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# Organisational Dynamics of Digital Innovation

PhD dissertation

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*Thank you to the PhD committee members for taking the time to review and provide feedback on my work— professor Andrea Carugati, professor Nicholas Berente, and associate professor Xiao Xiao.*

## Opening and Acknowledgements

Every text, once written, becomes a message from the past. My time as a PhD student is now becoming a part of the past. What is the message I can send from this time, which can provide value to you, the reader who didn't skip the opening of this dissertation? You are most likely a friend, colleague, or you are someone who picked up this thesis to help you in your own research. If you are a friend, you have my appreciation and I hope I haven't forgotten you on the next page.

If you are scanning this thesis in hope of finding help on your PhD journey, I will use this page to recount some mistakes I made. I am doing this because during my PhD, I was swimming in advice that was often conflicting, hard to replicate, outdated, or not compatible my creative style. Yes, PhD is a writing job. Writing is a creative act or art. But I am losing you, sorry. I don't want to waste my reader's time. I don't know how to give good advice, so here are a few things I which I wish I realized sooner:

*I paid attention to outcomes when I should have focused on developing a solid routine.* The discussions I was exposed to tended to be about papers, publications, awards. Generally speaking, the more, the better. The more prestigious, the better. Such way of talking has misled me. Focusing on outcomes was just making me miserable. What lies behind the outcomes is a lot of things which are hard to control, like luck or whether your supervisor decides to be available or not. What can be controlled is the process one engages in and the routines one cultivates. The outcomes follow but focusing on the process and finding enjoyment in the practice of the craft is generally healthier, which took me too long to realize.

*I focused on collecting data when I should have focused on developing relationships.* The language I was exposed to was filled with phrases like "data collection" and "data access". Thinking in terms of data collection led me to a less productive path than if I focused on development of relationships. Especially in the case of qualitative work with organizations, approaching practitioner experts with the mindset of "I need to secure data access" is not as effective as thinking "I hope I can learn what these experts work on". While data are what matters in the end, focusing on them is not productive in establishing relationships that eventually lead to data.

*Focusing multi-disciplinarity is less effective than focusing on specific disciplinary intersections.* The idea of multi-disciplinarity is mentioned frequently. I took a while to realize that in practice, there is hardly any such thing multi-disciplinarity. What I was encountering instead were specific intersections of disciplines. When it comes to academic interactions, there is no truly “multi-disciplinary venue”. There are only people, familiar with certain topics and approaches. Being inter-disciplinary usually means introducing one group to an approach taken by another group. Perhaps relatedly, I also realized that sometimes strong disciplinarity is actually the truly renegade path, especially in areas where disciplines bleed together.

*I didn't realize how much I know.* PhD is partly challenging because the demands, competitive pressure, and constant comparison make people feel inadequate. When I got too embedded in the work and the academic game, I sometimes lost track of my own knowledge and capabilities. Especially now when my PhD time is over and I resumed contact with the outside world, I am often reminded of my level of skills and abilities. If I didn't forget that I am actually pretty good at this, I would have easier time during the PhD too.

*I was not idle often enough.* For too long, I didn't set upper limits on work. I worked on too many weekends and even when I did not work, I never really detached from the work. Being idle is a legitimate part of the research process because ideas need to grow once planted. Few hours of writing per working day with enough time to cook and exercise add up over time. On average, people work much less than how much they make themselves appear to work. Nevertheless, I am putting finishing touches in the dissertation, including this sentence, on a Sunday again.

Every text, once written, becomes a message from the past. This text is a message about where I was as an academic writer when my PhD concluded. I hope for chances to grow beyond that. The last three years have been transformative, as a PhD should have been and full of challenges, I am proud of having overcome. As I am closing this chapter, I sincerely thank to those who travelled alongside me. My best effort at a complete list follows on the next page.

There have been people along the way I appreciate dearly

Sergio, Nikolaus, Sune, Michael Zaggl, Joao, Philip, Marta, Martin, Tekin, Stewart, Huy

For getting me started  
Nikolaus, Kaveh, Tony, Gayle, Grandma, Mom and Dad

My thanks.

Michal  
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## **Executive summary**

The aim of this dissertation is to explore the organizational and managerial challenges that arise from systematic involvement of digital technologies in innovation. The work in this dissertation primarily contributes to the literature on digital innovation, which identified systematic involvement of digital technologies as an occasion to revise or problematize existing theoretical perspectives on management of technology and innovation.

Digital technologies have been theorized in the Information Systems literature as digital artefacts. Digital artefacts are objects made of algorithms and data. Digital products, profiles on social networks, databases of past transactions are all examples of digital artefacts. Digital artefacts are representative of an unusual type of materiality because they do not occupy physical space, can be duplicated and distributed freely. As a consequence, they can be arranged and recombined to achieve seemingly endless potential of configurations. The process of recombining digital artefacts is digital innovation, which this dissertation studies.

Digital artefacts are also at the centre of born-digital companies, which provide empirical focus for this dissertation. Existing research has often focused on traditional companies in their efforts to learn to effectively exploit possibilities of digital technologies. Such research provides insight into how digital innovation clashes with traditional innovation and offers insights of undeniable relevance. In contrast, the research here joins the less voluminous stream of research on born-digital organizations. With focus on born-digital organizations, we can uncover logics of digital innovation in their distilled form rather than emphasizing how they contrast or clash with organizing logics of industrial or pre-digital innovation.

The dissertation is composed of three papers: a theoretical literature review, a longitudinal case study and, a multiple case study. The first paper argues that consideration of digital artefacts is central to understanding the logic of digital innovation. This argument is developed by a means of a literature review. The theoretical literature review provides assessment of the attention given to digital artefacts in the extant literature and it constructs a research agenda. The second article presents a case study of organizing for innovation in a born-digital company, showcasing how distributable digital artefacts can stifle effectiveness of organizational separation as a vehicle for innovation. The third article investigates, by a multiple case study, how digital artefacts and organizational structures co-evolve as born-digital



companies innovate their products. Overall, the dissertation proceeds from a theoretical argument to exploration of an empirical case and development of a more robust theoretical understanding of the case by moving from a single to a multiple case design.

Empirical studies in the dissertation relate to a practical problem and hold managerial implications. The empirical problem tackled in papers II and III relates to the situation in which a company wants to develop a radical digital innovation. Is it better to develop the innovation in a new, separated group or is it better to continue development in an existing organization? Paper II highlights that focusing only on organizing can be misleading because digital artefacts can freely travel across organizational boundaries and cause drift from radical to incremental innovation. Paper III presents a multiple case study that revisits this problem and finds out that the decision to organizationally separate an innovation effort appears to be more suitable when a new group of users with a distinct need is being targeted. Organizational separation goes hand in hand with development of separate digital artefacts because organizations and products tend to mirror one another. Overall, the dissertation first emphasizes that, when selecting organizational arrangements for innovation, handling of digital artefacts should be considered alongside organizational structures. Second, the dissertation implies that a choice to organizationally separate may be more appropriate when a new set of users with a distinct need is being targeted by the innovation.

Overall, this dissertation uncovered some organizational and associated managerial challenges that are especially salient in born-digital organizations and therefore emblematic of digital innovation. Organizationally, this research highlights the effects that digital artefacts can exert on organizational structures. They can cause drift from organizational separation to integration. They can be re-interpreted and thus interact with identities of especially born digital businesses. Such organizational phenomena are associated with new managerial challenges. First of all, the research calls for more conscious management of digital artefacts for organizing for innovation. Architectural decision regarding to reuse or new development arise as an area of concern that accompanies decisions about organizational structures. A second managerial challenge is connected to unstable identity of a digital artefacts. The identity of digital artefacts is tied to its role in consumption or to the role they play for consumers. The same digital artefacts can provide a core for a product that solves a very different need. Therefore, effective management of digital innovation requires paying attention to the changing needs that the ever-changing digital products are directed to address.

## Dansk Resumé

Formålet med denne afhandling er at undersøge de organisatoriske og ledelsesmæssige udfordringer, der opstår, når digital teknologi inddrages systematisk i innovation. Arbejdet i denne afhandling bidrager primært til litteraturen om digital innovation, der har identificeret systematisk inddragelse af digitale teknologier som en anledning til at revidere eller problematisere eksisterende teoretiske perspektiver på ledelse af teknologi og innovation.

Digitale teknologier er blevet teoretiseret i litteraturen omhandlende informationssystemer som værende digitale artefakter. Digitale artefakter er objekter bestående af algoritmer og data. Digitale produkter, profiler på sociale netværk, databaser over tidligere transaktioner er alle eksempler på digitale artefakter. Digitale artefakter repræsenterer en særlig form for materialitet, idet de ikke optager fysisk plads, kan duplikeres, og kan distribueres frit. Som en konsekvens heraf kan de arrangeres og kombineres i et tilsyneladende uendeligt antal konfigurationer. Processen med at kombinere digitale artefakter er i sig selv udtryk for digital innovation, hvilket denne afhandling undersøger.

Digitale artefakter er også centrale for digitalt indfødte virksomheder, som udgør det empiriske fokus i denne afhandling. Eksisterende forskning har ofte fokuseret på traditionelle virksomheder i deres bestræbelser på at lære at udnytte de digitale teknologiers muligheder effektivt. Denne forskning giver indsigt i, hvordan digital innovation adskiller sig fra traditionel innovation og giver ny relevant indsigt. Denne afhandling er del af den mindre omfangsrige litteratur med fokus på digitalt indfødte organisationer. Med fokus på digitalt indfødte organisationer er det muligt at kortlægge de styrende logikker bag digital innovation i deres rene form frem for at undersøge, hvordan de adskiller sig fra andre organiserende logikker.

Afhandlingen er sammensat af tre artikler: et teoretisk litteraturreview, et longitudinelt casestudie og et multipelt casestudie. Den første artikel argumenterer for, at en forståelse af digitale artefakter er helt central for at forstå logikken bag digital innovation. Dette argument baserer sig på et litteraturreview. Dette litteraturreview bidrager til en forståelse af, hvordan digitale artefakter er beskrevet i den eksisterende litteratur og danner dermed basis for en dagsorden for fremtidig forskning. Den anden artikel præsenterer et casestudie af organisering af innovation i en digitalt indfødt virksomhed og viser, hvordan distribuerede digitale artefakter kan modarbejde effektiviteten af såkaldt organisatorisk opdeling i

arbejdet med innovation. Den tredje artikel undersøger ved hjælp af et multipelt casestudie, hvordan digitale artefakter og organisatoriske strukturer udvikler sig sammen, når digitalt indfødte virksomheder innoverer deres produkter. Overordnet set bevæger afhandlingen sig fra et teoretisk argument til empiriske casestudier og udvikling af en mere robust teoretisk forståelse i en bevægelse fra et enkelt til et multipelt casestudiedesign.

De empiriske studier i afhandlingen vedrører et praktisk problem og har ledelsesmæssige implikationer. Det empiriske problem, der behandles i artikel II og III, vedrører den situation, hvor en virksomhed ønsker at udvikle en radikal digital innovation. Er det bedre at udvikle innovationen i en separat gruppe, eller er det bedre at udviklingen foregår i en ny organisatorisk enhed? Artikel II fremhæver, at det kan være vildledende udelukkende at fokusere på organisering, fordi digitale artefakter frit kan distribueres på tværs af organisatoriske grænser og resultere i en såkaldt driven fra radikal til inkrementel innovation. Artikel III præsenterer et multipelt casestudie, der genbesøger dette problem og konkluderer, at beslutningen om organisatorisk at adskille en innovationsindsats ser ud til at være bedre egnet, når den målrettes en ny gruppe af brugere med et særskilt behov. Organisatorisk adskillelse går hånd i hånd med udvikling af separate digitale artefakter, fordi organisationer og produkter har en tendens til at spejle hinanden. På et overordnet niveau understreger afhandlingen for det første, at håndtering af digitale artefakter bør overvejes sideløbende med organisatoriske strukturer, når organisering af digital innovation skal planlægges. For det andet viser afhandlingen, at et valg om organisatorisk adskillelse kan være mere passende, når innovationen målrettes nye brugere med et særskilt behov.

Overordnet set har denne afhandling afdækket nogle organisatoriske og tilhørende ledelsesmæssige udfordringer, som er særligt fremtrædende i digitalt indfødte organisationer og derfor kendetegnende for digital innovation. I et organisatorisk perspektiv fremhæver denne forskning de effekter, som digitale artefakter kan have på organisatoriske strukturer. De kan forårsage en driven fra organisatorisk adskillelse til integration. De kan genfortolkes og dermed interagere med organisatoriske identiteter for især digitalt indfødte virksomheder. Sådanne organisatoriske fænomener er forbundet med nye ledelsesmæssige udfordringer. Først og fremmest efterlyser forskningen en mere bevidst håndtering af digitale artefakter i forbindelse med organisering af innovation. Arkitektoniske beslutninger vedrørende genbrug eller nyudvikling af teknologi opstår som et problemområde, der ledsager beslutninger om organisatoriske strukturer. Digitale artefakter styrker dog deres identitet fra processer, der medierer deres

skabelse eller anvendelse. Derfor kræver en effektiv styring af digital innovation bevidsthed om de socialt konstruerede kategorier, som hænger tæt sammen med de behov, de digitale artefakter tjener.

En anden ledelsesmæssig udfordring knytter sig til digitale artefacters foranderlige identitet. En digital artefacters identitet er forbundet med dens rolle i brugssituationen eller den rolle som den spiller for brugeren. Det samme digitale artefakt kan udgøre kernen i et produkt, som løser et helt andet behov. Effektiv ledelse af digital innovation kræver derfor opmærksomhed på de omskiftelige behov, som de evigt foranderlige digitale produkter søger at adressere.

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Part 1

# **Introduction**

## Introduction and Aims

The aim of this dissertation is to explore the organisational and managerial challenges that arise from systematic involvement of digital technologies in innovation. The work in this dissertation primarily contributes to the literature on digital innovation (Kohli & Melville, 2019; Nambisan et al., 2017; Vial, 2019; Yoo et al., 2010), which has identified the systematic involvement of digital technologies as an occasion to reinvent or problematise existing theoretical perspectives (Avital et al., 2019; Yoo et al., 2010).

In both private and public organisations, digital innovation has risen to the top of agendas of many managers, and organising represents a key challenge (Westerman et al., 2014). While digital technologies present a wealth of options for product development or enhancement of customer relationships (Sebastian et al., 2017), effectively unlocking their potential for innovation proves difficult. Many of the difficulties with digital innovation are tightly tied to organisational problems. For instance, companies struggle to navigate the tension between organisational integration and separation of digital innovation efforts. Should digital innovation be separated and housed in a separate organisation (Svahn et al., 2017)? How should digital innovations be brought back or integrated into the main organisation (Smith & Beretta, 2020)? What is an effective way to reconcile competing logics that govern the development of digital and non-digital products (Hylving & Schultze, 2020)? Overall, it is telling that in a large-scale survey of executives (Obwegeser et al., 2020), the most commonly mentioned challenge of digital innovations are adaptations to organisational structure.

Organising for innovation and management of technology are established topics in research. We know that in order to organise to innovate, organisations need to address many factors, including knowledge re-use, treatment of resources or selection of appropriate organisational arrangements. However, recent research argues that the existing body of literature is often not directly applicable to the digital context (Avital et al., 2019; Lyytinen, 2021; Nambisan et al., 2017; Yoo et al., 2010). The organisational challenges of digital innovation are accentuated by the specific properties of digital artefacts. In digital innovation, companies need to manage technologies that are characterised by properties like generativity (Garud et al., 2008; Huang et al., 2021), which allows for fluid evolution in their meaning (Lehmann & Recker, 2021). Digital artefacts are layered modules (Yoo et al., 2010), which contrasts with the hierarchical decomposability of non-digital products (Hylving & Schultze, 2020; Lee & Berente, 2012).

Digital artefacts are characterised by loose coupling of their architectures (Henfridsson et al., 2014; Lyytinen, 2021; Yoo et al., 2010) which allows their meaning to remain ambiguous until the point of use (Zhang et al., 2021). As a sum effect of these properties, the literature on digital innovation departs from the position that digital artefacts represent a challenge to the practice of management of innovation. The new managerial logics of digital innovation also challenge the theories through which we understand how management of innovation is practiced.

This dissertation responds to the call for new organising logics theories of digital innovation (Avital et al., 2019; Gkeredakis & Constantinides, 2019; Nambisan et al., 2017) by revisiting established perspectives from the broad literature on management of technology and innovation. The approach taken here is to focus on born-digital organisations and within them observe processes of digital innovation. This empirical focus allows for the new logics of digital innovation to be observed in their pure form as opposed to observing how the logic of digital innovation clashes with the logic of pre-digital innovation and the constitution of pre-digital artefacts. In development of new theories of digital innovation, this dissertation selectively draws on concepts from the broad literature on management of technology and innovation, explicating how they need to be elaborated or problematised in order for us to be able to describe and understand them accurately.

## **Relevant literature**

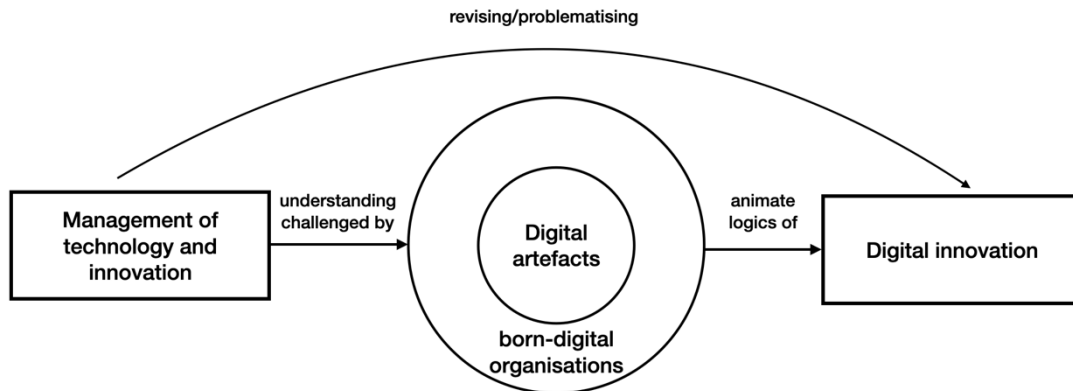
The work presented here leans on three streams of literature related to digital innovation. First, this dissertation makes use of the literature on digital artefacts (Ekbia, 2009; Hui, 2016; Kallinikos et al., 2013), because digital artefacts are arguably the root of novelty of digital innovation (Yoo et al., 2010). It is digital artefacts which trigger the need to develop new theories of innovation (Hinings et al., 2018; Nambisan et al., 2017). In the early 2000s, Orlikowski and Iacono (2001) catalysed a discussion about the apparent absence of the IT artefact from Information Systems research. They called for the IT artefact to be explicitly considered because the field itself is “premised on the centrality of information technology in everyday socio-economic life” (ibid.). The discussion on conceptualisation of the IT artefact continues to this day (Chatterjee et al., 2021) and provides a platform to continue ongoing reflection on the identity of the IS discipline (Hassan & Hovorka, 2011; Sarker et al., 2019).



