I produced a new PowerPoint [laughs] and as you can see from my completely imaginary business plan, this is the expected performance of my idea'"* – Innovation Specialist. Although these digital artefacts proved useful to the department in helping determine which stakeholders could help develop the idea in line with the overall business strategy, it turned out to be of little value to employees and their innovation practices. This observation made the department wonder how to leverage employees' digital creativity and prototyping skills more efficiently.

4.3 Unlocking the digital creativity of employees

The early focus on idea management resulted in a predominantly linear approach to digital innovation. This was further exacerbated by the strong reliance on IT staff for technological development, which caused iterative rounds of digital prototyping to be prohibitively costly and time consuming. While the stage-gate logic provided a good fit with our case's project management practices, it ultimately made employees unable to iteratively experiment with digital technologies to explore their ideas. As a member of the digital innovation department put it: *"What we are missing is the iterative approach. I mean do we allow ourselves to redefine an idea and to reconsider the relevance of a problem? That's where it gets stuck"* – Innovation Specialist. The IT unit constituted a bottleneck that caused emergent

feedback to be disregarded in fear of missing stage-gate targets. A member of the digital innovation department summarised: *"[Employees] are thinking: 'I committed budget to this idea, and people are working on it. I can't just tell them to stop everything and work on this other idea I had which seems much more promising according to external feedback'. The process is not fluid enough to allow for this"* – Innovation Specialist. Unlocking non-IT employees' creativity required digital prototyping to be more independent from the IT unit (*self-orchestration – decouple*). Some non-IT employees had started to experiment with rapid prototyping tools for themselves to help crystallise the envisioned digital solution. The department eagerly supported these isolated efforts by setting up a digital showroom featuring innovative digital technology (e.g. virtual reality headsets, 3D printers, artificial intelligence software) to provide inspiration for physical and virtual prototyping. Promoting digital prototyping activities among non-IT employees was expected to reduce the need for IT staff in the early stages of idea development and stimulate iterative development (*self-orchestration – iterate*). It indeed allowed to show prototypes to target users early on, to test multiple draft versions quickly, and to continuously learn from their feedback: *"So what we did in terms of prototyping was kind of prototyping a platform. But it since evolved… And you know that's the thing too! Sometimes these things just evolve… Some things start to shift and change as you go [laughs]. It's a constantly evolving kind of project"* – Global Creative Director. Ultimately, this gave employees the ability to orchestrate contributions to their projects on an individual level: *"I have also presented the prototype to key stakeholders within [the firm], so all the other global leads are familiar with this... Technology people here, fragrance design, people working on emotions… So, I loop them in. And that's a key part of the process, looping in all the key people who might have a role or might be able to help"* – Global Creative Director.

4.4 Consolidating digital prototyping activities

When the digital innovation department met in July 2019 to set the strategic focus for the coming year, the need to strengthen digital prototyping activities emerged as a strong priority. Indeed, several dozen prototypes had been kicked off since March 2018, yet an overwhelming majority remained stuck in various stages of development because of scarce IT resources: *"The irritating aspect for us is that we lack 'doers'. We don't have designers and we don't have developers. When we must prototype something, it's very complex"* – Digital Innovation Director. To help streamline ongoing digital prototyping activities, an UX designer joined the digital innovation department. The hire benefited the department in that it complemented the team's current expertise with low-code prototyping skills that allowed to leverage IT and non-IT employees' contributions more efficiently (*choreography – streamline*). The low-code prototyping platform featured reusable visual components for software application development. These building blocks allow to quickly develop, test, and refine functional high-fidelity prototypes in an experimental environment without running the risk of impacting the

existing IT infrastructure. Inside the boundaries of the platform, ideas could be explored without the constraint of involving IT staff, yet with the benefit of creating digital artefact that could easily be understood by IT staff in later stages of technical development (*choreography – align*). Even though low-code technology had not yet been widely adopted throughout the organisation, it had proven potential for the coordination and integration of employees' contributions in digital innovation workshops: *"Our designer uses low-code when he prototypes digital applications with employees in our workshops. It really makes a difference in how we involve stakeholders. We're better able to tell IT what we want from them and avoid unnecessary costs… We'd like to use it at larger scale internally but for now I think we're not quite ready for it"* – Digital Innovation Director.

5 Discussion

Organisations that foster innovation are experimentative – eager to embrace new ideas regardless of their origins. Employees readily come up with innovative ideas relative to their day-to-day use of digital technology and therefore constitute a potent and prolific resource for digital innovation (Shao et al., 2021). Since employees' contributions to digital innovation tend to be diverse, emergent, and ill-defined, innovation research has long examined how managers can promote high quality contributions (Gerlach and Brem, 2017) and efficiently assess ideas for further development (Blohm et al., 2013). These aspects will only become more relevant as digital technology offers novel and often unexpected ways for employees to generate innovations (Arvidsson and Monsted, 2018). However, non-IT employees' increased involvement in digital innovation transforms organisational innovation in more fundamental ways (Nambisan et al., 2017). Thanks to the ability of digital artefacts to support innovation practices (Ciriello et al., 2019), orchestration processes are more likely to unfold also at the individual level, with non-IT employees taking an active role all along the idea development process. In contrast to how innovation management research has generally conceptualised employees' role as that of idea providers in a clear-cut initiation phase (Zuchowski et al., 2016), our case understood that all employees, including those with minimal technical skills, may actively contribute to digital innovation in overlapping phases of initiation, development, and implementation. These transformations in the management and practice of digital innovation required our case to reassess its capabilities for digital innovation. To explore this further, we identified three competencies that jointly enabled our case to strengthen its capabilities for digital innovation in an enterprise-wide manner: orchestration, self-orchestration, and choreography. We further observed how digital artefacts and the multiple roles they enact in the innovation process were instrumental in building these competences. Table 2 provides an overview of our analysis.

	Orchestration	Self-orchestration	Choreography
Key challenges	Employees' various backgrounds cause contributions to be **diverse**.	Employees' active involvement causes contributions to be **emergent**.	Employees' lack of digital expertise causes contributions to be **ill-defined**.
Managerial interventions	- Launch idea campaigns - Structure innovation process - Negotiate IT resources	- Acknowledge IT bottleneck - Set up digital showroom - Promote digital prototyping	- Hire UX designer - Refine innovation workshops - Optimise IT resource use
Main objective	*Oversee contributions to digital innovation*. **Marshalling** employees' ideas for digital innovation enabled the department to **channel** efforts towards strategic opportunities.	*Enhance self-efficacy for digital innovation*. **Decoupling** digital prototyping activities from the IT unit brought economic freedom via low-cost development and enabled employees to **iterate** quickly.	*Build a common understanding of digital innovation*. **Streamlining** digital prototyping activities helped **align** IT and non-IT employees' contributions to digital innovation.
Case illustration	Employees' stage-gate presentations enabled the department to guide idea development with key business and IT stakeholders.	Low-code technologies allowed employees to explore contradictory insights and pivot independently from the IT unit.	Prototyping platforms incorporated technological guidelines that eased the transition towards a deployable digital artefact.

Table 2. Overview of the narrative and competence analysis

5.1 Competences for enterprise-wide digital capability

- The **orchestration competence** builds on the idea that organisations must centrally coordinate and integrate contributions to digital innovation as innovation boundaries become more diffuse (Nambisan et al., 2017). Our case started developing its orchestration competence early on in the deployment of its digital innovation initiatives. It materialised as a deliberate effort driven by top-management to create new organisational structures for the purpose of involving non-IT employees in digital innovation. Accordingly, the coordination and integration of employees' contributions was performed centrally by the digital innovation department, with the benefit of creating a safe space where non-IT employees could experiment with digital technology and obtain resources to develop their ideas. The idea campaigns that were launched and overseen by the department channelled employees' efforts towards a specific business opportunity. The stage-gate process directed participants' contributions by formally defining phases, actors, and roles. Accordingly, IT staff and non-IT employees were incentivised to collaborate at specific points in the idea development process and this was gradually refined to make the most efficient use of available IT resources. As orchestration stems from the need to combine knowledge and skills that are scattered across the organisation, it is important to consider how different structures help integrate knowledge in practice (Iho and Missonier, 2021). For instance, organisations increasingly deploy digital innovation labs as alternative structures to integrate business and IT knowledge (Holotiuk and Beimborn, 2019). These structures affect the roles and responsibilities of the IT unit when it comes to exploration and alter the organisation's economic and political logics regarding digital innovation (Goebeler et al., 2020). The expression and effect of orchestration competences may thus vary across organisations.

- The **self-orchestration competence** extends on the idea that employees must integrate and coordinate contributions on an individual level when they develop digital artefacts. Previous research recognises the inherent ambiguity of digital artefacts (Leonardi, 2011) and the difficulty for employees to clearly communicate the purpose and potential of ideas with digital core components (Ciriello et al. 2019). In fact, digital artefacts can have divergent meanings to stakeholders with different backgrounds (Briel et al., 2018). In our case, employees experimented with rapid prototyping tools to help themselves and others make sense of ambiguous contributions. Digital technology thus served as a tool to facilitate the coordination and integration of IT and non-IT employees' contributions at the individual level, and this ultimately resulted in a more efficient use of IT resources. Table 2 notes in this regard how decomplexifying technical tasks was a critical enabler for self-orchestration as it helped non-IT employees to explore ideas themselves with their digital prototypes. Employees as active co-creators in a distributed digital innovation process has been previously observed in the literature (Mueller and Renken, 2017) and, as our case shows, requires a rudimentary understanding of IT by non-IT employees. We thus view orchestration and self-orchestration as complementary competences, especially with regards to guiding employees in digital prototyping efforts (Majchrzak and Griffith, 2021).
- The **choreography competence** is for now quite poorly understood. In their study of digital innovation management at Volvo Cars, Svahn et al. (2017) suggest that organisational initiatives do not necessarily lead to successful digital innovation because of competing concerns triggered by underlying shifts in organisational logics. In our case, employees' experimentations with digital prototyping tools caused competing concerns in innovation governance because of the blurred boundaries between employee empowerment and control (Majchrzak and Griffith, 2021). Our case indeed needed to establish governance mechanisms that would guide employees' behaviour without excessively constraining their digital creativity (Wareham et al., 2014). As Table 2 notes, low-code technology was part of the answer in that it lowered the barrier for technical development by non-IT employees, while at the same time providing a guiding canvas for digital prototyping that was in line with the overall IT strategy. Choreography thus complemented orchestration and self-orchestration competences in that it helped align employees' contributions and further enhance the use of IT resources. Future research on choreography may build upon the paradox perspective (Ciriello et al., 2019) to understand how digital artefacts simultaneously enable and constrain digital innovation practices.

Finally, we find that digital artefacts simultaneously served as an avenue to guide development and implementation, to uncover needs and assumptions, and to align understandings and interests in digital innovation initiatives (Ciriello et al. 2017; von Briel et al., 2018). Table 3 illustrates the multiple roles of digital artefacts. Owing to this multiplicity of roles, non-IT employees could free themselves from traditional innovation processes in streamlined innovation practices. As such, digital technology may

constitute both a liberating and a constraining force for employees. While we have started to gain a better understanding of how digital artefacts support individual innovation practices in recent years (Ciriello et al., 2019), research is far from conclusive on how organisations should address this tension. Our case organisation demonstrated the benefits of orchestration, self-orchestration, and choreography in this regard. However, the use of digital artefacts in employees' innovation practices may differ significantly and organisations may therefore need to consider complementary competences to successfully mitigate the tension between employee empowerment and control. As digital artefacts offer tremendous potential for digital innovation, future research would do well to investigate the relationship between their use in innovation practices and organisational competences for digital innovation. In particular, understanding nuances in how the plural role of artefacts enhance the use of IT resources in digital innovation may constitute a promising avenue for research (Ciriello et al., 2017; Nicolini et al., 2012; Nambisan et al., 2017).

Role	Definition (Ciriello et al., 2017; Nicolini et al., 2012)	Case illustration	Competence
Activity object	Activity objects embody different types of knowledge, thereby generating contradictions, triggering collaboration, directing activities, and sparking innovation.	The department leveraged digital artefacts to oversee idea development and enhance its fit with strategic interests *(guide development and implementation)*.	Orchestration
Epistemic object	Epistemic objects embody what one does not yet know and thereby generate desire and attachment through their unfulfilled nature.	Employees used low-code prototyping technology to unearth needs and challenge assumptions with key stakeholders *(uncover needs and assumptions)*.	Self-orchestration
Boundary object	Boundary objects enable collaboration by developing and maintaining coherence across social worlds.	Prototyping platforms promoted a shared understanding of the envisioned solution and helped guide technical implementation *(align understandings and interests)*.	Choreography

Table 3. Overview of digital artefacts' multiple roles and related competences

5.2 Implications for research and practice

The focus of capabilities research in the IS discipline has significantly evolved over the last decades (Wade and Hulland, 2004). While research initially aimed to understand how IT resources could provide a sustainable competitive advantage (Clemons and Row, 1991), subsequent studies also recognise the strategic potential of non-IT resources (Mata et al., 1995). The focus consequently shifted from how to set up IT units (Bharadwaj et al., 1998; Feeny and Willcocks, 1998) to how to develop enterprise-wide capabilities for digital innovation (Peppard, 2018). Today, it is clear that innovating with digital

technology is a complex phenomenon that requires organisations to reassess their approach to innovation management (Vega and Chiasson, 2019; Kohli and Melville, 2019). Considering the disruptive potential of digital technologies, numerous calls have been made to examine how organisations can strategically harness their IT and non-IT resources to strive in such dynamic environments (Arvidsson and Monsted, 2018; Nambisan et al., 2017; Svahn et al., 2017; Shao et al., 2021).