In the present day, it is the digital artefact, not the IT artefact, that should be in the spotlight. In areas like digital strategy or digital innovation, it is digital artefacts that animate so much novelty because it is the “impressive improvements in information, communication, and connectivity technologies have unleashed new functionalities” that drive the novelty of digital strategy (Bharadwaj et al., 2013, p. 472). For digital innovation, it is the layered architectural arrangement of digital artefacts that “instigates profound changes in the ways that firms organize for innovation” (Yoo et al., 2010). Even in digital work, “most practices involve digital technology to a greater or lesser extent” (W. J. Orlikowski, 2016).

Second, we focus on born-digital organisations. These are organisations that have a digital artefact at their centre (von Briel et al., 2018). Born-digital organisations provide a context wherein digital innovation should be on display in its pure form. Therefore, native theories of digital innovation can be derived here. This contrasts to an approach to study as traditional organisations learning to embrace digital innovation. Studies of such context provide valuable insight into how logics of pre-digital innovation come into tension with digital innovation (Smith & Beretta, 2020; Svahn et al., 2017). While such insights are of undeniable value, the research here accepts that digital innovation is governed by different logic and proceeds to uncover it in its own right.

Third, the work here draws on the rich tradition of management of technology and seeks ways to elaborate (Fisher & Aguinis, 2017) or problematise (Gkeredakis & Constantinides, 2019) those established notions for the context of digital innovation. Rather than seeking to build new theories, digital innovation is understood by careful revision of the extant perspectives. Figure 1 schematically captures the relations between the mobilised literature streams. A succinct explanation of the approach of the three literature streams can be given by stating that this dissertation contributes to the development of theories of digital innovation by exemplifying how digital artefacts, at the core of born-digital organisations, contribute to dynamics that challenge established theories of management of technology and innovation.



**Figure 1 Relevant streams of literature and their relations**

## 1.1 Digital innovation

Digital innovation can be formally defined as “carrying out of new combinations of digital and physical components to produce novel products ” (Yoo et al., 2010, p. 725).

A growing body of research has investigated digital innovation as summarised in a number of literature reviews (Hund et al., 2021; Kohli & Melville, 2019; Vial, 2019). Research on digital innovation is often motivated by a shared sense that the established perspectives on innovation and management of technology are ill-suited for understanding the process and mechanisms of innovation involving digital technologies (Avital et al., 2019; Hinings et al., 2018; Nambisan et al., 2017; Yoo et al., 2010). For example, the existing body of research on business process management is challenged, as digital technologies allow for flexible adjustments to infrastructure, which therefore should not be viewed as rigid (Baiyere et al., 2020). Similarly, while the extant literature tends to depict innovation as mostly directed, the flexibility of distributed IT allows innovators to proceed in a more unpredictable manner (Arvidsson & Mønsted, 2018). The novelty of digital innovation thus often challenges assumptions such as the distinction between process and outcome of innovation. All the changes of digital innovation give rise to a new organising logic, by which we mean the new “managerial rationale for designing and evolving specific organisational arrangements” (Sambamurthy & Zmud, 2000, p. 107). The new organising logic of digital innovation can be best understood through new, or at least revised, theories of innovation management and related areas (Nambisan et al., 2017).

Finding effective ways of organising is a critical issue within digital innovation. Be it the anchoring of innovative concepts in organisations (Arvidsson & Mønsted, 2018) or the dynamics of self-organised online efforts (Baldwin & Clark, 2006), digital innovation is accompanied by a range of specific organisational effects. The novelty of digital innovation is particularly apparent by comparison. Hylving and Schultze (2020) demonstrate how managing development of a system for a car contrasts with the layered modular architecture of the digital components. While traditional non-digital products can be understood as hierarchies of parts, digital products are more effectively treated as collections of reusable patterns (Henfridsson et al., 2014). The logic of reusable patterns invites a different organising logic, such as more flexible teams as opposed to a hierarchical organisation. Properties such as generativity and distributability (Garud et al., 2008; Kallinikos et al., 2013) of digital artefacts contribute to amended organisational dynamics that characterise digital innovation (Lyytinen, 2021).

## 1.2 Digital artefacts

Digital technologies have been theorised on an abstract level as digital artefacts<sup>1</sup>. Theorising digital artefacts per se is important, as it is the properties of digital artefacts that give rise to new dynamics which may challenge existing theory (Avital et al., 2019; Gkeredakis & Constantinides, 2019). Publications on digital artefacts in Information Systems characterise digital artefacts as being comprised of layers such as data and device (Henfridsson et al., 2018; Yoo et al., 2010). While the physical component acts as an important “bearer,” the semantic meaning of a digital artefact is often captured in its non-material component (Runde & Faulkner, 2019). Purely non-material digital artefacts represent a challenge because they are “a new type of materiality that disrupts some of the concepts that are fundamental to philosophy” (Hui, 2016, p. 3).

Digital artefacts are at the core of digital innovation. Digital innovation is defined as recombinations of digital technologies, and it is the ease with which digital artefacts are recombined that helps distinguish it (Henfridsson et al., 2018). Besides recombining, other properties of digital artefacts trigger different dynamics. On an organisational level, extensions of digital artefacts can determine which strategic

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<sup>1</sup> Some authors prefer the term “digital object” in place of “digital artefacts”. In line with disciplinary conventions of Information Systems research, I use “digital artefact”. I do not consider the two terms meaningfully different for the presented arguments.

options are available (Woodard et al., 2013), reflecting the generative potential in digital artefacts (Eck et al., 2015). For individuals, the flexibility and interactivity (Kallinikos et al., 2013) of digital artefacts affords opportunities for individualisation (Lehrer et al., 2018). The novelty of the dynamics of digital innovation stems largely from the specific properties of digital artefacts that are especially apparent in their non-material components (Lyytinen, 2021).

By placing the digital artefact at the centre of the approach to theorising, this dissertation follows the seminal work of Orlikowski and Iacono (2001), who directed attention to the “IT artefact” and called for its explicit theorisation in Information Systems research. A balanced consideration of the IT artefact and the social environment can be seen as the distinguishing feature of Information Systems research (Sarker et al., 2019). The wave of theoretical work on the digital artefact, however, departs from a consensus that advances in information technologies and changes in the ways they are being deployed in society are so significant that new theorising is called for (Kallinikos et al., 2013). Hence, while Orlikowski and Iacono (2001) were “desperately seeking” the IT artefact, this dissertation embarks on a similar quest, but with the digital artefact as the target. The literature on the digital artefact provides us with concepts that should be able to not only describe but also explain the source of novelty in the observed phenomena of digital innovation.

### **1.3 Born-digital organisations**

This dissertation leverages the nascent literature on born-digital organisation to gain insight into the environment in which processes of digital innovation should be on full display. Born-digital organisations are “essentially data-driven operations ” (Huang et al., 2021, p. 17) that have a digital artefact “at the core of their market offering” (von Briel et al., 2018, p. 278). Studying *traditional* organisations and their attempts to learn to realise benefits from digital technologies is undeniably valuable. Such research exposes the kinds of tensions between digital and non-digital innovation (Jovanovic et al., 2021; Smith & Beretta, 2020; Svahn et al., 2017; Wessel et al., 2020). In contrast to this approach, the focus here is on organisations that do not experience tensions between digital and non-digital innovation, as they are formed around digital artefacts from their inception. Therefore, the dynamics of digital innovation should be directly observable in born-digital organisations.

Because born-digital organisations are built around digital artefacts, they are influenced by the properties of the technologies around which they are formed. As one kind of influence, digital artefacts form a “design capital” (Woodard et al., 2013) which shapes the strategic options available to the company. The digital design capital is agnostic and can be deployed to a number of contexts (Alaimo & Kallinikos, 2021). It is easy to re-deploy digital artefacts because they can be duplicated with no additional cost even though the organisation needs to establish legitimacy for each new context (Tumbas & Berente, 2017). Re-legitimisation can happen more than once, as products of born-digital organisations are “ever in the making” (Lehmann & Recker, 2021) or perpetually unfinished, just like their offerings (Garud et al., 2008). The focus on the interplay of the organisation with its (digital) resources signals affiliation with the resource-based view as it has been translated for the purposes of Information Systems research (Wade & Hulland, 2004; Nevo & Wade, Michael, 2010).

### **Management of technology and innovation**

Organising for innovation and management of technology are long-standing topics within management research (Okhuysen & Bechky, 2009). From research on different organisational forms for innovation (Eisenhardt, 2001) to scholarship on ways of integrating innovation within existing structures (Birkinshaw & Gupta, 2013), the extant literature offers a wealth of concepts and insights which cannot be reviewed in its entirety here. The aim of this sub-section is to outline how the research within this dissertation engages with this sizable corpus.

Despite the availability of the voluminous research on management of technology and innovation, the agenda for research of digital innovation is often framed as an opportunity for a wholly new theory development. In contrast, this dissertation selectively engages extant literature and pursues theories of digital innovation by seeking to problematise or elaborate those perspectives to adapt them to the context of digital innovation.

The research agenda on digital innovation seeks to develop radically new logics (Baiyere et al., 2020; Yoo et al., 2010). It engages in reconceptualisation of extant perspectives (Chen et al., 2010; Sambamurthy et al., 2004) or even reinvention of old theories (Nambisan et al., 2017). The need for revision is brought on by changes in the phenomena of innovation. The established theories have been

developed with a background of industrial production, which provided a “root metaphor” (Avital et al., 2019, p. 12). In an economy of industrial production, managerial rationalism directed effort to increasing efficiency in the production of products with fixed identities by tools such as bureaucratically codified division of labour (ibid.). Digital innovation, however, is concerned with the development of products with evolving identities (Lehmann & Recker, 2021) in organisations that are often less bureaucratic and more likely to morph across different industrial fields (Tumbas & Berente, 2017). Put bluntly, digital innovation “cannot be explained by older models that allowed many companies of industrial era to succeed for a century or so” (Lyytinen, 2021, p. 2).

The papers in this dissertation show how digital artefacts challenge assumptions of established research or invite their deepening. In other words, this dissertation approaches the phenomena of digital innovation by problematising (Alvesson & Sandberg, 2011) or elaborating (Fisher & Aguinis, 2017) established perspectives from the broad literature on management of technology and innovation. Problematisation is a strategy whereby theoretical advancements are achieved through scrutinisation of assumptions in extant literature (Alvesson & Sandberg, 2011). We are particularly aligned with an approach that Gkeredakis and Constantinides (2019) term “phenomenon-driven problematization” (p.2). This approach is suitable because it “helps us identify and scrutinize the limits of a particularly dominant theoretical metaphor (ibid.) In our case, the metaphor of industrial production is often lacking when used to depict organisational dynamics of digital innovation. New frameworks that use software development as a root metaphor (Avital et al., 2019, p. 12) are called for (Yoo et al., 2010).

## **Research approach**

This section briefly outlines the research approach, beginning with the position philosophy of science and proceeding to outline how the position is operationalised into specific research designs and methodologies in the contained research papers.

## Philosophy of science

In this dissertation, I am aligned with critical realist approaches that simultaneously acknowledge the existence of a socially constructed knowledge and an objective reality that is unaffected by people's cognitive beliefs (Bhaskar, 2008). This position has found numerous adherents in information systems research (Mingers, 2004) because it avoids extremes of both interpretative and positivist stances. A critical realist researcher observes phenomena and proposes explanatory mechanisms on the assumption that the events exist (ibid. 797).

Within the realist approaches, my thought has been strongly influenced by object-oriented ontology which, in line with critical realism, proposes a view of reality in which (real) objects are only accessible indirectly via “sensual objects” (Harman, 2011). This position is suitable to study non-material digital artefacts because it does not demand that objects must be material, but unlike critical realism, it places emphasis on objects as opposed to mainly events. Object-oriented ontology offers a formulation of a realist position which avoids the widely shared sense that realism is “a boring enforcer’s philosophy that merely slaps down the excesses of wildly imaginative people” (Kimbell, 2013, p. 109). Rather, it acknowledges all objects as deep but only indirectly accessible. From this position, digital artefacts and other objects are observed not in their entirety (that would not be possible), but in a form of simplification.

Within the landscape of sociomaterial theorising (W. J. Orlikowski, 2010), I align with the position that Jones terms “weak Socio-materiality” (Jones, 2014) in which technologies are given ontological status that transcends momentary periods of use (Leonardi, 2011). From the standpoint that digital artefacts are the root of novelty of digital innovation, the strong sociomaterial position (Jones 2014), which draws on Agential realism (Barad, 2007), is less productive. We can take the position that every technology is manifested as a practice. By adopting such an approach, we can attain a valuable description; however, without relating the observed practices to the specific materiality represented by digital artefacts, we are not likely to succeed in explaining what animates novelty of digital innovation vis-à-vis non-digital innovation. The core argument of the dissertation to develop theories of digital innovation with reference to the digital artefact and its properties accords with Mutch (2013) and his critique of sociomateriality and its alleged “failure to be specific about technology” (p. 28).

## **Methodological approach**

The work in this dissertation takes a point of departure in the position that the digital artefact, which is at the center of a born-digital organisation, contributes to the emergence of phenomena represent a new managerial logic. This new logic is different from the logic assumed in established theories of management of technology and innovation. This position is thoroughly developed in the opening paper by a means of a theoretical literature review and drives the approach of data analysis and collection in the subsequent empirical papers.

## **Literature review**

Conducting a systematic literature review is a common first step to any research project (Webster & Watson, 2002). However, for the topic under investigation—digital innovation—several literature reviews are already available (Kohli & Melville, 2019; Vial, 2019). Therefore, Paper I does not chiefly aim to provide a duplicate summary of the literature. Rather, it can be understood as a theoretical review, a review that “goes beyond merely assembling and describing past work. The primary contribution and value of this type of review lies in its ability to develop novel conceptualizations or extend current ones by identifying and highlighting knowledge gaps between what we know and what we need to know” (Paré et al., 2015, p. 188). The review in Paper I “draws on existing conceptual and empirical studies to provide a context for identifying, describing, and transforming into a higher order of theoretical structure and various concepts, constructs or relationships” (Paré et al., 2015, p. 188). The conceptual works engaged are the works on the nature of digital artefacts (Kallinikos et al., 2013; Runde & Faulkner, 2019). The empirical work that Paper I draws on are studies of digital innovation, which adopt the ensemble view in the classification proposed by (W. Orlikowski & Iacono, 2001). The ensemble view represents a portrayal of technology that attends to the complex webs of relationships in which technologies are embedded. These empirical papers are typically in line with the critical realist assumptions in the sense that they document observed events and provide plausible explanations of inaccessible mechanisms or processes that produce them. In line with the focus on objects (Harman, 2008) and the weak sociomaterial position (Leonardi, 2011), the analysis of the literature focuses on the theorised properties of digital artefacts and assesses whether (and how) they are reflected in the empirical work.



### **Single and multiple case studies**

The theoretical review is followed by two empirical papers: a single and a multiple case study which follow up on another. The theoretical review provides the empirical papers with key elements of a theoretical approach and an articulated research agenda. The empirical papers II and III adopt critical realist stance when they focus on events and processes and propose plausible explanations of the phenomena.

This qualitative but realist approach allows us to unpack the processes of innovation with the aim of studying the micro-level processes of organising in order to gain deep insights into the effects of macro-level organising decisions on daily practices (Whittington, 2006). The dissertation uses qualitative data (interviews) and follows advice to “invite materiality” into interviews (Hultin, 2019) to feature the digital artefact in the theory building. The reliance on interviews allows the integration of digital artefacts as seen by the informants, which is suitable because of the strong role of social construction for the identity of digital artefacts, as highlighted in Paper III in particular.

The single case study (Paper II) develops an initial insight into a phenomenon with an exploratory longitudinal case study. Case studies are suitable for “sticky, practice-based problems where the experiences of the actors are important and the context of action is critical” (Benbasat et al., 1987, p. 369). Such an approach is suitable for the study of digital innovation, which cannot be understood through extant theories and therefore requires deep engagement with the practices and experiences of actors in context. The critical realist position alerts us to objectively occurring events but also leaves space to account for interpretation and experience of the actors involved.

Paper III likewise attends to the effects of digital artefacts-in-use and documents their co-evolution with organisational arrangements. The follow-up multiple case study allows us to “confirm emergent relationships enhance confidence in the validity of the relationships” (Eisenhardt, 1989, p. 542). By purposeful and theoretical sampling of similar cases, replication and extension across cases is possible, which allows us to perceive patterns more easily (Eisenhardt, 1993).

The overall dissertation therefore first proposes and then deepens a theory through a single case study and a follow-up multiple case study, which are both approaches suitable to theory building.

**Table 1 Overview of papers**

	<b>Paper I</b>	<b>Paper II</b>	<b>Paper III</b>
<b>Short Title</b>	Quest for New theoretical Logics of digital innovation	Innovation Drift	Mirroring and interpreting
<b>Research question</b>	Which properties of digital artefacts do different conceptualisation of digital artefacts uncover?	How do the specific properties of digital artefacts influence organising for innovation?	How do digital artefacts and organisational forms mutually influence each other?
<b>Core concepts<sup>2</sup></b>	Conceptualisation of digital artefacts as resources, knowledge etc.	Organisational integration, separation	Mirroring hypothesis
<b>Method</b>	Literature review	Single Case Study	Multiple Case Study
<b>Data</b>	53 papers	Interviews over 2 years	Interviews from 5 born-digital companies
<b>Digital artefacts</b>	As described in literature	Online housing market place	Five different born-digital businesses
<b>Finding</b>	Different conceptualisations emphasise different properties of digital artefacts. Research agenda proposed	Reuse of digital artefacts can cause drift of innovation from radical to incremental	Organisations mirror the socially constructed understanding of digital artefacts
<b>Co-authors</b>	Single-authored	Nikolaus Obwegeser, Sune D Muller	Single-authored
<b>Status</b>	Published at HICSS	Published at IOM	Prepared for submission to JSIS

<sup>2</sup> Excluding concepts from the literature on digital artefacts

## Overview of the papers

The three studies contained within this dissertation consist of a literature review, a single case study, and a multiple case study. The first paper develops the point that theories of digital innovation can be developed by referencing the digital artefact. Paper I also constructs a research agenda. Part of the research agenda is answered in the subsequent studies. The single case study (Paper II) departs from the position established in Paper I and presents a longitudinal case study of organising for innovation in a born-digital company. The following multiple case study (Paper III) revisits similar phenomenon as the single case study, deepens the emergent theory, and proposes a more general process model.

### **Paper I: Quest for New theoretical Logics of digital innovation**

Digital artefacts are at the core of digital innovation, and therefore, theories of digital innovation can be productively developed with theoretical accounts of digital artefacts as their building block. This first paper develops this argument by means of a systematic review of the literature on digital innovation within high-ranking information systems journals. It provides an assessment of how much the literature on digital innovation attends to the digital artefact and articulates a research agenda that would center on the digital artefact.

Digital artefacts have been characterised by multiple properties (Kallinikos et al., 2013) such as editability/interactivity, distributability, or generativity. They can also be conceptualised in different ways within organisations (e.g., as knowledge or resources). Different properties are revealed by different organisational conceptualisations. Theories of digital innovation are more likely to be achieved when the different properties of digital artefacts are attended to. Against this backdrop, this paper reviews the literature to answer the research question: *Which properties of digital artefacts do different conceptualisations of digital artefacts uncover?* Through evaluation of the literature, this paper also uncovers a number of research opportunities which are assembled as an agenda for future research.