The three competences we have identified suggest several implications for IS research and practice. To underline the novelty and impact of our research, we discuss our main findings with regards to three emerging trends in IS strategy research as described in Teubner and Stockhinger (2020).

First, IS strategy research is reassessing its understanding of IS strategy development (Teubner and Stockhinger, 2020). Rather than being driven solely by top management and the exploitation of existing technologies and use cases, IS strategy is increasingly acknowledged to derive from the explorative use of technology at all levels of the firm (Peppard et al., 2014). Our findings add to this by highlighting the role of digital artefacts for enterprise-wide experimentation and learning "with a sense of direction and purpose" (Teubner and Stockhinger, 2020, p.4). Specifically, our case encouraged non-IT employees to contribute their exclusive and highly contextualised business knowledge to digital innovation using digital prototypes such as low-code applications. Harnessing non-IT employees' digital creativity with digital artefacts put our case in a better position to identify and act upon opportunities that top managers would have missed. We argue that non-IT employees participate in IS strategizing when they transform their ideas for digital innovation into implementable concepts with the help of digital artefacts. Our case understood that extending strategy development to non-IT employees calls for a digital innovation governance that creates a safe space for employees to flexibly develop their ideas, while guiding their creativity to ensure the efficient use of available IT resources. Other organisations can learn from our case in this regard, especially when it comes to balancing empowerment and control with orchestration, self-orchestration, and choreography competences and digital artefacts, such as low-code development platforms. Managers would do well to reflect on how the structures they implement enable and constrain non-IT employees' participation in IS strategy development.

Second, IS strategy research increasingly acknowledges the blurring of IT and business capabilities and the need for IT-enabled business capabilities (Teubner and Stockhinger, 2020). In a world where digital technologies lie at the heart of doing business, digital innovation often originates outside the IT department and viewing IS as a separate organisational unit thus no longer reflects the reality of digital innovation management (Peppard, 2018). Our findings concur that the initiation of digital innovation is not confined to the perimeter of the IT unit. We further argue that capabilities that bridge the language, culture, and skills gap between IT and non-IT employees are key to digital innovation and superior performance. Specifically, our case developed orchestration, self-orchestration, and choreography

competences to integrate and coordinate contributions to digital innovation stemming from its IT and non-IT employees. Doing so allowed our case to address the malleability and ambiguity of digital technology (von Briel et al., 2018) and to efficiently deal with the emergent and iterative nature of the digital innovation process (Nambisan et al., 2017). However, much remains to be understood about non-IT employees' increased involvement in IT-enabled business capabilities. In particular, little is known about the challenges non-IT employees face when they perform digital exploration alongside their traditional business role (Holotiuk and Beimborn, 2019) and about the underlying cognitive burden and behavioural requirements they face when switching between exploitation and exploration activities (Iho & Missonier, 2021). While not focusing on the individual level per se, our study supports these research efforts by pointing out managerial interventions that can support non-IT employees' digital innovation practices.

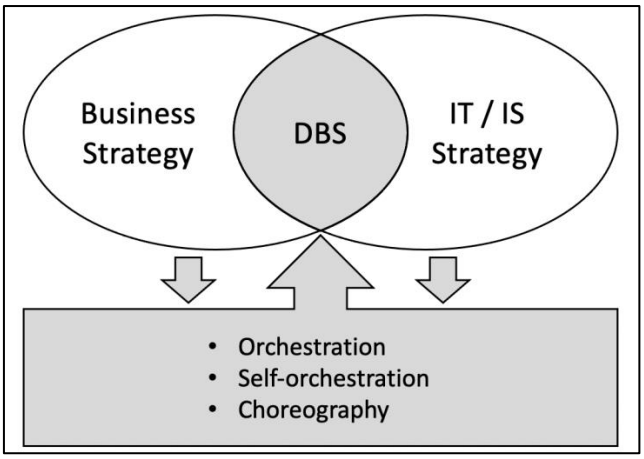

Figure 1. Orchestration competences and business and IT / IS strategy

Third and last, IS strategy research increasingly acknowledges the interconnectedness of business and IT on a strategic level (Teubner and Stockhinger, 2020). The concept of digital business strategy (DBS) captures how digital technology has become an integral part of business strategy (Bharadwaj et al., 2013). While recognising the importance of business strategy and IT strategy independently, DBS specifically focuses on their intersection and "new concerns in business strategy making that arise from digitalisation" (Teubner and Stockhinger, 2020, p.10). Our findings highlight the participation of non-IT employees in the initiation of digital innovation as one such concern. Specifically, our case had to understand how non-IT employees can make valuable contributions beyond the idea generation phase by leveraging digital technology. It learned to think of non-IT employees' contributions as resulting from the interaction between organisational structures and individual innovation practices, and the supporting role of digital artefacts. We argue that orchestration, self-orchestration, and choreography competences helped strengthen our case's DBS (i.e. arrow from competences to DBS). Specifically, our case leveraged these three competences to direct non-IT employees' digital innovation efforts

towards strategic business opportunities (i.e. arrow from business strategy to competences) while making sure their digital prototyping practices fit with the overall IT strategy (i.e. arrow from IS/IT strategy to competences). At the same time, non-IT employees indirectly shaped our case's business and IT strategies by contributing to DBS (i.e. DBS intersects with business and IS/IT strategy). Figure 1 provides a visual representation of how non-IT employees initiate digital innovation at the intersection of business and IT strategy thanks to orchestration, self-orchestration, and choreography competences.

6 Conclusion

In markets characterised by fast-paced innovation and frequent disruption, organisations long for a sustainable competitive advantage that effectively shelters them from market turbulences and ensures long-term profitability. According to the resource-based view (RBV) of the firm, it is the resources they own and the competences they possess that allow organisations to build distinct capabilities that competitors cannot easily imitate or acquire. Although it is just emerging, we are getting glimpses of how involving non-IT employees in digital innovation critically transforms capabilities for digital innovation from being mostly confined to the IT unit into "enterprise-wide" drivers for competitive advantage.

To explore this aspect, we studied the case of an incumbent organisation and its initiatives for initiating digital innovation with employees. We focused on how the organisation orchestrated employees' contributions over time, especially in terms of how it integrated and coordinated the ideas employees shared, the feedback they received, and the prototypes they built. We view our main contribution in the identification of three competencies that jointly enabled the organisation to create digital innovation with non-IT employees and to strengthen its enterprise-wide capability for digital innovation while making efficient use of its IT resources. The competences we identified –orchestration, self-orchestration, and choreography– underline the shift from employees as a mere source of innovative ideas to employees as active contributors throughout the innovation process and to the organisation's digital business strategy. This shift evidences the need for organisations to actively harness the plural roles of digital artefacts in the innovation process.

We acknowledge limitations to our study. A first limitation is inherent to our single longitudinal case study design. While it is an adequate fit for the emergent nature of the phenomenon and the exploratory nature of our research, investigating a single organisation entails limitations regarding the generalisability of our findings. The reader should thus acknowledge our case's specific context and characteristics before transferring our findings to other organisations. A second limitation lies in our narrow analytical focus on orchestration competences. We acknowledge that other competences may critically underlie enterprise-wide digital capabilities. Yet, we purposefully chose to zoom in on orchestration as we suspected it to constitute a particularly relevant, yet poorly understood, competence

for digital innovation with employees. Furthermore, we remained alert to complementary competences (i.e. self-orchestration and choreography) by allowing for novel insights to emerge during our analysis.

This paper aims at providing interesting insights to scholars who study how digital innovations form and evolve within incumbent firms, and how digital artefacts supports this evolution. Whereas our analysis was primarily developed with research in mind, we hope that our findings will also prove useful to managers who wish to gain competitive advantage with digital innovation initiatives that involve employees across functional boundaries. We see fruitful research avenues in investigating orchestration, self-orchestration, and choreography competences in other organisational settings. We thus strongly encourage our fellow researchers to build on our study to further validate, amend, and enrich our understanding of organisations' much-needed capabilities for digital innovation.

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APPENDIX F – METHODOLOGICAL BRICOLAGE

This section described "methodological bricolage" as conceived by Pratt et al. (2022). Specifically, we first highlight the benefits of methodological bricolage and then explain common pitfalls in using more rigid methodological approaches.

Benefits of methodological bricolage. Pratt et al. (2022), whose authors are well-versed editors in top-tier qualitative research journals, have recently proposed "methodological bricolage" as an organizing metaphor for producing trustworthy qualitative research. Methodological bricolage is defined as an approach to the purposeful arrangement of various methodological moves to address a specific research setting. Researchers are understood to as "bricoleurs", who must display agency, creativity and craft when doing qualitative research to match the reality of the field. Pratt et al. (2022) argue that "methodological bricolage" can help qualitative researchers show competence, integrity, and benevolence, and thereby enhance the trustworthiness of their research in situation where they do not follow a rigid template. In short, "custom fit" bricolage is opposed to "one-size-fits-all" template solutions. Mindfulness in methodological choices can help researchers avoid the recipe-like and creativity-destroying use of established methodologies, and safeguard methodological diversity and innovation against the alarmingly narrow use of methodological templates.

Methodological templates. By contrast, methodological templates offer a valuable starting point to qualitative methods by offering concrete guidance on how to execute qualitative research. From the perspective of a doctoral student, templates hold particular potential in situations when a suitable methodological mentor cannot be easily found or when published applied examples of a given methodology are scarce.

Two methodological templates have experienced particularly strong interest in qualitative research (Langley and Abdallah, 2011): the Eisenhardt method (Eisenhardt, 1989, 2021) and the Gioia method (Gioia et al., 2013). These methods are named after Kathleen Eisenhardt and Dennis Gioia respectively, who first described and justified the strategic use and purposeful combination of specific "analytic moves" in their qualitative studies (Pratt et al., 2022, p.1). While both methods deal with case study research, they strongly differ in their epistemological approach. On the one end of the philosophical spectrum, the Eisenhardt method has traditionally provided guidance to scholars who engage in multiple case study research with a positivist mindset (Eisenhardt, 2021). On the other end, the Gioia method has often served scholars who engage in single case study research with an interpretative mindset (Gioia et al., 2013). The two templates consequently advocate different methodological choices. For instance, a prominent analytic move in the Eisenhardt method is cross-case analysis in multiple case study research (Eisenhardt, 1989), and the Gioia method is most famous for its data table in single case study research (Gioia et al., 2013). Langley and Abdallah (2011) provide

an excellent overview and a thorough analysis of each method's constituent moves, along with the method's methodological references, philosophical underpinnings, inherent logic, and rhetoric tactics[3].

Pitfalls of methodological templates. Although the Eisenhardt and Gioia methods were not initially intended as methodological templates (and the authors themselves caution against using their work as such), they appear to be particularly effective for publishing qualitative research. As a result, they are now extensively used by scholars across the social sciences to guide the design and writing up of case study research (see Langley and Abdallah (2011) for examples). However, *the methods are often used with an incomplete understanding of their epistemological foundations and methodological implications* (Pratt et al. 2020). While appreciating the accessibility templates have brought to qualitative research, Pratt et al. (2022) note how the increased use of templates tends to confuse researchers as to how the template fits their specific research objectives and narrow their methodological choices, thus potentially limiting ground-breaking theoretical work. By proposing the concept of "methodological bricolage" instead, they engage in a fierce and long-winded debate in qualitative research: *what is it that makes qualitative research trustworthy?*

We agree with Pratt et al.'s (2022) argument that **trustworthy qualitative research entails the mindful use of methods that are selected specifically for the context and objectives of the study at hand**, rather than the reuse of a ready-made set of methods on the basis of their proved potential for publication.

[3] Langley and Abdallah (2011) also point towards other emergent approaches to qualitative analysis (specifically in the strategy and management field): the practice turn and the discursive turn. These turns are less mature and have not yet made it into formal templates.