Methodologically, the literature review replicates and elaborates the seminal study that directed attention to the IT artefact and called for its theorisation (W. Orlikowski & Iacono, 2001). Orlikowski and Iacono conclude by identification of an “ensemble view” of the IT artefact, which is a view that carefully attends to the networks of practices and social context within which the IT artefact is embedded. This paper takes

the papers classified as the “ensemble view” as its starting point and examines how such conceptualisation can be productively attained in the context of digital artefacts and digital innovation.

## **Paper II: Innovation Drift:**

### **The influence of digital artefacts on organising for innovation**

The established literature on management of technology and innovation includes numerous voices that advocate for organisational separation as an effective strategy for development of radical innovation (Christensen & Raynor, 2013; Markides, 2013). This longitudinal case study documents how organisational separation can become ineffective when digital artefacts come to be reused. Digital artefacts can be duplicated and distributed. When a separated organisation reuses digital artefacts, their independence declines, and their output can drift from radical ambition towards incremental realisation. The exploratory case study leverages the core argument from the first paper and places digital artefacts at the centre of the theory building. The guiding research question for this study is: *How do the specific properties of digital artefacts influence organising for innovation?*

The paper puts forward the notion of an *innovation drift*, i.e., the proclivity of radical innovation ambitions to gradually drift towards more incremental realisations as a result of the reuse of digital artefacts. Innovation drift can occur along three inductively derived dimensions. Organisational arrangements can drift from separated to integrated, framing of innovations can drift from novel to derivative, and finally, realised innovations can drift from radical to incremental. The notion of innovation drift revisits the literature on organisation for innovation. Established literature examined effectiveness of organisational separation and integration for development of innovations (Christensen & Raynor, 2013; Johansson et al., 2007; Markides, 2013). We revisit this literature to point out that digital artefacts can disseminate across organisational structures and hamper effectiveness of selected organisational arrangements. If digital artefacts are not managed consciously, they can cause drift from organisational separation to integration and from radical innovations to their incremental realisations.

### **Paper III: Mirroring and Interpreting: Co-evolution of Digital Artefacts and Organisations**

Digital strategy relies on digital artefacts and organizational resources. A dominant explanation of the relationship between organizations and technical products has been the Mirroring hypothesis (Colfer & Baldwin, 2016) which predicts that organisational architecture will correspond to the architecture of products under development. This paper explores the process of execution of digital strategy as co-evolution of digital artefacts and organizations. Through a multiple case study of five born-digital organisations from multiple industries, we elaborate on the Mirroring hypothesis by adding a co-occurring process of interpretation. Because digital artefacts are characterised by unstable identity, the product architecture is not simply given but rather is a result of a socio-cognitive process. The identity of digital artefacts is stabilised with reference to different user groups and their needs.

The multiple case study investigates the same type of phenomenon as the preceding single case and leverages the same core inductive categories (organisation, product, presentation) to investigate: *How do digital artefacts and organisational forms mutually influence each other?* Through analysis of interviews from five companies, a fourth category of users/markets is discovered through analysis of new data. While the single case study established the three aforementioned categories, the multiple case study adds a fourth and models the relationships by proposing a process model of two processes: mirroring and interpreting. Because malleable digital artefacts are characterised by unstable identity, their architectural composition is not simply given but is socially constructed. It is this socially constructed understanding of the product identity that the organisation mirrors. This paper therefore envisages mirroring as a process rather than an effect and proposes to adapt mirroring for the context of digital innovation by elaborating an accompanying process of interpretation.

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Part 2

# **Research Papers**



Paper I

# **The Quest for New Theoretical Logics of Digital Innovation: Linking Properties of Digital Artifacts with their Conceptualizations in Organizations**

Michal Hron

## **Abstract**

In order to develop theories of digital innovation, it is necessary to explicitly consider the digital artifact that grants digital innovation its distinguishing features. Recent theoretical contributions elaborate the distinguishing properties of digital artifacts. These results have however not yet been systematically connected with the meta-theoretical conceptualizations that are used to frame empirical studies.

A systematic review of empirical studies in Information Systems literature on digital innovation is conducted. We focus on how digital artifacts are being conceptualized. On top of an overview of usage of four conceptualizations of digital artifacts, we contribute by discussing how each of the four meta-theoretical conceptualizations enables demonstration of a particular property of digital artifacts. From the analysis, we formulate a research agenda that would lead us closer to accomplishing the quest for new theoretical logics of digital innovation.

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## 1. Introduction

The Information Systems research of digital innovation has been presented as quest to articulate new theories of innovation. The received wisdom on pre-digital innovation is deemed insufficient (Yoo, Henfridsson, and Lyytinen 2010). Senior scholars urge us to “reinvent innovation” (Nambisan et al. 2017), find new theoretical logics (Nambisan et al. 2017; Yoo, Henfridsson, and Lyytinen 2010) in response to the realities of digital innovation that represent a paradigm shift (Nambisan et al. 2017; Yoo, Henfridsson, and Lyytinen 2010).

Fortunately, together with the demand to theorize digital innovation, a stream of theoretical work emerged with increasingly refined theories of properties the digital artifact (Runde and Faulkner 2019; Kallinikos, Aaltonen, and Marton 2013). This theoretical work provides possible building blocks of the elusive “new theoretical logics” of digital innovation. Empirical work on digital innovation however makes use different set of meta-theoretical conceptualizations of digital artifacts that provide views of digital artifacts suitable for organizational level analysis.

Some of the common ways to represent the digital artifact in organizations include seeing digital artifacts as kind of resource (Wade and Hulland 2004), particular type of knowledge (Runde and Faulkner 2019), a stock of options to-be-unlocked (Woodard et al. 2013) or as facilitator of a service (Barrett et al. 2015) (we will call this products-in-use). It is however not clear how these meta-theoretical conceptualizations reflect properties elaborated in the theories of digital artifacts. By extension, it is not clear how each of the conceptualizations can be conducive to revealing the new theoretical logics of digital innovation.

We argue that we are more likely to articulate new theories of digital innovation if future scholarship reflects the fundamental perspectives on digital artifacts (Sarker et al. 2019). However, the ambitions of developing new theoretical logics of digital innovations will be difficult to articulate, if a link is not established between theoretical treatments of digital artifacts and empirical research.

A decade has elapsed since the initial theoretical works elaborating properties of digital artifacts have been put forward (Ekbja 2009; Leonard 2010). Hence, a literature review of the accumulated empirical

work on digital innovation is in order to evaluate the correspondence between the fundamental work on digital artifacts with empirical work on digital innovation.

Reviews of literature on digital innovations have been published and we will review them next (Vial 2019; Kohli and Melville 2019). In this paper, we however approach the literature with a specific and very different aim than the preceding reviews. We are interested in relying on the extant body of empirical work to gain understanding of how digital artifacts are conceptualized in organizations. Moreover, we are interested in understanding how useful the different meta-theoretical conceptualizations are for surfacing and elaborating specific properties of digital artifacts. Our research question is: *Which properties of digital artifacts does each meta-theoretical conceptualization of digital artifacts uncover?*

By pursuing this aim, the present work contributes by developing a much-needed link between the (mostly) theoretical work on properties of digital artifacts and studies on digital innovation in innovation. By taking stock of existing literature, we can provide assessment of the progress of the quest for new theoretical logics for digital innovation. More than that, we provide an overview and assessment of conceptualizations that are being used to develop a nuanced view of technological artifacts in digital innovation. We discuss what each of the meta-theoretical conceptualizations teaches us about digital artifacts and what future research questions may look like.

We proceed by first outlining two relevant literatures. The first strand of literature concerns properties of digital artifacts. The second literature to-be-presented concerns the dominant conceptualizations of digital artifacts in organizations. After describing the method, we present results that link the conceptualizations of digital artifacts with their properties through analysis of empirical literature. Based on the analysis, we offer a research agenda that could take us closer to closing gaps between the digital artifact and organizational reality of digital innovation.

## **2. Theoretical background**

### **2.1 Digital Innovation**

Digital innovation can be defined as the “carrying out of new combinations of digital and physical components” (Yoo, Henfridsson, and Lyytinen 2010). Digital innovation has been a subject of several



conceptual treatments that variously recognize the need to acknowledge the digital artifact (Nambisan et al. 2017; Yoo et al. 2012; Agostini, Galati, and Gastaldi 2019). Similar to our approach, Yoo et al (Yoo, Henfridsson, and Lyytinen 2010) acknowledge the role of specific properties of digital technologies when they point out properties of reprogramability, self-reference and homogenization of data as the properties that give rise to layered modularity and ultimately “new organizing logic” of digital innovation. Nambisan et al., in their widely cited editorial, also direct our attention to digital technologies, specifically to their “affordances and constraints” (Nambisan et al. 2017) which they present as one of the four “new logics of digital innovation”.

Besides conceptual papers, the hitherto published work on digital innovation has been summarized in literature reviews, two of which stand out. The first review by Vial (Vial 2019) systematized 282 publications across disciplines and provides an inductively derived overview of addressed themes. The second review by Kohli and Melville (Kohli and Melville 2019), on the other hand, is limited to papers within the IS Basket of Eight (similar to our approach). Further departing from Vial, Kohli and Melville approach their review deductively and discuss the extant finding as they relate to stages if the innovation process.

Neither one of the two reviews places particular attention to the materiality of digital technologies. Starting from the premise that the novelty of digital innovation derives from the particular properties of digital artifacts, we will place them in the center of our review of the literature on digital innovation. We argue that doing so can take us to the root of the “new theoretical logics” of digital innovation and hence review from this standpoint therefore provides a valuable contribution for the literature on digital innovation.

## **2.2 Technological Artifact in IS research**

Our assertion that the technological object (digital artifact) needs to be considered for IS scholarship on digital innovation to develop faithful theories of its subject finds precedence in calls for explicit treatment of the technological artifact dating back to Orlikowski, and Iacono in 2001 (Orlikowski and Iacono 2001) who initially tallied the ways in which the technological artifact is being represented in research to find out that only 12.5% of published papers represent the artifact with the nuanced “Ensemble view” that attends to the webs of relationships in which technologies are embedded. The proportional share of publications which achieve this portrayal of the technological artifact across major IS journals has

remained similarly low when different authors later duplicated Orlikowski and Iacono's analysis (Runde and Faulkner 2019; Tilson 2010; Akhlaghpour et al. 2013).

Nineteen years since Orlikowski, and Iacono's analysis, a significant portion of IS scholarship is pursuing agenda on digital innovation. The currently discussed digital artifacts are however different from IT artifacts of days prior (Kallinikos, Aaltonen, and Marton 2013; Wessel et al. 2020) and their role in organizing economic activity has also shifted (El Sawy 2003). Digital artifacts and their non-material nature (Leonard 2010) have been extensively theorized as we review next.

### **2.3. Properties of digital artifacts**

Digital artifacts rely on material components (Yoo, Henfridsson, and Lyytinen 2010; Runde and Faulkner 2019), but the crux of their novelty lies in their non-materiality. Hui understands digital artefacts as objects that “take shape on a screen or hide in the back end of a computer program, composed of data and metadata regulated by structures or schemas” (Hui 2016). We subscribe to this definition in this review. Archetypical examples of such digital artefacts are “computer bugs”, a profile on a social media website (Ekbia 2009), or—more broadly—data (Hui 2012).

The non-materiality of digital artifacts has been a subject of a relatively recent stream of research (Kallinikos, Aaltonen, and Marton 2010; Runde and Faulkner 2019; Ekbia 2009). Kallinikos et al (Kallinikos, Aaltonen, and Marton 2013) provide a high-level summary of the cross-disciplinary debate on digital artifacts by summarizing the discussed properties of digital artifacts: distributability, editability, and openness.

**2.3.1. Distributability:** Digital artifacts are duplicable and transferable. They can “freely diffuse throughout organizational fabric” (Kallinikos, Aaltonen, and Marton 2010). Seen as distributable, digital artifacts can be seen as a input for combinatorial innovation (Henfridsson et al. 2018).

**2.3.2. Editability:** Digital artifacts can be dynamically assembled and reassembled at will. As a result, the same artifact can adopt to different contexts (Ciborra and Willcocks 2006) and take on a new meaning either by being materially reconstituted or re-interpreted (Faulkner and Runde 2009; Nevo, Nevo, and

Pinsonneault 2016). Thanks to editability, individuals can change the technology according to knowledge, norms, and rules (Orlikowski 2000).

**2.3.3. Openness:** Digital artifacts can be variously extended (Woodard et al. 2013). They can form software platforms (Tiwana, Konsynski, and Bush 2010) providing baseline for further development. As such, they can be seen as incomplete by design (Garud, Jain, and Tuertscher 2008) and thus their meaning can evolve as they are being extended (Ekbia 2009).

Those properties have been developed with some backing in empirical work, but their integration with theories of digital innovation has been limited. This may be because, although fundamental, their application in empirical work is not always intuitive and authors rely on a separate set of conceptualizations to describe digital artefacts in organizations.

## **2.4. Conceptualizations of Digital artifacts in Organizations**

While the debates theorizing digital artifacts and their properties have grown to provide increasingly layered debate of the properties of digital materiality, a parallel line of theorizing offers perspectives on how to conceptualize the digital artifact in organizations. That is, conceptualizations of digital artifacts that lend themselves more readily to analysing influence of digital artifacts on individual use, functioning of teams, mechanisms of organizations, metabolism of ecosystems, or heartbeat of whole industries.

Faulkner and Runde (Faulkner and Runde 2019) critically review three meta-theoretical perspectives: (1) digital artifacts as resources, (2) digital artifacts as knowledge and (3) conceptualization in line with service-dominant logic. A fourth conceptualization sees digital artifacts as a design capital (Woodard et al. 2013). As a comment to the first three conceptualizations, Faulkner and Runde note that “all three views devote considerably more attention to IT-related competences in the form of managerial and technical knowledge, skills and processes, than they do to the devices involved” (p. 1282.). This comment could apply to the fourth conceptualization as well. Nevertheless, since these views drive much of current literature, we review them next.

**2.4.1. Digital artifacts as resources** drawing on the resource-based view (Wade and Hulland 2004), digital artifacts in organizations can be seen as resources from which competitive advantage is derived. Specific concepts can be brought up such as network resources (Rehm, Goel, and Junglas 2017) or IT resources (Wade and Hulland 2004). As a stark departure from the view of resources as being difficult to difficult to imitate and transfer (Melville, Kraemer, and Gurbaxani 2004), much theory development is needed for the context digital innovation.

**2.4.2. Digital artifacts as knowledge** drawing on knowledge management (Nonaka, Toyama, and Konno 2000) or socio-cognitive perspectives (such as sensemaking (Lewis, Mathiassen, and Rai 2011)), digital artifacts can be seen as a form of knowledge. One way of seeing digital artifacts as knowledge is to invoke the idea of externalized knowledge and understand knowledge as electronic records (explicit knowledge) (Nonaka, Toyama, and Konno 2000). Alternatively, we can see digital competences as a form of knowledge a company needs to acquire to be able to manipulate the technology (tacit knowledge). Since knowledge that can reside within individuals or be externalized (Nonaka, Toyama, and Konno 2000), this perspective provides perhaps the most flexible framework.

**2.4.3. Digital artifacts as products-in-use** drawing on service-dominant logic (Barrett et al. 2015), digital artifacts can be seen as medium for delivery of a service, which is suitable to their non-material character (Leonard 2010). Service-Dominant logic offers a theoretical reflection on the nature of materiality. Operant or operand resources have been distinguished (Akaka and Vargo 2014). Operand resources just enable action (and are typically understood as material) whereas operant resources are initiating action (and are typically seen as non-material) (Akaka and Vargo 2014). Thus, the focus of S-D logic is on the experience of (immaterial) service delivery where digital artifacts are just enablers.

**2.4.4. Digital artifacts as design capital** this conceptualization is drawing on real options theory (Sambamurthy, Bharadwaj, and Grover 2004; Woodard et al. 2013) where the stock of digital artifacts in a company can be valued through bundle of options that it can unlock. When a company invests into digital artifacts (e.g. into digital infrastructure), the real options view would argue that although the infrastructure may not be valuable per se, its value is in the potential to enable development of features or applications on top of it.

While other theoretical devices are also in use, the above-described four conceptualizations are by far dominant. Some of the other theoretical devices include quasi-objects (Ekbja 2009), Actor-Network Theory (Latour 1987) or boundary objects (Star and Griesemer 1989). Their use will however be revealed as marginal in review of literature on digital innovation.

### **3. Method of literature review**

Since our aim is to link the perspective elaborating properties of digital artifacts with the organization-level conceptualizations, we relied on the extant corpus of empirical studies and decided to carry out a literature review. We have followed a widely accepted procedure for conducting a systematic reviews of literature (Webster and Watson 2002) further informed by recent advice (vom Brocke et al. 2015). The analytical process unfolded in five distinct stages.

First, a search query was executed in late June 2020 on the Scopus database for the word “innovation” in abstract, title or keywords in all eight journals of the “Basket of Eight”. We have limited our search to the Senior Scholars’ Basket of Eight because we were interested in the treatment of digital innovation from the IS perspective. The initial query returned 552 papers.

Second, we have limited the results to papers published in 2011 and onwards because that is when the earliest theoretical papers (Ekbja 2009; Kallinikos, Aaltonen, and Marton 2010) on digital artifacts started appearing and we could expect to see them reflected in the papers. The year filter left us with 263 papers.

Third, we have conducted initial screening of the papers to eliminate non-empirical work (reviews, conceptual papers, editorials etc.) because we explicitly aimed to review empirical papers. To be sure, we have consulted non-empirical work as a part of our literature background but they did not form a part of our sample. This resulted in a collection of 202 papers.

Fourth step preparing our sample was sorting the sample using the different views of the technological/digital artifact following Orlikowski and Iacono (Orlikowski and Iacono 2001). We were only interested in papers that provided a sophisticated view of the digital artifact, i.e. those which adopted the ensemble view in the typology of views of IT provided by Orlikowski and Iacono (Orlikowski and

Iacono 2001). 53 papers from the previous step satisfied this criterion and therefore formed our final sample.

**Table 1: Literature review process**

	<b>Stage Description</b>	<b>Papers left</b>
1.	Initial search in the Basket of 8 for “innovation”	552
2.	Limit to papers after 2010	263
3.	Initial Screening. Limit to empirical papers.	200
4.	Limit to papers that explicitly consider digital artifact.	53

Since this kind of analysis has been conducted by several authors since Orlikowski and Iacono (Akhlaghpour et al. 2013; Tilson and Lyytinen 2010; Grover and Lyytinen 2015), we could rely on a those papers for process notes and for wealth of examples in categorizing papers into categories of view of the technological artifact. The previous research finds that fairly consistent proportion of articles attend to the technological artifact with the nuance of the ensemble view. Our analysis found a share a paper consistent with the previous findings.

In the fifth step, we analysed the 53 papers with respect to which of the properties of digital artifacts are addressed (Kallinikos, Aaltonen, and Marton 2013) and what is the dominant conceptualization of digital objects adopted (Kallinikos, Aaltonen, and Marton 2010). Fortunately, the extant theoretical work provides a wealth of examples against which the presence of the properties can be assessed (Kallinikos, Aaltonen, and Marton 2013; Runde and Faulkner 2019) which was helpful, during careful reading of the manuscript, to determine which properties are addressed. In the next section, we present an overview of the results.