APPENDIX G – INTERVIEW PROTOCOL

1. *My name is Désirée Krejci, I am a PhD student at Unil. This is part of my doctoral research.*
2. *Thank you for participating in this research on digital innovation management.*
3. *To facilitate note-taking, I will record our conversations. [start recording]*
4. *You can ask to stop the recording at any time.*
5. *Explain content of consent form and request (verbal) consent to participating.*
6. *The interview is planned to last X minutes. [start timer]*
7. *During this time, we have several open questions that we would like to cover.*
8. *Your participation is voluntary, and you can withdraw from this interview at any time.*

****

Introduction

You have been selected to speak with us today because you have been identified (or recommended to us by X) as someone who has a great deal to share about (or first-hand experience with) the internal idea campaigns/digital innovation management. Our research project as a whole focuses on the improvement of idea campaigns/digital innovation management, with a particular interest in how the development of innovative ideas can be supported within organisations. We do not aim to evaluate your work or experiences. Rather, we are trying to learn about idea campaigns, and hopefully learn about practices that help improve digital innovation management. All information you share will be kept confidential. Transcripts of your interviews will not be accessible to your management or colleagues.

A. Interviewee Background

- Please present yourself and briefly describe your role within the organisation.
- What is your professional background?
- How long have you been in your present position? At this organisation?

B. Open Questions to Idea Campaign Participants (refined after each interview & adapted on the fly)

- Idea campaigns
  - e.g. Could you please explain the idea you submitted? What is its current state?
  - e.g. How did you first think of your idea? How did it come to your mind?
  - e.g. When did you first hear about the idea campaigns? What motivated your participation?
  - e.g. Can you walk us through the process of submitting your idea to the campaign?
  - e.g. Can you walk us though what happened after you submitted the idea?
  - e.g. What are the next steps for developing your idea?
- Idea management system
  - e.g. Why did you decide to submit the idea to the idea platform? What was your motivation?
  - e.g. What is your experience of the idea development process on the platform?
  - e.g. What is your experience of other features of the platform (track/comment/vote…)?
  - e.g. Does the platform fit your idea development practices? Why (benefits/challenges)?
- Digital innovation
  - e.g. Does this idea development differ from your normal role? How?
  - e.g. How did you go about developing the digital aspects of your idea?
  - e.g. How did you experience the prototyping of the digital solutions? (skills/resources…)
  - e.g. What resources did you use to develop the digital aspects? (software/methodology…)?
  - e.g. Did you make use of the digital innovation workshops, showroom, and/or mentors?
- Organisational culture
  - e.g. Did you feel supported in the idea development process? By whom? How?

- e.g. What impact do you expect from your participation? Personally? For the organisation?
- e.g. What were the biggest drawbacks/challenges in your idea development until now?
- e.g. Do you think everyone is capable of doing (digital) innovation? Why?

C. Open Questions to Members of the Digital Innovation Department (refined & adapted on the fly)

- Digital innovation department
  - e.g. When was the department created? For what reason? (motivation)
  - e.g. What is the overall aim of this department? (mission statement)
  - e.g. Who works in the department? What are their roles and responsibilities?
  - e.g. How do you position yourself with regards to other departments (business/R&D/IT)?
  - e.g. How did the department evolve since its inception? (major milestones)
  - e.g. How does this department compare to other big organisations/competitors?
- Innovation initiatives/Idea campaigns
  - e.g. What are the digital innovation initiatives you are currently working on?
  - e.g. What are the roles and responsibilities for these initiatives?
  - e.g. How are idea campaigns created and promoted? Can you walk us though?
  - e.g. How are ideas developed in campaigns? Can you walk us through?
  - e.g. Who participates in idea campaigns? Why do they participate? What is their role?
  - e.g. Can you please show and explain the idea pipeline for each campaign?
- Idea management system
  - e.g. What need drove the deployment of the idea platform?
  - e.g. Who manages the platform? Who manages the ideas on the platform?
  - e.g. What are the pains and gains you have experienced with the platform until now?
  - e.g. Are you satisfied with the idea platform (benefits/challenges)?
- Digital innovation
  - e.g. How do you support the development of digital ideas?
  - e.g. How do you prototype digital solutions (skills/resources…)? Can you walk us through?
  - e.g. What resources do non-IT employees have access to (software/methodology…)?
  - e.g. Can you please explain what digital innovation workshops, showroom, mentors are?
  - e.g. What is your experience with other approaches to digital innovation (hackathons/labs)?
- Organisational culture
  - e.g. What is the company's overall strategy with regards to digital innovation?
  - e.g. What performance/impact is expected from this department? How is it measured?
  - e.g. Who else is responsible for digital innovation within the organisation?
  - e.g. Are employees aware of/involved in the overall strategy for digital innovation?
  - e.g. What are the biggest challenges for digital innovation in this organisation?

****

9. *Is there anything else you would like to add? Any resources you would like to share with us?*
10. *Can you think of anyone we should interview? Who would be particularly valuable to talk to?*
11. *Thank you for your participation in this interview.*
12. *We will get back to you within X weeks if we need additional information.*
13. *We may also get back to you to ask for feedback on our findings.*
14. *Please reach out anytime if you have any questions, comments, or concerns.*

[stop recording; stop timer]

APPENDIX H – OBSERVATION PROTOCOL

1. *Briefly present myself and explain overall objective of observation.*
2. *Explain content of consent form and request (verbal) consent to participating.*

****

Overall objective

Our research project as a whole focuses on the improvement of idea campaigns/digital innovation management, with a particular interest in how the development of innovative ideas can be supported within organisations. We do not aim to evaluate your work or experiences. Rather, we are trying to learn more about idea campaigns by observing your practices around digital innovation management.

A. "Daily-business" observation (6 months – 8 hours/day)

- Type of observation: Active participation (i.e. becoming an active member of the digital innovation department, working at the Globex organisation).
- Observer: Lionel Küng.
- Role of observer: Company intern in the digital innovation department. Main responsibilities include supporting the idea management process, by maintaining the idea management system and promoting the digital innovation workshops and showroom.
- Purpose of observation:
  - Gain initial understanding of digital innovation within Globex.
  - Check fit with phenomenon of interest and refine research question.
  - Provide overview of digital innovation initiatives, their status, and challenges.
  - Identify organisational structure, culture, key stakeholders, and potential interviewees.
- Location: On premise (old headquarters – shared office; new headquarters – open space).
- Observation episodes:
  - Attending individual meetings with members of digital innovation department (~1x/day).
  - Attending team meetings with digital innovation department (~1x/week).
  - Attending strategic meetings/calls with other members of the organisation (~1x/week).
  - Preparing/attending employees' idea pitches (~1x/month).
  - Accompanying employees on visits to the digital innovation showroom (~1x/month).
  - Assisting monthly digital innovation workshops for employees (~1x/month).
  - Maintaining/interacting with employees on the idea management system (~4h/day).
  - Sporadic interactions with other employees during breaks/social events.
- Observation artefacts:
  - Observation report
  - Emails and social media communication
  - Company internal slides
  - Pictures

B. "Workshop" observation (1day – 8 hours)

- Type of observation: Passive participation (i.e. being in a bystander role during digital innovation workshop, sporadically asking questions to workshop participants).
- Observer: Désirée Krejci.
- Role of observer: External researcher.
- Purpose of observation:
  - Understand how the process of idea generation/ development unfolds for digital artefacts.
  - Understand the role of employees/ digital innovation department members in the process.
  - Gain a better understanding of the challenges related to digital (vs traditional) innovation.
- Location: On premise (new headquarters – open space).
- Workshop participants:
  - 24 employees across functional departments, hierarchical levels, and geographical locations;
  - 2 members of the digital innovation department;
  - 1 external designer.
- Observation episodes:
  - Workshop preparation and setup with digital innovation team (40 minutes)
  - Welcome, round table, and agenda (20 minutes)
  - Introduction to workshop context, problem, scope, and challenge (10 minutes)
  - Introduction to design challenge: "How to engage medium customers online?" (5 minutes)
  - Individual idea generation (5 minutes)
  - Share individual ideas (20 minutes)
  - Rate and select user needs from "must have" to "nice to have" (30 minutes)
  - Networking break (45 minutes)
  - Identify user goals and map user process (90 minutes)
  - Rapid prototyping of digital solution for client (60 minutes)
  - Pitch idea and prototype (60 minutes)
  - Wrap-up and closure (20 minutes)
  - Workshop debrief with digital innovation team (60 minutes)
- Observation artefacts:
  - Field notes
  - Agenda sheet

****

APPENDIX I – CONSENT FORM

Research Title: Case study on digital innovation
Research Affiliation: University of Lausanne, Department of Information Systems
Research Funder: Swiss National Science Foundation (SNSF project n° 100018_176359)

Reasons for Consent:
Ethical procedures for academic research require that participants explicitly agree to being interviewed/observed and to how the collected information will be used. This consent is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation.

Time:
The interview/observation will take approximatively X minutes/hours.

Risks:
We don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview/observation or withdraw from the research at any time.

For Interviews:

- The interview will be recorded, and a transcript will be produced.
- You will be given the opportunity to correct any factual errors.
- The transcript of the interview will be accessed and analysed by Désirée Krejci and academic colleagues or researchers with whom she might collaborate as part of the research process.
- Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed.
- Your words may be quoted directly but your name will not be published. All or part of the content of your interview may be used: in academic papers, on feedback events such as academic conferences, in an archive of the project.
- The actual recording will be destroyed at the end of the research project.

For Observations:

- Observations may be captured in pictures, videos, and drawings.
- Pictures and videos with identifiable people will not be made available through academic publication or other academic outlets, and care will be taken to ensure that other personal identifiers are obscured.
- The pictures and videos will be destroyed at the end of the research project.

Verbal Consent: By consenting I agree that:

1. I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview/observation at any time;
2. The transcribed interview or observation extracts may be used as described above;
3. I don't expect to receive any benefit or payment for my participation;
4. I can request a copy of the transcript of my interview and may make edits to ensure the effectiveness of any agreement made about confidentiality;
5. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

Contact Information:
If you have any further questions or concerns about this study, please contact:
Désirée Krejci, desiree.krejci@unil.ch
You can also contact the research supervisor:
Prof. Stéphanie Missonier, stephanie.missonier@unil.ch

APPENDIX J – DATA EXCERPTS

This section provides selected data excerpts from our interviews and observations. Personal identifiers such as participant names, location, and organisation name have been blackened for anonymity.