## 4. Results

### 4.1 Descriptive results

The papers in our sample were quite evenly distributed across the near-decade we studied (from 2011 to 2020, see Figure 1 and Table 2). While the overall volume of publications on digital innovation has been growing (Vial 2019), our sample is restricted to a selection of journals, where the topic of digital innovation seems to occupy relatively constant share of attention. The focus of our analysis are papers that explicitly consider the technological artifact (which is the digital artifact in the literature on digital innovation).

**Table 2: Papers across journals<sup>3</sup>**

Journal	Hits after 2010	Final sample
EJIS	32	5
ISJ	26	6
ISR	38	5
Journal of IT	26	8
Journal of MIS	27	1
JSIS	35	5
Journal of AIS	36	9
MIS Quarterly	43	10
Total	263	53

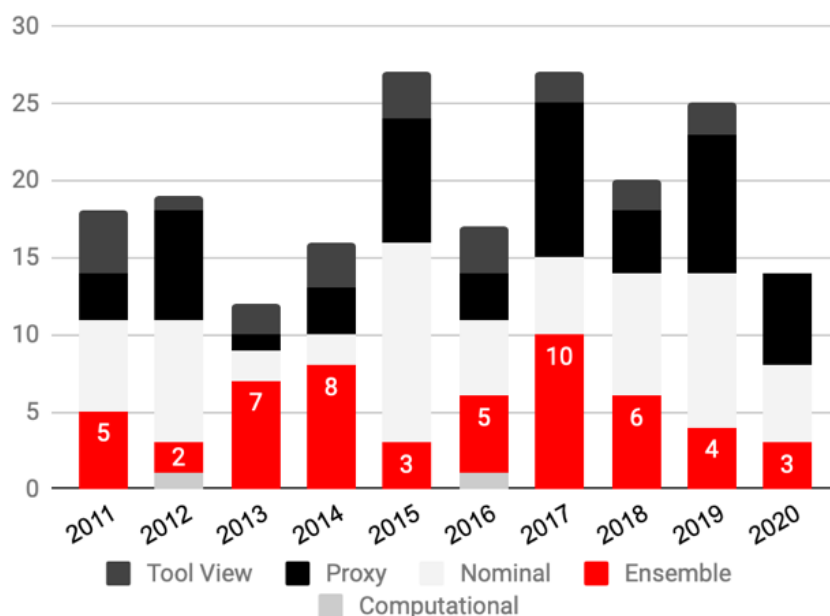
Before analyzing the 53 papers that consider the technological artifact in detail (stage 4 in method section, Table 1), it is worth remarking about the how the literature on digital innovation literature treats the artifact more broadly (using literature from stage 3 of method section).

In coding the papers following the categories of how the technological artifact is conceptualized from Orlikowski and Iacono (Orlikowski and Iacono 2001). We found the largest number of papers only mentioning the digital artifact (nominal view). We counted 71 of such papers. As an example of such

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<sup>3</sup> Note: First column corresponds to stage 2 in Table 1, Second row corresponds to stage 3 in Table 1

conceptualization consider a paper (Oshri, Arkhipova, and Vaia 2018) which discusses role of familiarity of advisory services on innovation outcomes with only passing mentions of the context of information technologies.



**Figure 1: Literature over time according to view of technological artifact following Orlikowski and Iacono (2001)**

53 papers in the sample conceptualized the digital artifact through providing a proxy. A typical example of a proxy of digital artifacts in a company is the number of digital patents (Hanelt et al. 2020) in examining digital mergers and acquisitions. Proxies are generally common in quantitative work, that can use surveys.

21 papers of the sample conceptualized digital artifacts as tools. This is typical in research examining technology adoption at work such as when researchers examine IT as a tool for workplace learning (Torkzadeh, Chang, and Hardin 2011). Just two papers saw digital artifacts as computational objects (algorithms).



Finally, 53 of the papers considered digital artifact with the refined view that Orlikowski, and Iacono term “ensemble view”. The ensuing analysis will provide wealth of examples.

Ultimately, we found that 20% of the publications in the Basket of Eight published after 2010 satisfied our criteria, which is in line with previous findings of other authors who have duplicated the analysis by Orlikowski and Iacono (Orlikowski and Iacono 2001; Grover and Lyytinen 2015).

## 4.2 How do the meta-theoretical conceptualizations reflect properties of digital artifacts

Our analysis confirmed wide use of the four prevailing meta-theoretical conceptualizations of digital artifacts discussed above in organizations. Table 3 provides a numerical overview of results and an outline for our analysis. Each meta-theoretical conceptualization unearths different set of dynamics stemming from properties of digital artifacts and finds use for particular instances of digital innovation.

**Table 3: Meta-theoretical conceptualizations vs. properties of digital artifacts<sup>4</sup>**

Dominant conceptualization	Papers invoking conceptualization as dominant	Properties of digital artifacts		
		Openness	Distributability	Editability
Digital Resource	18	11	15	5
Design Capital	13	11	8	7
Knowledge	13	6	12	5
Product-in-use	9	4	4	5
Total	53	32	39	22

We will continue to discuss each of the meta-theoretical perspectives, noting what its extant use for empirical work can teach us about digital innovation and its new theoretical logics.

<sup>4</sup> Note: Numbers give count of papers that adopt a conceptualization (row) and address each of the three fundamental properties (columns). Single paper can address multiple properties.

**4.2.1 Design Capital:** When digital artifacts are seen through the design capital lens, their generative potential (i.e.; openness) gets appreciated more than other properties. Digital artifacts can be extended into many new, unanticipated directions and investments into fundamental infrastructures can be valued for the options, which they can enable later on. The empirical work reveals the challenges associated with developing some of the new options. The role of technical debt is brought to the surface (Rolland, Mathiassen, and Rai 2018). Sometimes, the generative design capital can be bypassed and solutions can be “grafted” on top of it (Sanner, Manda, and Nielsen 2014). In other cases, the stock of design capital is technically deficient and needs to be replaced (Mehrizi, Modol, and Nezhad 2019).

The design capital view has been explicitly theorized (Woodard et al. 2013; Sambamurthy, Bharadwaj, and Grover 2004) even though it is sometimes invoked implicitly. Notions like path dependence, path constitution (Singh, Mathiassen, and Mishra 2015) or extensions of existing architectures (Sanner, Manda, and Nielsen 2014) are often indicative of thinking of digital artifacts as a form of design capital.

This perspective finds its use especially for company-level analysis but also for studying ecosystems of actors organized around an artifact that provides a bundle of options for a host of interlinked actors.

**4.2.2 Digital Resource:** Thinking about resources of organizations has a long tradition in management scholarship. Even within IS, notions like IT resources has been an anchor of much work (Wade and Hulland 2004). However, when considering digital artifacts as resources, new dynamics are unearthed. Those particularly concern the fact that they can be duplicated and transferred at virtually no cost (i.e. distributability). As a particularly stark example of a break from the old view of resources as rare and inimitable, some companies embrace openness and distributability and strategically make their digital artifact available as open source (Morgan and Finnegan 2014).

The idea of distributable resources is especially apparent in platform ecosystems with notion of “boundary resources” (Eaton et al. 2015) defined as “software tools and regulations that serve as the interface for the arm's-length relationship between the platform owner and the application developer” (p.176). This aptly captures the view of resources than can span across organizations and need to be negotiated among ecosystem actors (Ghazawneh and Henfridsson 2013; Selander, Henfridsson, and Svahn 2013). Similar concept, network resources, speaks to a similar dynamics also implicitly drawing on the tradition of the resource based view (Rehm, Goel, and Junglas 2017, 596).

The resource-based view on strategy is therefore clearly upended with digital resources. In line with its theoretical root, this perspective is most used for analysis of companies and their competitive positioning (which may be within broader ecosystems).

**4.2.3 Knowledge Perspective:** Seeing digital artifacts as knowledge opens a broad set of flexible theoretical approaches. Concepts from knowledge management theories (Nonaka, Toyama, and Konno 2000) or socio-cognitive perspectives like sensemaking are employed (Lewis, Mathiassen, and Rai 2011). With knowledge management theories, some authors, for instance, (Kranz, Hanelt, and Kolbe 2016) leverage the notion of absorptive capacity to arrive at “refined theory on absorptive capacity regarding business model change resulting from the emergence of disruptive digital technologies“ (p. 500).

Digital artifacts are seen as tools that can facilitate organizational learning in communities involving participants within and across organizations (Schlagwein and Bjørn-Andersen 2014). However, digital artifacts are not just providing the tools for managing knowledge; they can also be the knowledge itself (Kyriakou, Nickerson, and Sabnis 2017). The knowledge view affords to capture the full arsenal of characteristics associated with digital artifacts (Kyriakou, Nickerson, and Sabnis 2017), especially distributability. It can also often sheds light on the interconnectedness of digital artifacts and organizing (Montazemi et al. 2012) where digital artifacts can for example redefine established roles (Whelan, Golden, and Donnellan 2013).

In sum, the knowledge perspective reveals in particular distributability and openness. The perspective is being applied for a wide range of units of analysis. It however often relies on established theoretical concepts, which may be limiting in developing unique theories for digital innovation.

**4.3.4. Product-in-use:** The immateriality of digital artifacts makes it possible to think of them in terms of the service they enable. In doing so, the discourse on Service-Dominant logic is often invoked (Lehrer et al. 2018, 446). The notion of affordances can be applied (Leonardi 2011). Digital artifacts here recede into the background in favor of an almost phenomenological account. Moreover, this perspective reveals digital artifacts as more than a material to-be-manipulated. They are revealed as actants which can influence course of action. For example, a cleverly designed carbon management system (Corbett 2013) can be steer employees into behaving more ecologically. Lastly, the notion of co-creation is often a focus.

The notion between creation and consumption is blurred (Lang, Shang, and Vragov 2015). This perspective is in use for user-level level of analysis or when discussing the design process of digitally delivered experiences.

## **5. Discussion**

### **5.1 What does each meta-theoretical conceptualization reveal about digital artifacts?**

Throughout the reviewed sample of literature, four meta-theoretical conceptualizations of digital artifacts in organizations have been identified, each particularly suitable for revealing one property of digital artifacts in particular: When digital artifacts are seen as design capital, emphasis is placed on their openness. When digital artifacts are conceptualized as resources, their distributability is often brought to bear. When digital artifacts are conceptualized as product-in-use, their editability is often elaborated. Lastly, when digital artifacts are conceptualized as a form of knowledge multiple properties are seemingly addressable, especially distributability.

The presented review analyzed literature on digital innovation with respect to how are digital artifacts being operationalized in empirical studies and how do these conceptualizations reflect distinguishing properties of digital artifacts.

Overall, we uncover a literature where only a about a fifth (18%) of the total published articles present a refined portrayal of the technological artifact in its organizational surrounding. This share is in line with what has been tallied in previous analyses duplicating the pioneering work of Orlikowski and Iacomo (Clegg, Rhodes, and Kornberger 2007; Runde and Faulkner 2019). On a positive note however, while the IS discipline has been critiqued for over-reliance on borrowed theories that do not explicitly consider the digital artifact (Grover and Lyytinen 2015), the conceptualizations used in our sample of empirical papers on digital innovations are either native to IS (e.g. the design capital logic of business strategy (Woodard et al. 2013)) or meaningfully adapt inherited concepts (e.g. distributable resources (Eaton et al. 2015) as an adaptation of the resource based view). In what follows, we construct a research agenda consisting of questions, that could enrich four meta-theoretical conceptualizations to better reflect properties of digital artifacts.

## 5.2 Research Agenda

In general, two motivations drove the development of the research agenda: The first motivation is the theoretical ambition for “new logics of digital innovation” grounded in our position that the digital artifact and its properties need to be reflected. The second motivation reflects a concern for addressing matters of relevance for practitioners. Our research questions thus aim to bring theoretical abstractions “to the ground” by opening up some pragmatic concerns that are abstracted away in certain forms of theorizing.

**5.2.1. Questions about Digital Artifacts as Design capital:** Since the conceptualization of artifacts as a stock of capital derives from an economic perspective on real options, it starts relatively distant from practical perspective (Woodard et al. 2013). Imagine for instance a company that owns a stock of design capital and wishes to execute an extension of it. As an immediate practical concern, it is not clear what organizational arrangements are suitable for unlocking the options. Should it be the same organization? A sub-unit? Similarly, if the options to-be-developed concern new user-facing features, it is not clear how when should they be presented as a part of the old product and when a new product identity (branding) is suitable.

From the standpoint of theories of digital innovation, investigating the role of openness and distributability leads to additional research avenues. For instance, more could be known about operations uniquely enabled by digital artifacts such as forking (duplication of design capital). Lastly, on the topic of “technical debt”(Mehrizi, Modol, and Nezhad 2019), which serves as an additional cost on unlocking certain options, not much is known about decisions to abandon design capital in favour of fresh development. How are these decisions made and how are they managed?

**Table 4 Possible Research Questions**

Design capital	<ul style="list-style-type: none"> <li>- When companies work on unlocking a set of options of a design capital, how should they organize (within company or across ecosystem)?</li> <li>- How the decision about how to present the new options are made? New or old product identities?</li> <li>- What is the role of openness and distributability in managing design capital (and motions like forking)?</li> <li>- When to favour decisions to abandon an existing design capital and favour fresh development?</li> </ul>
Digital Resource	<ul style="list-style-type: none"> <li>- How can companies attain competitive advantage when digital resources can be duplicated, edited, or freely distributed?</li> <li>- What kind of digital resources and associated practices facilitate generativity and attract other actors when companies try to orchestrate an ecosystem?</li> <li>- How can the meaning of digital resources as resources be stabilized and negotiated?</li> </ul>
Knowledge	<ul style="list-style-type: none"> <li>- What are some new dynamics in organizational learnings and knowledge management that are enabled by unique properties of digital artifacts?</li> <li>- How are previously theorized socio-cognitive processes affected by properties of digital artifacts? How does that affect innovation?</li> <li>- Is high degree of technical knowledge necessary to navigate digital innovation?</li> <li>- How should innovation teams be composed?</li> </ul>
Product-in-use	<ul style="list-style-type: none"> <li>- How can companies leverage editability of digital artifacts and design for co-creation?</li> <li>- How to ensure/manage consistent product identity when digital objects can be changed or locally interpreted?</li> <li>- How to manage threats of piracy stemming from distribution/reuse of digital artifacts?</li> </ul>

**5.1.2. Questions about Digital Resources:** Reinventing the resource-based view for the digital age (to paraphrase Nambisan et al, 2017) can be accomplished by pursuing multiple questions. How can companies attain competitive advantage when digital resources can be duplicated, edited, or freely distributed? Starting from the premise that generativity is at the core at digital innovation, what kind of digital resources and associated practices facilitate generativity and attract other actors when companies try to orchestrate an ecosystem?

However, a problem with opening up resources for co-creation may lead to challenges stemming from a loss of control. We know that digital artifacts can be re-interpreted. A theoretical as well as managerial concern may arise in how can the meaning of digital artifacts as resources be stabilized and negotiated?

**5.2.3. Questions about Digital Artifacts as Knowledge:** When empirical research on digital innovation leverages the knowledge perspective, pertinent questions relate to the unique dynamics of organizational learning, which are enabled by digital technologies and their specific properties. Knowledge management is a well-researched area (Schultze and Leidner 2002) but since digital artifacts display new properties (Hui 2016) and because their role in organizations has shifted (El Sawy 2003; Wessel et al. 2020), revision of these perspectives for the context of digital innovation may be a worthwhile pursuit. One however needs to cautious not to slip into well-trodden path of technologically enabled Knowledge Management (Hatchuel, Le Masson, and Weil 2002).

The research avenues for digital innovation from the knowledge perspective are also tightly linked with organizational matters. Pursuing this set of questions, research may investigate the particularities of knowledge for digital innovation. For instance, since digital innovations occur at intersection at multiple traditional departmental areas, we may inquire into the role of specialization. Is high degree of technical knowledge necessary to navigate digital innovation? How should innovation teams be composed, when it comes to technical/non-technical specialists?

Besides relying on knowledge management perspectives, digital innovation research, that adopts the knowledge view, also makes use of socio-cognitive theories like sensemaking. Here as well, the particular properties of digital artifacts may justify revision of these perspectives.

**5.2.4 Questions Digital Artifacts as Product-in-use:** When digital artifacts are seen as products-in-use, questions arise about the interactions between the user and the product. How are the digital products themselves being recombined? How are identities of digital artifacts negotiated (destabilized and stabilized)? A line of inquiry of high relevance to practitioners concerns how these unbounded interactions between networks of co-creators and consumers can be managed. In such settings, the questions of how identity of editable/interactive products is vital. Similarly, from a managerial point of view, the product development process which results in products that are always incomplete could be expanded in further research. How can companies effectively leverage editability and manage co-creative communities? Another practical concern that accompanies co-creation is piracy (Lang, Shang, and Vragov 2015) which surfaces the “dark side” of co-creation with distributable digital artifacts. This generally invites more work on the paradox between control and generativity that is enabled by editable digital artifacts.

## **6. Conclusion**

The central argument of our paper, that digital artifacts need to be considered in order for the quest for new logics of digital innovation to succeed, proves the enduring value of the point raised by Orlikowski and Iacono in 2001. However, in the context of digital innovation, the theoretical pathways to accomplish a refined view of the digital artifact need to be revised. The reviewed empirical literature on digital innovation is driven by four common conceptualizations of digital artifacts, each particularly suitable to surface different property of digital artifacts. (1) Design Capital conceptualization can surface especially openness. (2) Digital Resource conceptualization is particularly effective at surfacing distributability. (3) Knowledge conceptualization offers a versatile interpretative framework with focus on distributability. Finally, (4) Product-in-use theories surface editability/interactivity of digital artifacts.

As a major limitation of the presented work, we need to highlight our choice to limit the review to major journals. Given the timeliness of the phenomena, many contributions are being discussed at conferences or other outlets. However, as the major journals should present the best of IS scholarship, we believe our review to be sufficiently instructive and thus represents a step towards the quest of new theoretical logics of digital innovation.



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## **Innovation Drift: The influence of digital artefacts on organizing for innovation**

Michal Hron, Nikolaus Obwegeser, Sune Dueholm Muller

### **Abstract**

The literature on digital innovation often relies on examples of radical, even paradigm-changing novelties. In order to develop such radical innovations, organizational separation of innovation efforts has been advocated by many as an effective strategy. We have conducted a longitudinal case study of a radical innovation project at a born-digital company. The company established a separate organization to develop radical innovation, but over time, the innovation drifted from radical to incremental. Even keeping the organization separate proved difficult.

In explaining the events in the case study, we follow the argument that new theories of digital innovation can be developed with reference to the specific properties of digital artefacts. We outline how properties like editability and distributability may contribute to innovation drift, i.e., the proclivity of radical innovation ambitions to gradually drift towards more incremental realizations. Due to their nature, digital artefacts can diffuse through the organization and, thus, pose a challenge to the effectiveness of organizational separation as a strategy for innovation.

With this work, we contribute to the literature on digital innovation by responding to calls for research on new theories of digital innovation and the demand for greater appreciation of digital materiality in organizing. We also challenge the prevailing view of digital innovations as radical and aim to open a debate on the possibility and considerations surrounding incremental digital innovations.

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## 1. Introduction

A growing body of literature has investigated digital innovation (Kohli & Melville, 2019) and digital transformation (Vial, 2019), and the question of how to effectively manage digital innovation in practice is on the top of many managers' agendas (Obwegeser et al., 2020). In both research and practice, digital innovation is often motivated by examples of radical changes to existing products (Baiyere & Hukal, 2020; Gong & Ribiere, 2021; Vial, 2019; Wessel et al., 2020). Commonly discussed examples are how Uber disrupted the taxi business or how Amazon transformed the retail industry. This, in turn, influences the way we talk and think about innovation in a digital context, including the question of how to best organize for digital innovation.

This paper presents a longitudinal single case study of the development of a digital innovation. The case company aimed to pursue radical changes and hoped that the envisioned innovation project would lead to new types of value (Gong & Ribiere, 2021) and an eventual redefinition of its organizational identity (Wessel et al., 2020). To succeed in this radical innovation effort, the firm's leadership decided to set up a separate team. Partly, this was because the company had previously experienced the challenge of trying to innovate within its existing organizational structure. Partly, it was justified through widely popularized innovation studies, in which there are many proponents of organizational separation to achieve innovation (Christensen & Raynor, 2013; Duncan, 1976). Organizational separation should provide a space for developing new perspectives, knowledge and framing problems (Gilbert, 2004; Markides, 2013) because the separated organization can escape the competency trap (Liu, 2006) and inertia of the old business (Hannan & Freeman, 1984; Leonard-Barton, 1992).

Even though the case company pursued the innovation project with a separate organization, it did not attain the expected results. Keeping the existing organization separate from the innovation unit turned out to be even more difficult than expected. Eventually, the company's innovation ambitions drifted from radical innovation and settled on incremental innovation. This 'unusual incident' (Katz, 2001) was at odds with the expectations of practitioners, and their understanding of theory. This paper investigates the reasons for this puzzle and provides a possible explanation.

Based on recent calls for research, we approached the puzzle with a focus on the digital nature of the innovation effort. Many scholars agree that digital innovation represents a substantially different context than innovation that does not involve digital technologies. In digital innovation, widespread deployment of digital technologies leads to potential ‘implications for extant management theories and assumptions’ (Avital et al., 2019). Thus, a digital innovation context creates demand to develop new innovation theories (Nambisan et al., 2017; Yoo et al., 2012, Hron, 2021) or, at least, provides incentive to revise the established perspectives (Gkeredakis & Constantinides, 2019).

Consequently, in order to investigate the case, we built on prior research that emphasizes the role of the technological artefact (Grover & Lyytinen, 2015; Orlikowski & Iacono, 2001). In particular, we were interested in the relationship between the specific properties of digital artefacts, as highlighted by recent studies, and the organizational arrangements for innovation, i.e., the tension between separation and integration (Christensen & Raynor, 2013). Therefore, we formulated the following exploratory research question: *How do the specific properties of digital artefacts influence organizing for innovation?*

Our longitudinal case study concerns a born-digital company operating an online marketplace for rental housing. We followed this case for two years and observed how the tensions between radical and incremental, as well as between the separation and integration of digital innovation efforts unfolded in practice. Our findings reveal that the inherent properties of digital artefacts may contribute to a phenomenon we term *innovation drift*, i.e., the proclivity of radical innovation ambitions to gradually drift towards more incremental realizations.

With this study, we follow recent calls for research on digital innovation (Nambisan et al., 2017; Yoo et al., 2010). By problematizing the established literature on organizational separation and integration for innovation, we aim to contribute to the literature on digital innovation and increase our understanding of the practical matters of organizing for digital innovation. We do so by building on prior research that emphasizes the role of the technological artefact (Grover & Lyytinen, 2015; Hron, 2021; Orlikowski & Iacono, 2001). Within the range of options for organizing for digital innovation, we focus on the continuum between radical and incremental innovation. Our case study documents that, contrary to the views that dominate the discourse on digital innovation (Baiyere & Hukal, 2020; Riemer & Johnston, 2019; Vial, 2019), digital innovation may not always take the form of radical innovation. Companies

should give full consideration to both radical and incremental approaches and carefully explore the options between organizational integration and separation.

## **2. Literature background**

### **2.1 Challenges of radical and incremental digital innovation**

The recent literature on digital innovation employs a range of examples and definitions with an unmistakable bias toward digital innovation as radical innovation. Riemer & Johnston (2019), for instance, tell the story of the digitalization of the music industry as an ‘interpretative discontinuity’ or ‘worldview change.’ Baiyere & Hukal (2020) similarly define a related term—digital disruption—as ‘alteration of a domain-specific paradigm due to the digital attributes of an innovation’ (p. 5482). Gong & Ribiere (2021) pursue a definition of digital transformation as ‘a fundamental change process’ (p.12) that can lead to altered value propositions. Lastly, Wessel et al. (2020) make the distinction between contemporary digital transformation and previous IT-driven organizational change similarly on the grounds that digital transformation employs digital technologies to redefine value propositions as new organizational identities emerge.

Research has long distinguished between more modest incremental innovations and ambitious radical innovations, where radical innovations represent a higher degree of departure from familiar technologies and markets (Ettlie et al., 1984). Although the present-day literature on digital innovation favours debating innovations of the radical kind, this established distinction remains relevant for the context of digital innovation.

Radical innovations present a set of daunting managerial challenges, including the necessity to acquire new knowledge, develop new competencies, and overcome organizational inertia (Cohen & Tripsas, 2018; Hannan & Freeman, 1984). Radical innovation requires stepping outside the territory of familiar knowledge (Liao et al., 2008), well-understood technologies and well-known markets (Gillier & Piat, 2011; McDermott & O’Connor, 2002). A company may find itself in a ‘competency trap’ (Liu, 2006) brought on by organizational rigidities (Leonard-Barton, 1992). Radical innovation may require breaking away from the current understanding of what the product (Norman & Verganti, 2014) or company (Hatch, 2011) is.

Extant literature on digital innovation makes scarce use of the distinction between radical and incremental innovation; thus, it offers limited insights into managing the options offered by the continuum between radical and incremental innovations. At the same time, numerous voices have articulated a need to revisit existing innovation management principles in the context of digital innovation (Avital et al., 2019; Nambisan et al., 2017; Yoo et al., 2010).

To answer this call for action, this study focuses on what lies at the core of digital innovation, i.e., the digital artefact. Digital innovation (as opposed to traditional innovation) is accomplished by ‘carrying out of new combinations of digital and physical components’ (Yoo et al., 2010). Thus, the novelty of digital innovation can be traced back to the specific properties of the artefacts being recombined. Some of these artefacts are material (Henfridsson et al., 2018) while others are digital (Faulkner & Runde, 2011; Hui, 2016). The non-material digital artefacts, in particular, are characterized by a range of properties that influence digital innovation efforts and their outcomes.

## **2.2 Digital artefacts**

Digital artefacts have been conceptualized in various ways in extant literature on digital innovation. They can be seen as a resource to be recombined (Henfridsson et al., 2018), capital to be extended (Woodard et al., 2013), or a system with layered modularity (Yoo et al., 2010). In this study, we are concerned with digital artefacts that are primarily non-material, i.e. we follow Hui’s understanding of digital artefacts as objects that ‘take shape on a screen or hide in the back end of a computer program, composed of data and metadata regulated by structures or schemas’ (Hui, 2016). Archetypical examples of such digital artefacts are ‘computer bugs,’ a profile on a social media website (Ekbia, 2009), or data more broadly (Hui, 2012).

The specific properties of such digital artefacts have been the subject of several recent theoretical works (Baskerville et al., 2019; Ekbia, 2009; Runde & Faulkner, 2019). Kallinikos et al. (2013) offer a high-level summary of this literature and propose three main properties of digital artefacts: *editability/interactivity*, *openness/reprogrammability*, and *distributiveness* (Table 1).

**Table 2: Properties of digital artefacts following Kallinikos et al. (2013)**

<b>Property</b>	<b>Description</b>	<b>References</b>	<b>Potentiality</b>
<i>Editability/interactivity</i>	Artefacts can be changed by rearranging or adding elements	(Ekbia, 2009) (Ciborra & Willcocks, 2006)	Can enable contingent actions
<i>Openness and reprogramability</i>	Artefacts can be accessed and modified by other digital artefacts or human actors	(Garud et al., 2008) (Faulkner & Runde, 2009)	Can enable generativity
<i>Distributability</i>	Artefacts can be dispersed across multiple organizations, possibly via information infrastructures	(Y. Yoo et al., 2012) (Kallinikos et al., 2010) (Ekbia, 2009)	Can facilitate convergence

*Editability/interactivity* Individuals can change the technology according to knowledge, norms, and rules (Orlikowski, 2000). Digital artefacts enable different actions depending on the context, by adapting to the environment, and by being used according to local needs (Faulkner & Runde, 2009). In other words, the same artefact can serve different purposes to different groups by being locally adapted and combined.

*Openness and reprogramability* Digital artefacts enable generativity, i.e. they can be combined to generate new solutions (Nambisan et al., 2017; Eck et al., 2015; Zittrain, 2008) and form extensible software platforms (Tiwana et al., 2010a). Consequently, they can also be seen as intentionally unfinished (Garud et al., 2008), precisely because they are perpetually in the making.

*Distributability* Digital artefacts can freely ‘diffuse throughout the institutional fabric’ (Kallinikos et al., 2010) and be implemented across work processes and, thereby modify or extend them. The materiality of digital artefacts reflects and stems from their ability to configure networks (Ekbia, 2009). Digital artefacts are, therefore, essentially inseparable from the associated networks of actors. In other words, they are inseparable from organizing. As a result of their ability to freely diffuse across organizations and be combined with other artefacts, they can facilitate a degree of convergence of product categories and traditional industries (Yoo et al., 2012).

It is only by considering digital artefacts as a class of objects by itself—different from natural objects (e.g., trees) or man-made tools like hammers—that we can truly understand their dynamics. The most recent literature on digital artefacts highlights their interconnectedness with organizational phenomena. The relational view, developed by Hui (2012, 16), is one example. Similarly the notion of quasi-objects (Ekbja, 2009; Lange et al., 2019) and evidence that digital artefacts are constitutive of reality (Baskerville et al., 2019) direct our attention to how digital artefacts influence the organizational realities with which they are entangled.

## **2.3 Organizing for (digital) innovation**

The challenge of organizing for innovation is a longstanding and central topic of academic discourse (Andriopoulos & Lewis, 2009). Innovation challenges organizations to simultaneously address existing organizational objectives together with new objectives introduced by innovation (Tushman & O'Reilly, 2012). The approaches to organizationally addressing the challenge of competing objectives can be mapped on a continuum that ranges from decoupling innovation efforts from the organization entirely on the one end, to integrating the innovation within existing organizational structures on the other end. Both approaches to organizing for innovation have been extensively researched (Benner & Tushman, 2015).

### **2.3.1 Structural separation of innovation**

Separating radical innovation efforts may be effective because it allows for a new set of routines to be developed, independent of the parent organization (Duncan, 1976). This is well captured in the so-called SkunkWorks approach, defined as 'enriched environment that is intended to help a small group of individuals design a new idea by escaping routine organizational procedures' (Rogers, 2003). Organizationally separated innovation units bear names such as corporate accelerators (Bauer et al., 2016) and incubators (Becker & Gassmann, 2006). Companies may also acquire start-ups or develop spin-offs as means of structurally separating innovation (Burgelman, 1991; Lassen et al., 2006).

The key downside to organizational separation, however, is that separated innovation units cannot easily draw on existing resources, and they may be hard to integrate at a later point in time. Synergistic effects

between old and new units are also hard to reap: ‘By launching a spinoff, a company often creates conditions that make future integration very difficult. For enduring success, incumbent companies are better off creating a group that is—or will eventually be—integrated within their organizations’ (Iansiti et al., 2003, p. 58). Establishing a separate unit has been argued to be particularly advantageous when the task is exploring new technology (Utterback, 1994) or facing disruptive innovation (Christensen & Raynor, 2013). Separated digital innovation units have, thus, become a popular and widespread practice (Fuchs et al., 2019). They can be found under names such as ‘digital hubs’ (Obwegeser et al., 2020) and ‘digital innovation labs’ (Hund et al., 2019). Digital technologies can provide additional impetus for engaging in such activities (Joshi et al., 2019).

### **2.3.2 Organizationally integrated innovation**

On the other end of the continuum, integrating innovation efforts within the existing structures of the organization offers not only distinct benefits, but also drawbacks. Integration enables the capitalization of existing resources, which may be necessary, especially in the early phases of innovation. Integration also supports the systematic extension of existing offerings (Hess et al., 2016). However, when innovation is developed within the same organizational structure, relying on existing resources and capabilities may hamper the innovation effort when core capabilities manifest as rigidities (Leonard-Barton, 1992); therefore, breaking free from the ‘trap’ of existing knowledge can be difficult (Liao et al., 2008; Liu, 2006). Part of the literature explores the notion of contextual ambidexterity, which denotes the ability to simultaneously attain old and emerging objectives (Gibson & Birkinshaw, 2004), thereby circumventing limitations such as rigidities. Radical innovation can be accommodated within existing, albeit constantly shifting, organizational structures (Brown & Eisenhardt, 1997), e.g., by drawing on knowledge across boundaries (Le Masson et al., 2010, p. 113; Takeuchi & Nonaka, 1986).

Integrating innovation within existing organizational structures may be appropriate with regard to digital innovation, but it requires organizations to adapt their structures, roles, and processes, which is challenging and characterized by a high probability of failure (Kane et al., 2017; Sebastian et al., 2017; Wade et al., 2019).

Research suggests that organizational separation is well-suited for radical innovation, but it does not provide guidance in terms of integration with the existing business at a later stage. Organizational

integration, however, supports the reuse of existing capabilities, but it may stifle creativity and novelty, and bring the innovation closer to existing value propositions (Markides & Charitou, 2004; Westerman et al., 2006). The continuum spanning separation and integration does not preclude the coexistence of both approaches to organizing for innovation within the same organization (Birkinshaw et al., 2016). Organizational structures may also change over time as the innovation efforts unfold (Johansson et al., 2007; Obwegeser et al., 2020). What begins as an organizationally integrated innovation approach may be decoupled from the rest of the organization at a later stage, but re-integrated at the end.

## **2.4 Reuse versus new development**

Besides separation versus integration, digital innovation is also characterized by a second area for critical decision making with regard to the architecture of the digital artefact. Architectural innovations, defined by Henderson & Clark (1990), ‘change the architecture of a product without changing its components.’ They can either be radical or incremental. The point is that even an incremental change in the market offering can represent a daunting challenge when, to deliver it, the internal product architecture needs to be overhauled. In the context of digital innovation, this reflects a key decision between reuse and extension of existing resources versus the development of new digital artefacts. Extant literature shows that the reuse of existing resources, like knowledge, can lead to reduced learning (Liao et al., 2008) and innovation performance (Katila & Ahuja, 2020). Similarly, reusing existing technological capabilities can constrain the search for innovative product concepts (Leonard-Barton, 1992). Yet, building hybrid products combining elements of old and new technologies is reported as a strategy that can lead to successful innovation outcomes (Cohen & Tripsas, 2018).

The question of reusing existing resources is particularly relevant when it comes to digital artefacts, which are easily transferred and modified in contrast to non-digital artefacts (Nambisan et al., 2017). Because of their generative potential (Zittrain, 2008), existing digital artefacts can be used as platforms for developing new innovations. Editability allows digital artefacts to be brought into new contexts and their properties support distributability (Kallinikos et al., 2010) and low transfer costs (Yoo et al., 2012).

Digital artefacts are valuable resources that can facilitate innovation through recombination (Henfridsson et al., 2018), extension (Garud et al., 2008), and reinterpretation (Nevo et al., 2016). At the same time,



research has shown that digital artefacts may also constrain individual practices (Orlikowski & Robey, 1991) and limit the strategic options of organizations (Woodard et al., 2013) due to technical debt inherent in the stock of artefacts. That is why companies occasionally undergo the painful process of abandoning existing artefacts and starting anew (Mehrizi et al., 2019; Wimelius et al., 2020).

## **2.5 Intertwining of the two tensions**

While analytically separable, organizational choices tend to be reflected in the architecture of the product under development (Baldwin & Clark, 2000; Conway, 1968). This has come to be referred to as the mirroring hypothesis (Baldwin, 2015; Sorkun & Furlan, 2017). Eisenhardt (2001), for example, leverages the notion of architectural innovation to explicitly discuss changes in organizational arrangements, namely the creation of new charters in a multi-divisional corporation. This demonstrates that the notion of architectural innovation can be used for both products and organizations.

The mirroring hypothesis is easier to apply when products and the organizations they mirror are neatly hierarchically decomposable. However, this is not always the case in the digital context. Thinking in terms of reusable patterns may be more suitable for the digital context (Henfridsson et al., 2014). The challenge of the mirroring hypothesis further comes from the constitution of digital artefacts, which are composed in a layered, modular fashion (Yoo et al., 2010). This presents an alternative logic which is not easy to reconcile with the traditional hierarchical decomposition of products and the organizations they mirror (Hylving & Schultze, 2020). Flowing from this are challenges for organizational arrangements, when companies struggle to place the responsibility for digital innovation in a single department (Svahn et al., 2017).

## **2.6 Analytical framework**

Building on prior literature, we consolidate the aforementioned tensions between integration and separation as well as between extension and new development in an analytical framework that supports our empirical analysis (Table 2). The framework distinguishes between four approaches to digital innovation, along the two dimensions of organizational and architectural tensions, which are described in the following.

		Organizational tension	
		Integration	Separation
Architectural tension	Reuse / Extension	<b>Integrated Extension</b>	<b>Separated Extension</b>
	New development	<b>Integrated Development</b>	<b>Separated Development</b>

**Table 2: Analytical framework**

- **Integrated extension:** An organization uses existing organizational structures and resources to develop digital innovations. The ‘malleability and ubiquity of information technologies (IT) makes them prone to being reinvented, i.e., users changing an IT to pursue new goals’ (Nevo et al., 2016). This pertains mostly to incremental innovation and improvements to an existing product or service rather than introducing something radically new. Because the choice in product architecture mirrors the choice in organizational arrangements, this arrangement should be stable following the mirroring hypothesis.
- **Separated extension:** An organization relies on a separate unit to develop novel features, but it reuses existing resources. Organizationally, the parent organization may serve as a boundary object facilitating interactions between different social groups (Star & Griesemer, 1989) or even as a technological platform (Tiwana et al., 2010b; Woodard et al., 2013). In this case, the mirroring hypothesis is violated, as the innovation is developed by a separate team but also reuses and extends existing resources. The mirroring hypothesis would predict that within one organization this is an unstable setup and one of the two tensions needs to be changed for mirror-like symmetry to be achieved.

- **Integrated development:** An organization aims to develop novel digital artefacts within existing structures and without reusing existing resources. The development team needs to be able to escape organizational routines and explore new concepts. Developers are asked to balance contradictory demands of exploitation and exploration (Wang & Rafiq, 2014) within the same business unit (Gibson & Birkinshaw, 2004). This is one of the quadrants that defies the mirroring hypothesis. Organizationally, the development is integrated but architecturally it is not. Therefore, this should not be a stable organizational setup.
- **Separated development:** An organization establishes a separate unit to develop a digital innovation from the ground up, without reusing existing resources. Such an organizational structure can be suitable for housing radical innovative efforts that explore, e.g., a new technological core (Utterback, 1994). Both architecture and organization are separated. This should be a stable arrangement according to the mirroring hypothesis.