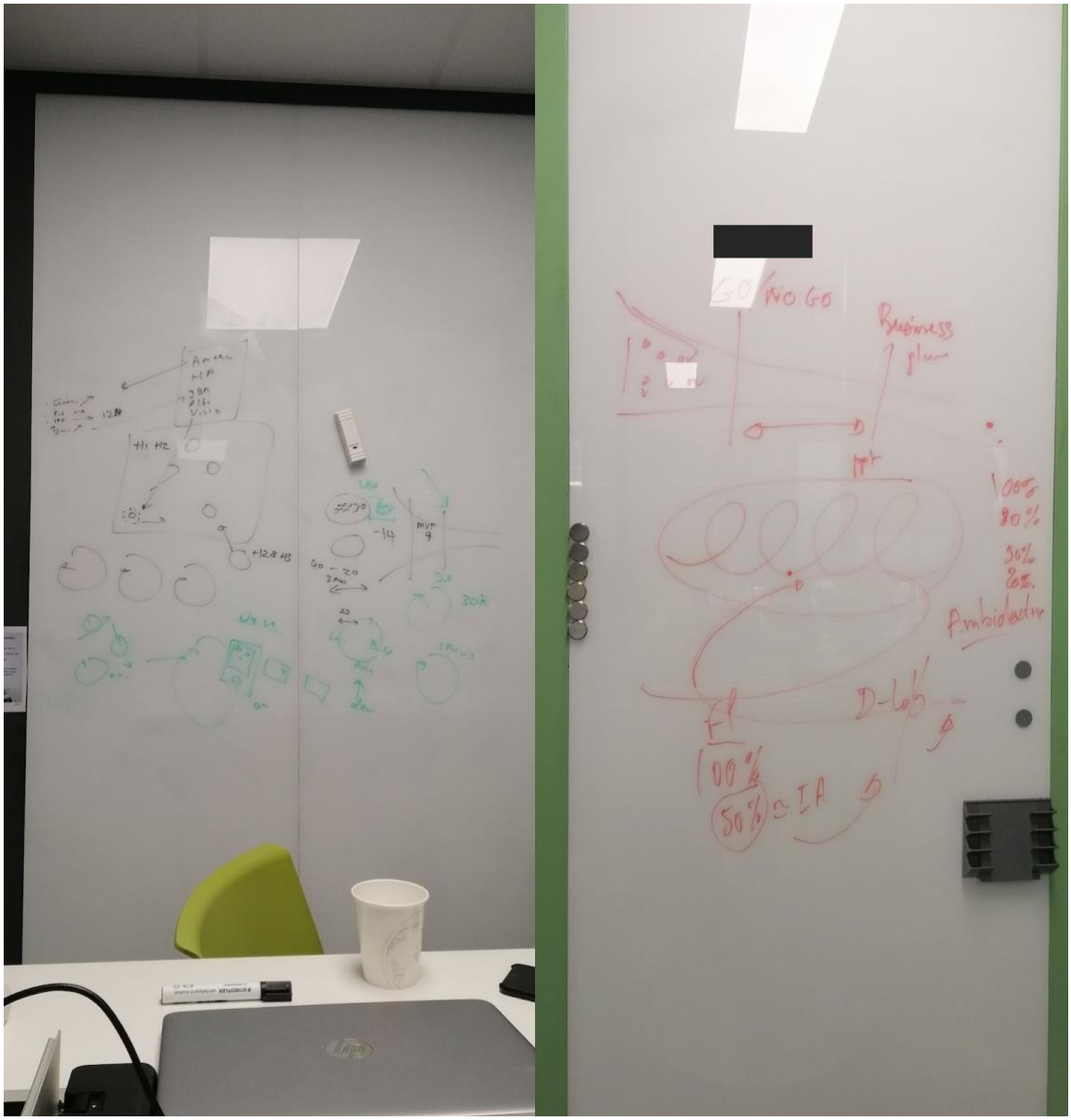

Figure 15. Observation pictures

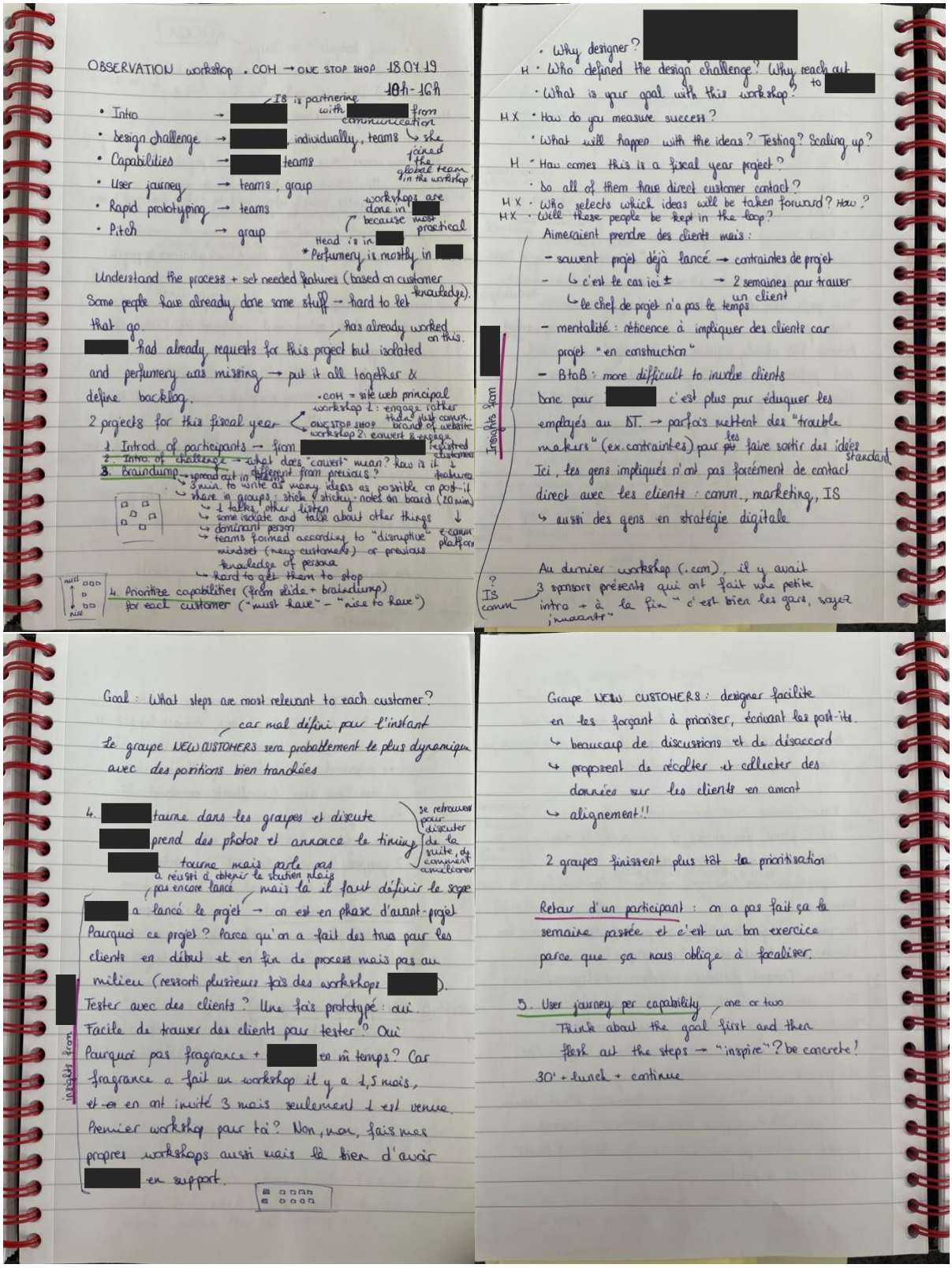

Figure 16. Observation notes, memos, and verbatims

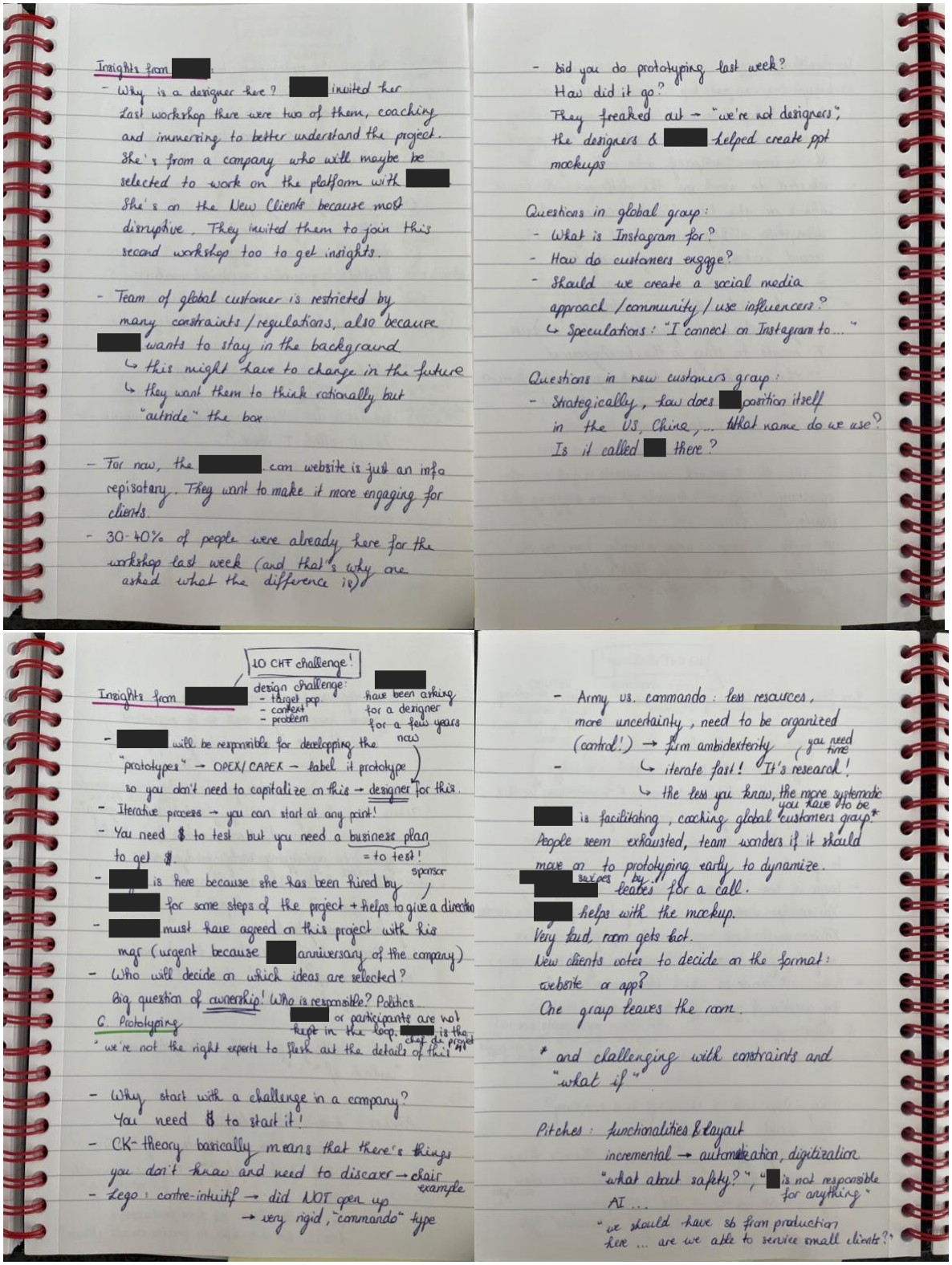

Figure 17. Observation notes, memos, and verbatims