### 3. Research design and analysis

We conducted an in-depth, longitudinal case study (Langley, 1999) of an industry-leading online real-estate platform company to understand how the unique properties of digital artefacts influence the practice of organizing for innovation. We aimed to study the micro-level processes of organizing in order to gain deep insights into the effects of macro-level organizing decisions on daily practices (Whittington, 2006). We wanted to capture the evolution of the firm's innovation journey; therefore, we decided to follow it over a period of two years.

#### 3.1 Case company

The case company is a European online real-estate firm—RentCorp—that connects owners of real estate (landlords) with those in need of rental housing. RentCorp has been operating exclusively through digital channels since it was established in 1999; it has become a household name on the national market, effectively replacing physical newspaper classifieds. The company has a single source of revenue: subscription fees from home seekers (landlords use the marketplace for free). This dependence on a single revenue source was the catalyst for the company's innovation efforts.

At the time of writing, the company employed about 50 people with annual revenues of about \$30 million. Developers and customer service staff are the two main employee groups. A small part of the development tasks is outsourced to Eastern Europe. Among the developers, we found front- and back-end developers, designers, and other specialized roles. Many of the key employees have spent substantial parts of their careers at the company. Overall, our informants characterize the company's culture as informal with a high-degree of openness and information sharing. For instance, early on, Slack was adopted as the company-wide chat application, including a popular 'business inspiration' channel where all employees can share links and ideas that may be helpful for the development of the company.

### **3.2 Data collection**

We gathered multiple sources of evidence over time: direct interviews, observation of key meetings, archival data (e.g., internal documents and e-mails), and externally available data. The data collection was initiated with a broad interest in how *digital innovation unfolds in practice*.

Observations enabled us to follow the decision-making process in relation to innovation. This included the kick-off meeting for the initiative where the innovation vision was spelled out. Publicly available information as well as internal data provided additional detail on these meetings. Interview data was collected over time as the innovation process unfolded. Initial interviews were exploratory and helped us understand the challenges of the company. Later, semi-structured interviews were conducted with a focus on the evolution of the vision and plans behind the innovation. Each interview lasted approximately an hour. Table 3 provides a detailed overview.

We followed a purposive sampling approach, including interviewees across all vertical and functional divides within the company (from the CEO to software developers). The head of RentCorp IT and the manager of the InnoCircle project (later 'head of new ventures') were interviewed repeatedly. Leaders of various business functions, such as sales and customer support, provided additional insights. Altogether, 14 interviews were conducted over a 20-month period, which allowed us to observe the trajectory of the innovation journey from conception through several trials to launch.

**Table 3: Overview of interviews**

	<b>Informant</b>	<b>Duration</b>
1	Controller	33m
2	CEO	56m
3	Head of IT	57m
4		59m
5	Head of IT, Scrum Master	1h 25m
6	Head of	1h 4m
7	New	1h 5m
8	Ventures	1h 22m
9	Head of IT	30m
10	Head of Support	48m
11	CEO	1h 4m
12	CPO, CFO	46m
13	Head of Sales	56m
14	Head of New Ventures	56m

### **3.3 Data analysis**

We used an abductive approach to qualitative content analysis (Alvesson & Kärreman, 2007), which involves moving back and forth between theory and empirical data in an iterative manner (Mingers, 2004; Wynn & Williams, 2012). The following stages, as proposed in Grodal, Anteby, & Holm (2020), formed the basis for our coding and analysis processes.

First, we started the data analysis with exploratory coding, identifying a variety of ‘first-order codes’ (Knudsen, 1975) that appeared naturally in the data. These codes concerned, e.g., product development, organizational practices, collaborations with external partners, and the growing challenge of integration versus separation. In total, 117 first-order codes were generated. Table 4 provides an overview of some of the frequently used first-order codes grouped into second-order constructs and categories.

**Table 4: Fragment of the coding scheme**

<b>First-order codes</b>	<b>Second-order constructs</b>	<b>Category</b>
Product, branding/presentation, organizational arrangements, work practices, staff/resources	Areas of separation/integration	<i>Separation and integration</i>
Synergy, leveraging, common infrastructures, cannibalization, technical debt, modularity	Effects of digital artefacts	
Move-in report, digital contract, advertising, data services, move-in report	Solutions for landlords	<i>Product extensions</i>
Payment, digital signatures	Solutions for tenants	
Agile development, prototypes, self-organizing teams, continuous deployment	Management models	<i>Organizational practices</i>
Outsourcing, digital components	Existing	<i>Inter-organizational arrangements</i>
Possible external partners, platform ambitions	Envisioned	

Grodal et al. (2020) suggest that the basis for formulating initial codes is a puzzle, i.e. ‘observations at odds with our existing knowledge about a category.’ For us, such an ‘unusual incident’ (Katz, 2001) occurred when the organizational separation did not produce the expected results. Also, the company did not seem to be able to keep the innovation unit and parent organization fully separated. The topic of organizational separation versus integration was then explored in subsequent interviews as we decided to focus on investigating the specific dynamics of organizing for digital innovation.

Second, we focused on integration versus separation and dropped or merged other codes. For instance, the matter of external collaboration became less relevant to the emergent objective of investigating internal organizational dynamics influenced by digital artefacts. ‘Partitioning’ and ‘unbundling’ (Miles et al., 2014, p. 285) of the data was a way to obtain more clarity in response to the identified puzzle: Which aspects of digital innovation efforts should be integrated versus separated? What organizational structures are most supportive of innovation efforts? And how do digital artefacts influence the dynamics of innovation? To explain these puzzles, we started working with the literature on digital materiality (Kallinikos et al., 2013).

Third, we worked with coded transcripts and interpreted them based on the analytical framework (Table 2). We followed three main areas derived from coding in stages one and two (organizational matters, product, and branding/presentation) and analysed their evolution against the configurations of the analytical framework (Table 1). With the case data, we were able to analyse each of the three areas (product, organization, presentation/branding) in three out of the four configurations of the analytical framework (Table 2). As such, the analytical framework provided a sensemaking device and a tool to structure the chronology of the case.

Lastly, we intended to ‘to create a theoretical scaffold to explain the studied phenomena’ (Grodal et al., 2020). The properties of digital artefacts as described in extant literature provided the concepts necessary to analyse the empirical data and make sense of the case. Table 5 presents an overview of the data across all interviews with emphasis on categories of theoretical interest. Three main areas are displayed horizontally: (1) Whether the innovation unit should be separated or integrated (organization), (2) what new product features should be developed, and (3) how the results of the innovation efforts should be presented. Specifically, should they be framed as a new product or branded as part of the existing product?

## **4. Results**

Below, we present the results of our case analysis by following the original timeline of events, starting with an outline of RentCorp’s initial motivation to engage in a radical digital innovation project (InnoCircle) and the steps and decisions that followed thereafter.

### **4.1 Introduction: Going beyond classifieds**

Since its establishment in 1999, RentCorp had experienced rapid growth of its national online marketplace for rental housing. The growth was reported by the business press, which recognized the company with five awards, between 2007 and 2015, for being the fastest growing company in the country. RentCorp is a monolithic company with one product that generates a single revenue stream. Despite a track record of adopting innovations like social media advertising, the company never successfully executed a larger-scale innovation that would allow it to diversify its revenue stream.

As a firm with a single business unit, the IT architecture is rather centralized and unified; however, it is plagued by a high degree of technical debt in some areas. This debt can be traced back to the earliest days of the company where development was outsourced. The central digital artefact of the company is a voluminous database storing transactions accumulated over the entire 16-year history of the company. Besides technical debt, additional challenges are imposed on development efforts as a result of some design choices made in relation to existing digital artefacts (e.g., database, interfaces, and applications). For instance, the original structure of the database behind the RentCorp product was tailored to facilitate a classifieds business and was not suitable for newly envisioned extensions. Some of the technologies on which the old infrastructure was based were also seen as outdated by today's standards.

RentCorp enjoyed market dominance for a long time. However, between 2016–2017, the company experienced a period of reduced growth and even a slight decline in revenue. Top management was concerned with the developments, especially since they received an industry award recognizing RentCorp's impressive growth just the year before. Management interpreted these negative financial results as a sign that the market was getting saturated. Saturated or not, the worrying decline in revenue questioned the longevity of the business model. The board and CEO were aware that the company was at risk and susceptible to market fluctuations. In light of the 2016 results, the CEO and board considered different sources of growth and how RentCorp might pursue them.



**Table 5: Preview of the data**

	<b>Views on separation</b> (Illustrative quotes)	<b>Views on integration</b> (Illustrative quotes)	<b>Views on digital artefacts</b> (Illustrative quotes)
<b>Organization</b>	<p>We had the problem of not being able to do this project within the organization that we currently have. So, now we are doing it in this way, pursuing this idea in an innovation lab sort of manner. (06)</p> <p>We wanted to hire a new front-end developer, but if we were to do that in InnoCircle, then we had a front-end developer in RentCorp who said, ‘I would love to do that.’ And, we told him, ‘You are not going to do that, we are going to hire a new one to do that.’ (03)</p>	<p>It’s important that we don’t get too far apart. If InnoCircle becomes a separate company and its successful, then all of a sudden, RentCorp can be in trouble. I think there’s too much value in us working together for that to be very long term. (13)</p> <p>I always wonder what we can learn from each other across RentCorp and InnoCircle, I go around in the organization talking about new ideas about InnoCircle and RentCorp, how we can cooperate better and so on. (14)</p>	<p>In InnoCircle, we are building our own database and our own front-end data, workflows and all that, but we still have a lot of links to the old, we are building it as microservices. (04)</p> <p>That’s one of the benefits of what we are doing right now. We are using RentCorp, some of their services that the back-end team supplies. (08)</p>
<b>Product</b>	<p>We do not want to be developing the product and then putting it back into RentCorp. (04)</p> <p>We need to be sure that we can go to the market with two different products that take the benefit from both landlords and housing seekers, but we need two different products. (08)</p>	<p>Right now, it makes more sense for this service that we have made to launch it with RentCorp, so that’s what we did. So, instead of saying, alright it needs to split into whatever scheme we have for this, then this actually makes sense right now. (06)</p> <p>We will have some links, like advertise your property here or a call to import your match, if you advertise something and then you have a match. (14)</p>	<p>You should use all the data and then make your listings even better. We have all the data now. We have the old classifieds business. We have been here for almost 20 years, so if someone should do this, we should do it. (15)</p>
<b>Presentation / Branding</b>	<p>If there is a loose connection to RentCorp, then we are freer to make the choices we want [in InnoCircle]. And of course, it has something to do with the fact that we want to expand out to other markets as well. (07)</p>	<p>I’m a little sceptical whether it’s the right solution because if a user is used to the RentCorp interface, then you move to InnoCircle, everything looks completely different. (11)</p> <p>We don’t want to charge customers twice for the same thing. If you are buying the contract module in RentCorp, and then you are also getting that in InnoCircle, then you would essentially pay for the same thing twice. (11)</p>	<p>But if you are a RentCorp user, then you have this feature built into the interface you are used to, and then you, then you can port your data to the new InnoCircle interface. (07)</p> <p>Digital contracts will be the central module of InnoCircle, once that’s released. For now, we are spending the time until the full release to learn about how the contracts work by having them inside RentCorp. (06)</p>

Note: This table shows illustrative quotes under the three most common categories of codes. The dichotomy between integration and separation is blurred due to the properties of digital artefacts (shown in the last column). The numbers in parentheses refer to interview numbers given in Table 3.

## 4.2 InnoCircle as a separated development

The development of a radical innovation, with the aim of establishing a new and self-sustaining business unit, was initiated within a separate organizational structure ('separated development'). The aim was to develop a separate product that could be marketed under a new brand identity. The entrance to the office building was adorned with a new logo, highlighting the separate visual identity of InnoCircle, as it was placed right next to the logo of RentCorp. To employees and visitors, this was intended to signal commitment to becoming a multi-division business. Clear separation would enable the company to dedicate resources to the innovation and develop a product that would be a radical departure from the product that has propelled the company to its present market-dominant position.

### 4.2.1 Organization

When the alarming financial results were released in 2016, the company consisted of around sixty employees, half of which were developers organized in one department. Other departments included customer support and traditional support functions like finance. Management understood that the company's fortunes could turn on a dime, even before the financial results came. However, it was difficult to cope with the uncertain future. In the words of the CEO:

*We have the experience that if we innovate at the same time that we are doing the development on the main platform, it tends to be a second priority or third priority. So, no real work gets started and as soon as we can, we take the resources away from that new project and then we lose the interaction and then it's stopped (CEO).*

This was echoed by the head of IT, who at that point, lamented about the amount of development time that is taken up by the development of technologies for internal use:

*At one point, we listed, I think, ten areas that the development department was handling—everything from operation to monitoring internal tools and so on. And only one of those ten items were actually creating new features for the product (Head of IT).*

In light of the difficulty to carve out time and resources for innovation, it was decided to pursue innovation within a separate organizational unit. A dedicated manager was appointed, and the unit was staffed with new hires in an office space that was physically separated from the rest

of RentCorp. The new unit was named InnoCircle in reference to the product concept that they were tasked with developing. The goal of InnoCircle was to achieve financial and organizational independence in a short to medium timespan. However, in the very early days, the InnoCircle team relied on support from the parent organization, but the new unit was eventually fully staffed and was, on the face of it, succeeding in its separation efforts. In fact, our interviewees enthusiastically discussed how InnoCircle would become its own legal entity with a product that had the potential for expansion into foreign markets.

*Actually, the worst thing that can happen is that we get a few important customers for InnoCircle, but not traction—not really growing that much. So, we would have a small team that needs to maintain a group of very important new customers but not that many. That's going to be very costly to do that. Then we would need to put that back into operation mode along with RentCorp. That's actually a worst-case scenario (Head of IT).*

#### **4.2.2 Product**

RentCorp's old business was a classifieds service that matched landlords with potential tenants. Tenants paid for a subscription to the service to contact landlords. While remarkably successful, it required a lot of resources to maintain operations.

*RentCorp, the old company, consumes all of the resources. All these small tasks swallow all the time. So, the old RentCorp, which is very successful, is our biggest problem at the moment because it's a success. So, we need to do something totally different (CEO).*

Management knew that something 'totally different' was needed, but it also sought ways to leverage existing capabilities and assets in developing the concept. Two insights were key as the CEO and the newly appointed manager of InnoCircle considered the path forward: First, while RentCorp was generating revenue through paid services to tenants, the large population of landlords were essentially given access to the marketplace for free. Second, while the rental relationship encompassed a large number of interactions between tenants and landlords (e.g., finding a place, signing a contract, and paying rent), RentCorp was only facilitating the initial matchmaking.

The idea was to deepen the range of services provided, especially to landlords, to cater to the various events and interactions that occurred over the rental lifecycle (hence the name InnoCircle). InnoCircle was intended to become a suite of services supporting all these interactions and, at the same time, open up a new revenue stream from the landlords who were

using InnoCircle as their main ‘operating system.’ Management envisioned a future in which landlords would see RentCorp as a provider of an essential suite of services rather than just a digital version of the classifieds page in a newspaper. In the words of the CEO:

*We want to give customers a platform where they can have this ongoing dialogue with tenants around a property. So, we hold the property and then we have a lot of dialogue going on.*

Pursuing this vision would accomplish two things: First, the company could obtain a new revenue stream from the landlords. Second, the company would provide customer value and engagement for a much longer time period than just during the time when tenants were searching for housing. If the new services supported the signing of rental agreements, collection of rent, and ongoing communication, there would be the potential for establishing a recurring source of revenue through a subscription model, a very attractive proposition for RentCorp.

Technologically, InnoCircle started out with the ambition of building a ‘greenfield product.’ Besides avoiding the technical debt amassed on the legacy platform, InnoCircle would be better positioned to develop the envisioned features. Therefore, InnoCircle started the feature development with the purposeful intention of not reusing existing digital artefacts.

A new database was formed, which was a radical decision as it presented a break with the core digital artefact around which RentCorp was built. InnoCircle further distinguished itself from the legacy organization by choosing modern programming languages and frameworks as opposed to the outdated technological stack that was used in the legacy organization:

*We have some new, younger people sitting here. Some work on top of some old legacy PHP code, which people just hate. In InnoCircle we are trying to evolve, we are trying to make use of microservices, a docker, and all the new stuff that’s coming up, trying to be innovative on that (Head of InnoCircle).*

### **4.3.3 Branding/presentation**

InnoCircle’s goal to become independent was ambitious. Many employees, including InnoCircle’s head, believed that InnoCircle would eventually outgrow the old business. The new services for landlords were not dependent on the domestic monopoly, although access to the domestic market helped; therefore, those new products could help with entering markets in

new countries. It was only natural that InnoCircle had its own brand and identity. It was decided to develop a new front-end system in support of InnoCircle's online presence. A completely new user interface was designed with a visual style reflecting the new InnoCircle brand, complete with a new colour scheme and modern layout that didn't resemble the old classifieds service at all. A high-fidelity mock-up of the new interface was presented at the kick-off meeting of the InnoCircle project. The company purchased a new .com domain name in anticipation of the internationally minded product. The legacy product had been hosted on a national domain name.

### **4.3 InnoCircle as a separated extension**

As the development of the 'greenfield product' was underway, a series of seemingly sensible decisions to leverage existing digital artefacts were made. While the InnoCircle unit remained organizationally separated, development efforts began to draw increasingly on existing digital resources, and as a result (moving from 'separated development' to 'separated extension'), the radical innovation ambition started to dissipate.

#### **4.3.1 Organization**

Following the establishment of InnoCircle, the new unit became increasingly organizationally independent. The InnoCircle team formed routines, and a new organizational culture was beginning to take shape. In fact, some attempts at sharing developers' time between the old and new units resulted in minor clashes, which only fuelled this process and helped foster distinct identities. The vision of InnoCircle was appealing to many, and it was easier to recruit new developers rather than convince job candidates to work on maintaining the aging online service of RentCorp.

Management understood the need to set up a new team that would be less burdened by the legacy platform. There was, therefore, a strong preference for establishing an independent team under separate management. Over time, as InnoCircle was staffed with its own people, its reliance on the parent company's resources declined.

The organization was indirectly impacted by choices with regard to how digital artefacts were set up. InnoCircle continued to develop its own database but found ways to synchronize the new database with the old one. That way, InnoCircle was able to define the data structure that

was needed to develop the envisioned services while drawing on the parts of the RentCorp database that were useful. Consequently, the use of the legacy platform would result in knowledge transfer from RentCorp to InnoCircle.

*So, the decision right now is that we are going to collaborate on that concept level, so we get the same instances and the same understanding of how to structure data and then make interfaces that communicate with each other (Head of InnoCircle).*

InnoCircle also relied on a set of critical back-end services developed by RentCorp:

*So, wherever it makes sense, we use something that's already been built. Could be a service that looks up businesses or the official registers. If there is already something we built there, we will just use that (Head of InnoCircle).*

The linkages between the two databases and the reuse of digital artefacts led to more frequent collaboration, which undermined the previously erected boundaries between InnoCircle and RentCorp.

#### **4.3.2 Product**

The InnoCircle team worked on making the vision a reality module by module. The first module was a feature that supported the crafting and signing of digital contracts. This module was seen as vital to the whole InnoCircle vision. If InnoCircle was to aid landlords in managing more parts of the rental relationship, they would first need to collect additional data. Collecting data for a formal rental agreement (i.e., a contract) was a natural first step. The digital contracts feature was intended as an isolated development task that would allow the new team to prove itself and act as a steppingstone toward realizing the vision.

Already at this stage, the divisions between the old business and InnoCircle had started to blur—not because the organization grew more independent, but because of reusing the digital artefacts. The intertwining of RentCorp and InnoCircle was paradoxically enabled by the choice to use different technology. InnoCircle chose to rely on microservices, partly as an attempt to pre-empt the cumbersomeness of the technological debt-ridden legacy product. However, microservices are easy to deploy across different products, which contributed to blurring the boundaries:

*One of the services we are offering has been made by one of the developers now on the InnoCircle project. It's now being used, for the next six months or so by RentCorp, and it's been fully developed by the guys in InnoCircle. So, it's already a mix of resources and usage. These things need to be very clear before the project starts and that's a perfect example of how blurry it can get (Head of IT).*

Besides the digital contract module, the subsequent features of the roadmap that the InnoCircle manager had defined included most notably rent collection and monitoring, electronic move-in and move-out reports, and data services about trends on the rental market. Providing landlords with data services became the next milestone. It represented the means to capitalize on the treasure trove of data accumulated over time by RentCorp. Based on data on past volumes and prices of rentals, InnoCircle would be able to sell information packages about trends in rental prices in particular neighbourhoods or provide similar data-based products. However, the development of the digital contract feature occupied the team longer than expected. When the work on digital contracts neared completion, questions were raised about how to bring it to market.

#### **4.3.3 Presentation/branding**

During development of digital contracts and other features supporting the InnoCircle vision, questions were occasionally raised about the long-term perspectives. It was beginning to seem conceivable that parts of InnoCircle could be integrated into the RentCorp service. After all, the linkages at the technological back-end resulted in data exchanges that facilitated a form of convergence. As the initial modules from InnoCircle began to be deployed within RentCorp, a careful customer could notice that when interacting with the new features, the browser quickly redirected them through an InnoCircle domain name. Also, the InnoCircle logo was still hanging at the entrance of the RentCorp office building.

However, reusing the RentCorp name and interface began to appear sensible for the new product. Even the InnoCircle team started to see the opportunities of integrating with the legacy platform as a way to rapidly reach a critical mass of customers.

All in all, as the development of InnoCircle was underway, organizational separation only strengthened, but the distinctiveness of the unit was eroding as it increasingly reused digital artefacts from RentCorp. The decision to, for instance, harmonize the old and new databases and rely on RentCorp's back-end services chipped away at the initial product vision. But the

transactions went both ways. RentCorp could also deploy some of the digital artefacts developed by the InnoCircle team. The microservice architecture followed by InnoCircle made the redeployment easier. All these changes together paved the way for the eventual merging of the two organizational units.

#### **4.4 InnoCircle as an integrated extension**

In the final stage of the case study period, the vision of InnoCircle being a separate business unit was largely abandoned. The InnoCircle unit was set on a trajectory from independence to semi-independence until it was fully re-integrated into RentCorp. The features that were the bread and butter of the InnoCircle vision were released and assimilated by RentCorp, and the InnoCircle brand was only used internally to refer to the team that incubated and developed new RentCorp features.

##### **4.4.1 Organization**

With the growing reuse of existing digital artefacts, InnoCircle was no longer seen as a separate business unit in the making. Rather, the developed features were seen as something to be mounted on top of the legacy platform, and the InnoCircle team was perceived less as developers of a ‘greenfield product’ and more as a team responsible for incubating and developing RentCorp. A new name was also used, which indicated the shift in role. It was no longer InnoCircle, but ‘the innovation lab.’ Our main informant changed his job title from head of InnoCircle to the much broader head of new ventures.

The interactions between the two teams became more frequent until, eventually, the CEO made the decision to merge the two teams under the leadership of the Head of Product. RentCorp continued to maintain two databases, but the linkages at the technological back-end required intensive cooperation between the two groups and resulted in blurring the boundaries between them. The two groups had no problem joining forces under common leadership when the merge decision was made. After the reorganization, the InnoCircle team members focused on the new features that targeted landlords, whereas the original RentCorp members focused on home-seeker features.



#### 4.4.2 Product

InnoCircle was developing new features that would have become part of the ‘greenfield product’ originally envisioned. However, the new features were used to extend the existing classifieds business. The original vision of a separate InnoCircle business existed only in fragments. As an example of such a fragment, it was widely agreed that providing services across the entire rental lifecycle was a goal to be maintained, as it supported the subscription model and, therefore, would help increase revenue.

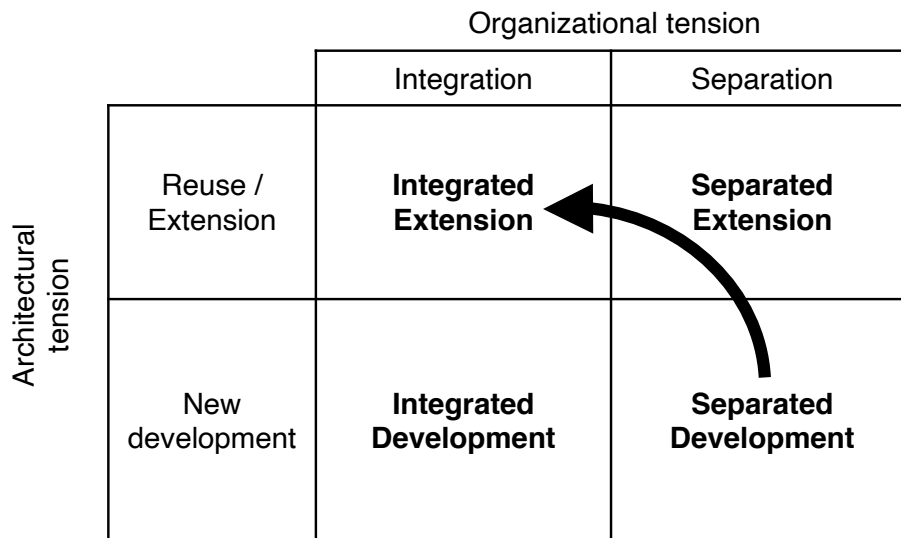
The increasing technological integration between RentCorp and InnoCircle paved the way for closer integration of services. They were not only linked at the back-end via the deployment of microservices developed by InnoCircle; it was also increasingly sensible to link front-ends as well. A new CEO was among those who doubted whether the new InnoCircle user interface was ideal, as the new design, compared to the one used by RentCorp, might potentially confuse and alienate users because it was foreign to them. After all, it would be a waste not to capitalize on the large number of users that could potentially be converted to subscribers of the new services?

Moreover, the merging of the two units impacted the type of features that were considered for future development. As the groups merged, the vision of InnoCircle became irreconcilable with the old business:

*InnoCircle may release new features that are difficult for RentCorp to release because politically they may offend some of our existing users in the RentCorp environment. In InnoCircle it isn't very obvious to release that kind of a service. So, then we are owning both the InnoCircle and the RentCorp, and we may offend some customers in one setup and please them in another one (Head of IT).*

More broadly, the services and vision of InnoCircle were reinterpreted and adapted to fit a wider umbrella of RentCorp services. Even as InnoCircle's innovations were growing into the legacy product, many in the company still believed in the vision of InnoCircle becoming a separate business unit:

*InnoCircle has a huge potential. And hopefully will grow and fulfil that potential. So, in two, three years, customer service will be different than it is today. In a few years, InnoCircle may not be considered a part of RentCorp. It may be a small start-up business in itself (Head of Customer Service).*



**Figure 2: Trajectory of organizational configurations of InnoCircle**

#### 4.4.3 Presentation/branding

The arguments for presenting InnoCircle features as a part of the legacy platform revolved around taking advantage of synergies and leveraging existing strengths. Among those strengths were a well-known brand, a user interface familiar to the existing user base, and the unique and voluminous database at the core of RentCorp.

*Right now, it makes more sense to launch this service with RentCorp, so that's what we did. So, instead of saying, alright it needs to split into whatever scheme we have for this, then this actually makes sense right now (Head of IT).*

Similar arguments unfolded in relation to the branding of InnoCircle. Much like the user interface, it was concluded that RentCorp's brand recognition in the market was strong and should be leveraged. Each decision to leverage existing assets reduced the novelty of the original vision. This drift away from an innovation toward incremental improvement of an existing service went mostly unnoticed because it was the result of many small and, what seemed like, sensible decisions.

Consequently, only those features that were aligned with the established platform were eventually released. The original vision of InnoCircle was reduced to a series of incremental improvements to the legacy platform (a rough illustration of the process is provided in Figure 1). Key aspects of the vision, e.g. the goal of InnoCircle to eventually become an independent company, became unattainable as the new features were integrated into the legacy platform. However, the InnoCircle project was not considered a failure, as it resulted in extensions to the traditional classifieds business that users welcomed. However, the radical vision of establishing a new business relying on new sources of revenue was not realized. Several months after we finished data collection, the logo of InnoCircle disappeared from the entrance of the RentCorp office.

## **5. Discussion: Drift of digital innovation**

The case of InnoCircle can be summarized as a story of an ambitious venture that fell short of expectations. Over time, the goal of developing a self-sustainable, radical innovation was gradually revised as it drifted toward more incremental improvements. The vision was of novel market offerings at the outset, but it ended up being add-ons to the existing business. The team began the journey as an organizationally separate unit, but it drifted toward integration and eventually merged with the parent company. The presentation and branding of the new features started with its own completely new identity, but they were eventually subsumed under the brand and user interface of RentCorp. In summary, it is a case of radical digital innovation drifting toward incremental digital innovation.

We use the term drift as an allusion to the work of C. Ciborra et al (2000) who contrast drift with control in their studies of corporate IT infrastructures. Innovation drift, as we describe it is a testimony to the challenges of radical innovation and is reminiscent of the previously articulated perspectives on organizational inertia (Cohen & Tripsas, 2018; Leonard-Barton, 1992). In the context of digital innovation the inherent properties of digital artefacts provide a new source of such challenges. The RentCorp case study and the described attempt at radical innovation showcases *how the specific properties of digital artefacts influence organizing for innovation*. In the remainder of this section, we will discuss the notion of innovation drift as it relates to organizational arrangements, product architecture, and presentation/branding. An overview is provided in Table 6.

## **5.1 Drift in digital innovation organizations**

Our analysis shows that, without conscious managerial decisions, distributable and editable digital artefacts may contribute to a drift of radical innovations toward more incremental innovations. The reuse of digital artefacts, and parts thereof, have the potential to cause a gradual departure from intended organizational separation (separated extension and separated development) to organizational integration (integrated extension and integrated development). In the case study presented, the innovating unit (InnoCircle) was established as organizationally separate, which was seen as a prerequisite for getting the project ‘off the ground.’ A stream of academic literature points to the benefits of organizational separation in support of radical innovation (Christensen & Raynor, 2013; Markides, 2013). It provides innovation space to grow ideas independent of legacy structures (Duncan, 1976). During the development journey of InnoCircle, the team decided to increasingly rely on existing technological resources. Links to the old database were established, the old user interface was repurposed, and new features were eventually merged with the traditional classifieds service business. The organizational unit remained separate, but as more and more technological bridges were built, the integration of the two organizational units also grew tighter and tighter. Interactions between members of the two units increased in frequency and knowledge was transferred across organizational boundaries, which reduced the distinctiveness of the InnoCircle group of employees.

For the parties involved, it seemed sensible at the time that InnoCircle wanted to leverage existing digital artefacts. After all, they are editable (Kallinikos & Mariátegui, 2011) and can be adapted to serve different purposes (Nevo et al., 2016). This is especially true for artefacts such as the old user interface, which could be modified to accommodate new features. Moreover, artefacts like the RentCorp database are open and reprogrammable and can serve as a platform (Garud et al., 2008) for new development of some (but not all) features. Using these artefacts was unproblematic, as they could be distributed and copied at no cost (Kallinikos et al., 2010), and multiple users could use the same artefact simultaneously (Faulkner & Runde, 2011).

## **5.2 Drift in products of digital innovation**

When digital drift occurs, the nature of digital artefacts may influence innovation efforts to shift from the ambition of a ‘greenfield product’ to extensions of existing products and services

(Figure 1). The original roadmap for InnoCircle included features such as rent collection and management of move-in reports. Those features, however, were difficult to realize as extensions of existing digital artefacts, and as the InnoCircle team became increasingly reliant on these artefacts, development priorities shifted toward features like selling data services, which could be more easily accommodated based on existing digital artefacts.

**Table 6: The influence of digital artefacts Kallinikos et al. ( 2013) on innovation**

	<b>Editable /interactive</b>	<b>Open and reprogrammable</b>	<b>Distributable</b>	
<b>Organizational arrangements</b> How is the development of new products organized?	The same artefact can be adapted and made sense of by different social groups.	Key digital artefacts can not only help connect organizational units and enable development of new features, but also constrain development of others.	Effects of organizational separation may be dampened as digital products can facilitate convergence.	Threat that organizational convergence will stifle creativity and innovation.
<b>Product</b> What features can be developed?	Unstable identity of the total product. Product can be different things according to how it is assembled.	Products can be extended in various ways. Different features can be developed by extending the stock of digital artefacts.	Different products can converge into one. New product derivations are possible by combinations.	Threat of a drift from radical to incremental innovation.
<b>Branding / presentation</b> How are product features presented?	Features can be integrated into different products and can be hard to brand as distinct.	Digital artefacts can provide a platform not just in the technical sense but also in the sense of providing brand and legitimacy.	Digital components can be locally assembled and can lose distinctiveness as a result.	Threat of a drift from novel framing to being subsumed under existing presentation.
	Enabling contingent actions.	Enabling generativity	Facilitating convergence	

The decisions that were made can be rationalized and explained by considering the specific properties of digital artefacts. Extant literature presents digital innovation as a recombination process (Yoo et al., 2010) in which different resources are linked to generate value (Henfridsson et al., 2018). The new linkages allow for existing artefacts to be extended (Eck et al., 2015; Zittrain, 2008) and used as building blocks for new development (Faulkner &

Runde, 2009; Garud et al., 2006). In fact, from a strategic point of view, it has been argued that the stock of digital artefacts dictates what strategic moves a company is able to make (Woodard et al., 2013). Digital artefacts also carry symbolic properties that can steer development of innovation. Ekbia (2009) cites Day (2001, p. 73) to drive a similar point about digital artefacts: '[digital artefacts] are representations of social desires that utilize objects in order to bring about goals of social organization'. Hui (2016, p. 57) similarly asserts: 'Digital objects take up the functions of maintaining emotions, atmospheres, collectives, memories....' Therefore, reuse of digital artefacts can anchor and direct innovation efforts from conceptualization to realization.

As an unintended consequence of the properties of digital artefacts, overreliance on existing digital artefacts in pursuit of digital innovation may challenge the novelty and radicalness of innovation efforts and engender their reduction to incremental improvements. Radical innovations may be envisioned but the development of breakthrough concepts may not be easily attained by leveraging existing artefacts. Furthermore, even though existing artefacts can be reinterpreted (Nevo et al., 2016), such an effort is demanding, and the reuse of a digital artefact can anchor development efforts by making certain (less radical) 'design moves' (Woodard et al., 2013) more easily attainable than others.

### **5.3 Drift in presentation and branding**

The InnoCircle project started with the ambition of becoming a venture in its own right, with new features for a new group of users, under a fresh brand name, and through a separate interface from the parent company. The digital innovations developed by InnoCircle ended up, however, being swallowed by the parent company and its products. The most prominent example is the feature supporting digital contracts. It might have served as the foundation for a separately branded suite of services targeting landlords. It was, however, also possible for this feature to be integrated into the existing classifieds service. As an add-on to the classifieds service, it gained instant exposure to users. By merging the new and existing services, InnoCircle closed the door on breaking away as a separate business with its own brand. The feature instead extended and reinforced the existing RentCorp business.

Properties of digital artefacts can partly explain the drift in presentation of the output of digital innovation from a novel brand to an extension of an existing brand. Editability (Kallinikos et al., 2013) of digital artefacts enables them to be dynamically assembled and re-assembled. New features can, therefore, be a part of old products and services that are already familiar and recognizable. Generative digital artefacts, like platforms (Baldwin & Woodard, 2008), are not only enablers of the development of new solutions but also sources of legitimacy. This desire for legitimacy may motivate a tightening of the reins on innovation efforts so as not to stray too far from the platform that enables development of, e.g., new features to begin with. (Hinings et al., 2018). Newly developed features are embedded in digital artefacts that can be distributed, locally interpreted, and together with the property of editability, can attain such a degree of dynamics that they can lead to a loss of distinctiveness.

As a counter-intuitive implication of such properties of digital artefacts, establishing new product identities can be more difficult in digital innovation. By new identities, we understand both new brands and the introduction of innovations that challenge the identity of organizations as a whole (Tripsas, 2009; Obwegeser & Bauer, 2016).

#### **5.4 Alternative mechanisms**

In our presentation of the case study, we have emphasized the role of digital artefacts and their specific properties as a potentially contributing factor to innovation drift. By doing so, we aim to address the need for in-depth investigations of digital materiality (Faulkner & Runde, 2011; Leonardi & Barley, 2008) and digital artefacts (Grover & Lyytinen, 2015; Orlikowski & Iacono, 2001; Tilson & Lyytinen, 2010) in organizing for digital innovation. It is, however, also necessary to acknowledge alternative mechanisms that likewise explain or provide justification for the reasoning that drives the dynamics between integration and separation. Besides the material account, it is necessary to discuss efficiency considerations and strategic choices.

First, the drift from radical innovation to incremental can be attributed to an economic incentive to reuse resources in the name of efficiency. Those resources include staff, which can be shared between the innovation and legacy teams, knowledge, or digital artefacts, as discussed at

length. Sharing of resources may be economical in development, and presenting the new innovation bundled with existing market offerings may be more effective.

Second, the drift from radical to incremental innovation can be attributed to a strategic choice. Radical innovations are sometimes seen as desirable, as was the case in RentCorp. In other cases, however, incremental innovation is what an organization may prefer. For instance, when dealing with an established digital product, a stream of incremental innovations may be what existing users prefer. Of course, as we know from Henderson & Clark (1990), what may appear as incremental innovation to the user may be enabled by a significant change in technology (Mehrizi et al., 2019; Wimelius et al., 2020).

The economic incentive and the strategic intent are two considerations that managers should be mindful of when deciding on the target of the innovation development effort (radical or incremental) and the way the target innovation is going to be reached (choices along architectural and organizational tensions).

## **5.5 Revisiting the analytical framework**

At the outset of this paper, we outlined a simple analytical framework (Table 2) to guide us through the case (Figure 1). The framework outlines two essential tensions in organizing for the delivery of digital innovation, i.e., tensions between integration and separation and between reuse and development of new digital artefacts. The case study presented traversed three out of the four quadrants of the framework, but it did not speak to the fourth. The unexplored quadrant (integrated development) presents a scenario of how the case could have evolved under different circumstances. If InnoCircle had not started reusing digital artefacts and instead grown organizationally intertwined with the legacy organization, it might have precipitated a decision to unify the two organizations architecturally. Based on the mirroring hypothesis, this would be followed by a harmonization of frameworks and programming languages in use and eventually by merging the two products together. Such a progression through the events would point less to the influence of digital artefacts and more to the economic incentives of sharing and reusing staff, skills, and knowledge.