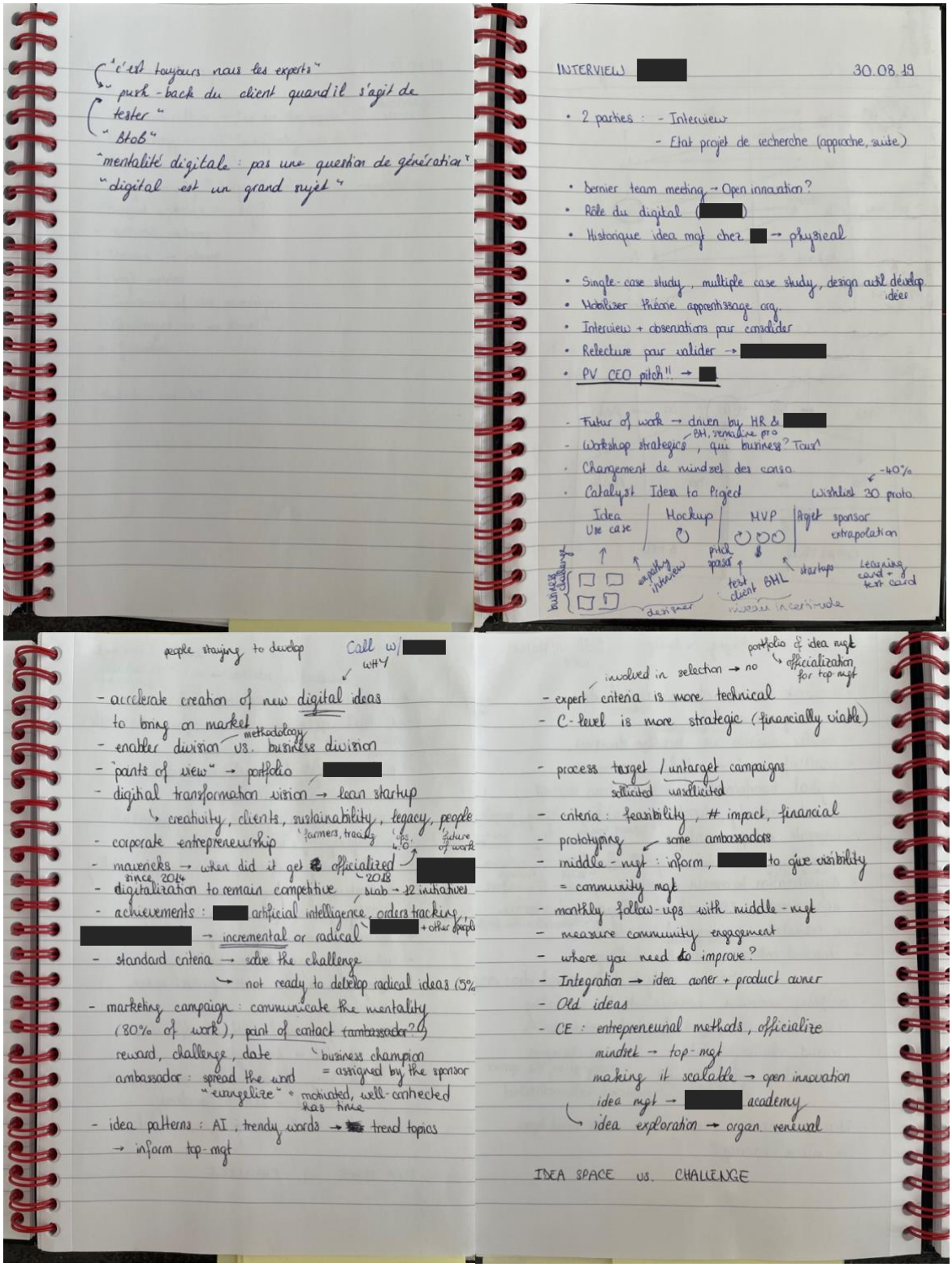

Figure 18. Interview notes, memos, and verbatims

APPENDIX K – OPEN SCIENCE

This thesis is also accessible online on the SERVAL open academic repository of the University of Lausanne.