## **6. Conclusion**

We presented a longitudinal case study of a born-digital company operating an online marketplace for rental housing that experienced the challenges of digital innovation. What began as a vision of radical innovation drifted toward becoming incremental improvements of existing organizational arrangements, the product, and its branding/presentation. This course of events was surprising because organizational separation has many advocates as an effective strategy for developing radical innovations (Birkinshaw & Gupta, 2013; Christensen & Raynor, 2013; Duncan, 1976; Gilbert, 2004). Our findings suggest that organizational separation may be less effective in the context of digital innovation, as digital artefacts can freely diffuse throughout organizational units (Ekbia, 2009; Kallinikos et al., 2010, 2013). We have captured this phenomenon under the label ‘innovation drift.’

The concept of innovation drift and our case study presents a challenge to the prevailing view of digital innovations as radical, paradigm-shifting discontinuities (Baiyere & Hukal, 2020; Riemer & Johnston, 2019). Our case shows that companies should consider the full spectrum between incremental and radical when developing innovations with digital technologies. To steer the process effectively, companies need to make decisions about how to organize the development and how to treat digital artefacts (reuse or new development).

This paper also contributes a novel perspective to the literature on digital innovation, which describes the recombination potential of digital artefacts as a driver and source of digital innovation due to their generative potential (Henfridsson et al., 2018; Yoo et al., 2010). In the case of RentCorp, a set of seemingly sensible decisions to leverage and recombine available digital artefacts in support of digital innovation challenged the vision of novel market offerings and reduced radical innovation efforts to incremental improvements of an existing classifieds service. Echoing earlier observations that technologies can be both enabling and constraining of action (Orlikowski, 2000), we similarly assert that digital artefacts can be generative and constraining. Innovation drift is one way the constraining effects may manifest.

### **6.1 Managerial implications**

This research addresses a topic that concerns many organizations seeking to innovate with digital technologies, particularly born-digital firms. Much like traditional firms, organizations

in the digital era have the option of developing radical innovations or more incremental innovations. To enable this development, both integrating innovation efforts within existing structures or separating them in dedicated units are possible options for organizations with digital or traditional products. Separation may seem particularly advantageous as it allows for the development of new concepts and routines away from the pressures of the governing rules and norms of the parent organization. In other words, members of such a separate organization enjoy greater degrees of freedom to explore and create. However, in the context of digital innovation, the role of digital artefacts needs to be considered. How are existing digital artefacts to be treated? Are innovation efforts going to rely on the reuse of existing digital artefacts, or will they be developed as part of those innovation efforts? As the case study demonstrates, answers to these questions influence the process and outcome of digital innovation. The threat of neglecting conscious management of digital artefacts is that they can result in drift of the innovation ambition from radical to incremental.

Our research uncovers three particular areas of which managers should be conscious. First, reuse of digital artefacts can decrease effectiveness of organizational separation. Second, if new products are grafted on top of existing solutions as additional features, any radical innovation attempt may be threatened. Third, the radical vision behind new digital products can be dissolved if they are presented under the established brand identity. All these threats can be attributed to the particular nature of digital artefacts, which can be distributed and extended freely. Mindful management of the choices along those three dimensions can prevent a radical innovation effort from drifting toward incremental innovation.

The digital innovation process can be negatively impacted if digital artefacts are reused by members of the innovation team at the expense of the independence and novelty of the innovation. The decision to reuse such artefacts may seem both rational and innocent, as they provide a powerful means of kickstarting or accelerating innovation efforts, but they come at the cost of dependence on the parent company, making it difficult to develop, e.g., new product concepts and organizational routines.

## 6.2 Limitations and future research

As our research presents the results of a single, longitudinal case study, it may be regarded as a first step toward investigating and understanding how the properties of digital artefacts influence how companies organize for innovation. As digital innovation is a broad concept that encompasses different phenomena; therefore, additional qualitative work is needed to corroborate and extend our findings by including other empirical settings and different types of digital innovations. Quantitative studies may contribute insights by surveying a large sample of innovation projects to evaluate the effectiveness of different organizational arrangements in support of digital innovations. Future contributions that seek to develop prescriptive knowledge by employing interventionists methodologies (David, 2002) would also be welcome.

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## **Mirroring and Interpreting: Co-evolution of Digital Artefacts and Organizations**

Michal Hron

### **Abstract**

Digital strategy requires both technical (digital) resources and organizational resources. An influential explanation of their relationship is the Mirroring Hypothesis which holds that an architecture of a technological product reflects organizational architecture. This literature has identified perfect mirroring to be efficient but also a hindrance when it comes to radical or architectural innovation. Perfect alignment of organizations and technical products produces a “Mirroring trap”.

For digital strategy organizations need to overcome the Mirroring trap. Digital strategy is marked by systematic involvement of digital artefacts which are distributable through organizations and are characterized by unstable identity. We depart from the literature on mirroring and combine it with the perspective on unique qualities of digital artefacts to examine how born-digital organizations overcome the Mirroring trap.

Through a multiple case study, we discover that a second process needs to be considered alongside mirroring: interpretation, which is important for digital artefacts with unstable identity. The organizational forms depend on not just the given architecture of the product but on the interpretation of boundaries of the product which evolve together with the firms’ understanding of customers and their needs. We contribute to the literature on organizing for digital strategy by revisiting established findings—the Mirroring hypothesis.

### **Status**

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## 1 Introduction

Born-digital companies are such companies that have a “digital artefact at its core” (von Briel, Recker and Davidsson, 2018). Those companies are frequently pressured to achieve and sustain high growth (Huang *et al.*, 2017). Digital artefacts at the core of those companies can aid in delivering on such growth expectations because they can be extended or repurposed (Garud, Kumaraswamy and Sambamurthy, 2006; Garud, Jain and Tuertscher, 2008; Huang, Henfridsson and Liu, 2021). Digital artefacts have been described as unusual in comparison to traditional materiality (Kallinikos, Aaltonen and Marton, 2013; Hui, 2016), possessing characteristics like unstable identity (Kallinikos, Aaltonen and Marton, 2013; Lehmann and Recker, 2021).

To execute growth strategies in the context of born-digital companies, both (digital) technical resources and organizational resources need to be mobilised (Nevo and Wade, Michael, 2010). The organizational resources include staff or capabilities which need to be combined with the versatile digital artefacts like data or code (Piccoli and Ives, 2005), at the core of born-digital companies. Organizational and technical resources when combined enable exploiting strategic options (Woodard *et al.*, 2013). The need to consider the organizational and technical resources in understanding strategy of born-digital organizations implies that a socio-technical perspective (Leonardi and Barley, 2008) is helpful because it enables focus on how the (digital) technical and organizational resources co-evolve.

Within the broader strategic literature, an influential perspective elaborating the relationship between technical and organizational resources has been the Mirroring hypothesis (Baldwin and Clark, 2000; Colfer and Baldwin, 2016). According to the hypothesis, we should expect the architecture of product under development and organizational arrangements to look similar. For instance, a new product should be developed by a new organizational unit. The Mirroring hypothesis explores the relationship between the organization and the technical resources and therefore aligns with the socio-technical perspective (Sarker *et al.*, 2019) and with the architectural perspective on digital innovation pioneered by Yoo (Yoo, Henfridsson and Lyytinen, 2010).

Although the Mirroring hypothesis has been often viewed as normative or deterministic (Colfer and Baldwin, 2016), some studies explore the processual view of mirroring. Some authors

explored the evolving industry dynamics which are transformed by new technology (Consoli, 2005) or by digital technology specifically (Lee and Berente, 2012; Hylving and Schultze, 2020). Other studies find that organizational arrangements adopted under a previous technology can hinder the efforts to unlock the potential of a new technology (Brusoni and Prencipe, 2011; Dougherty and Dunne, 2012). In other words, a well-mirrored organization can fall into a “mirroring trap” (Collinson and Wilson, 2006) in which a large architectural change (Henderson and Clark, 1990) will be difficult to access. To overcome the rigidity brought on by perfect mirroring, organizations may need to intentionally “break the mirror” (Colfer and Baldwin, 2016). For digital innovation to succeed, this mirroring trap needs to be overcome. In this study, we explore the process by which born-digital companies execute strategies to observe how digital and organizational resources co-evolve. With the background above, we specifically formulate the following research question: *How do born-digital companies overcome the mirroring trap in the process of executing digital strategies?*

We employ the findings from the Mirroring literature as a starting point for exploration of digital strategy. We specifically investigate the dynamics of digital organising by examining five born-digital companies that develop a spin-off product by repurposing the digital artefact at their core or developing a new one. Adopting a qualitative method allows us to conceptualize mirroring as a process rather than a deterministic effect. In our data on born-digital companies, we find that establishing a separate organization corresponds to separated development of digital artefacts, as the Mirroring hypothesis predicts. However, we also identify a second process that moderates mirroring: interpretation. The architecture of digital products is simply given but rather a result of a socio-cognitive process: interpretation. Interpretation stabilizes the understood structure of digital products, with reference to understanding of whether the digital product aims at the same or new market segment. A market need defined as distinct can lead to understanding of a need to separate development of the digital artefact and separate the organization tasked with the development. By re-interpreting the digital artefact at their core, born-digital organizations are able to overcome the mirroring trap.

The work here contributes to the literature that calls for new theory on digital organizing (Yoo, Henfridsson and Lyytinen, 2010) and responds to calls for explicit appreciation of materiality or digital artefacts in theorising (Leonardi and Barley, 2010; Avital *et al.*, 2019; Hron, 2021). We also contribute to the literature on born-digital organizations, which has explored the specific processes by which value of digital resources is unlocked (von Briel, Recker and

Davidsson, 2018; Huang, Henfridsson and Liu, 2021; Lehmann and Recker, 2021). By drawing on the literature on the Mirroring hypothesis, we add nuance to the literature that explores dynamics of mirroring with insights specific to the digital context.

As a background, the paper first outlines the processual view of the Mirroring hypothesis with emphasis on challenges against it in the digital context. The second part of the background is a presentation of the literature on digital artefacts. The paper then outlines the methodology and data. The results section takes the reader through the five cases, specifically how the processes of mirroring and interpreting unfolded in them. The discussion generalizes those observations into a summary process model, which shows how—during execution strategies in born-digital businesses—mirroring is moderated by a process of active interpretation.

## **2 Literature Background**

Much of recent research within Information Systems converges on the position that the way digital artefacts are being deployed in organizations, businesses, and society at large presents challenges to the existing understanding of organizational dynamics (Nambisan et al., 2017; Avital et al., 2019; Gkeredakis and Constantinides, 2019; Alaimo and Kallinikos, 2021). Many of the consequences of digital artefacts are linked with organizational challenges (Yoo, Henfridsson and Lyytinen, 2010). To develop the necessary background for the present paper, we outline the literature on the Mirroring hypothesis and two key challenges related to deployment of digital artefacts in organizations.

### **2.1 Dynamic view of the Mirroring Hypothesis**

The Mirroring hypothesis holds that “organizational patterns of a development project will correspond to the technical patterns in the system under development” (Colfer and Baldwin, 2010). When a born-digital organization establishes a spin-off group (organizational pattern), they should work on a corresponding spin-off digital artefact (system under development). The Mirroring hypothesis has been examined by a stream of literature which has been summarised by at least two systematic reviews (Colfer and Baldwin, 2010; Sorkun and Furlan, 2017) which find support for the idea of mirroring within a single firm. While the literature on mirroring sometimes favours a high degree of granularity (focusing on, e.g., specific communication links), it has also been studied on such level of abstractions as corporate acquisitions (Puranam, Singh and Chaudhuri, 2009).

The earlier studies of the Mirroring hypothesis have cast it as deterministic effect to be investigated normatively (MacCormack, Baldwin and Rusnak, 2012). Some studies however also explore the dynamics of mirroring. Those studies inquire, among else, into the direction of causality, demonstrating that new technology drives organizational changes (Consoli, 2005; Hoetker, 2006). The technologies can be specifically digital (Lee and Berente, 2012). A recurrent finding shows how integrated systems tend to drift towards greater degree of modularity (MacCormack, Rusnak and Baldwin, 2006). Speaking more directly to managerial concerns, some studies find that organizational arrangements adopted under a previous technology can hinder the efforts to unlock the potential of a new technology (Brusoni and Prencipe, 2011; Dougherty and Dunne, 2012). Such rigidity is reminiscent of the failure to explore elaborated by the literature on ambidexterity (Duncan, 1976; March, 1991). While mirrored state is efficient, it is a stable setup not conducive to exploration and innovation. Fortunately, architecture of a product can be changed by an organizational change process (MacDuffie, 2013). The challenge can be significant for well-mirrored organization where the “mirroring trap” can occur more easily (Collinson and Wilson, 2006). Because of the efficiency of a well-mirrored arrangement, any architectural change (Henderson and Clark, 1990) will be difficult to access. To overcome the rigidity brought on by perfect mirroring, organizations may need to intentionally “break the mirror” (Colfer and Baldwin, 2016).

The digital context has been frequent source for studies of mirroring. Studies of collaborative open source projects provided some of the findings (MacCormack, Baldwin and Rusnak, 2012). Within the digital context, the research taking a normative stance finds lacking evidence (Colfer and Baldwin, 2016) possibly because “digital technologies make possible new modes of coordination that enable groups to deviate from classical mirroring as seen within firms”. The imperfect applicability of the Mirroring hypothesis to open source settings can be connected to management of knowledge when participants join and leave and knowledge leaves with them (Malhotra and Majchrzak, 2021).

## **2.2 Challenges of organising (with) digital Artefacts**

Born-Digital organisations are such organisations that “have the digital artefact at its core” (von Briel, Recker and Davidsson, 2018). Digital artefacts have been subject to a recent stream of theorizing (Ekbj, 2009; Kallinikos, Aaltonen and Marton, 2013; Hui, 2016; Runde and



Faulkner, 2019). Understanding the discussion of digital artefacts is important because it is digital artefacts which have arguably threatened the Mirroring hypothesis as shown by selected research (Lee and Berente, 2012; Henfridsson, Mathiassen and Svahn, 2014; Hylving and Schultze, 2020). To develop theories of the socio-technical phenomena, which has long been an aim of Information Systems research (Sarker *et al.*, 2019), explicitly considering the technical artefact is critical (Orlikowski and Iacono, 2001). The current class of technical artefacts much of IS research has been focused on are digital artefacts. Digital artefacts give rise to challenges stemming from their unstable identity, which include the difficulty of managing the framing process (Wang, 2021) of products that evolve (Lehmann and Recker, 2021). Digital artefacts are also accompanied with challenges connected to the ability of digital artefacts to contribute to organizational fluidity. Those challenges include the ability for digital artefacts to interface with adapted organizational boundaries (Hron, Obwegeser and Müller, 2021) as they are copied and reused (Karhu, Gustafsson and Lyytinen, 2018).

### **2.2.1 Digital Artefacts have unstable identity**

The first challenge stemming from the specific properties of digital artefacts is that digital artefacts have unstable identity. Partly, this is because digital artefacts are malleable, extensible and generative (Garud, Jain and Tuertscher, 2008; Eck, Uebern timer and Brenner, 2015) on the whole (Yoo, Henfridsson and Lyytinen, 2010) and thus their identity can morph as they become entangled with the identity of a company (Wessel *et al.*, 2020). Partly, the unstable identity stems from the ability of digital artefacts to be locally reassembled. Because of their interactivity, they and can take on meanings in accordance to local contexts (Ciborra and Willcocks, 2006). Individual users can be active participants in interpretation of what a technological object is (Faulkner and Runde, 2009) especially when these technical objects are as easy to recombine as digital artefacts (Henfridsson *et al.*, 2018). Some digital artefacts even come intentionally unfinished (Garud, Jain and Tuertscher, 2008). Yoo gives the example of an iPhone which acquires its meaning and functionality by being bound with specific software and content. Which applications a user gets depends on the user's preferences and circumstances (Yoo, Henfridsson and Lyytinen, 2010). Self-service analytics tools are another example (Lehrer *et al.*, 2018). Recently, (Wang, 2021) studies how digital artefacts can occasion a reframing of existing products. He points out that "breaking out of a product area to create a new product, in fact characterizes the design of many highly innovative digital products today as more and more digitally native companies" (p. 18). The fact that digital

artefacts can freely travel as they are non-material only aids in multiplying the number of meanings that they can take on.

An “unstable identity of objects” can be seen as typical or even definitional for the current form of “innovation-intensive capitalism” (Le Masson, Weil and Hatchuel, 2010). The literature on digital innovation however places emphasis on the role of digital artefacts, and their particular properties, as a contributor to the instability of objects and their identities.

### **2.2.2 Digital Artefacts are linked with organisational fluidity**

The second challenge stemming from the specific properties of digital artefacts lies in that they can interface with organizational arrangements in a way which contributes to increased malleability and fluidity of organizational forms. Digital product innovation is characterized by “unprecedented level of unpredictability and dynamism” (Nambisan *et al.*, 2017, p. 225) which derives from the generative potential of digital artefacts (Garud, Kumaraswamy and Sambamurthy, 2006; Zittrain, 2008). The dynamism is reflected on organizational structures.

It is telling that finding good way to organize is the most commonly mentioned challenge of digital innovation (Obwegeser *et al.*, 2020). There are many ways by which digital innovation can be organized, (Fuchs *et al.*, 2019) because digital innovations are in mutual interplay with many other components and are therefore not easily compartmentalized (Svahn, Mathiassen and Lindgren, 2017). Digital innovation does not even need to have a dedicated unit because it can occur in a distributed way (Arvidsson and Mønsted, 2018). For digital innovation, fully bureaucratic forms of organizing fall short but some degree of temporary formalization is beneficial (Pesch, Endres and Bouncken, 2021). An extreme form of the degree of fluidity of organizing with digital artefacts can be seen on the self-organizing processes by which new groups get formed around new forks in development projects like blockchain (Andersen and Ingram Bogusz, 2019) or Android (Karhu, Gustafsson and Lyytinen, 2018).

For born-digital organizations, digital artefacts are the central resources around which a company is formed. They can enable or constrain the available options (Woodard *et al.*, 2013; Sandberg *et al.*, 2014). For example, they can enable for a company to pivot by redeploying its stock digital artefacts (Ye *et al.*, 2020) or develop spin-offs by taking existing artefacts as templates (Huang, Henfridsson and Liu, 2021). If the digital artefacts are of low quality, they can open fewer options (Rolland, Mathiassen and Rai, 2018). Digital artefacts can blur

boundaries across organisations or cause convergence on the level of industries (Yoffie, 1997; Yoo, Henfridsson and Lyytinen, 2010) by connecting different organizational groups.

Overall digital artefacts “diffuse throughout organizational fabrics” (Kallinikos, Aaltonen and Marton, 2010). As they do, they typically impart a degree of unboundedness, malleability or fluidity, which characterizes them, to the social structures they enter. In other words, digital social structures and organizations in general can become as fluid as the digital artefacts in them.

### **2.3 Digital artefacts and digital products**

This paper relates the organizational processes of digital innovation to some of the fundamental properties, that have been articulated as part of the theoretical reflection on the nature of digital artefacts. For the sake of disambiguation, this sub-section clarifies the vocabulary used. The relations between the terms are, in short, that digital artefacts are aggregated as data objects which can become building blocks of digital products. Hence, the focus on digital artefacts affords us to consider the root of what makes digital organizing distinctive because they are the deepest and most foundational elements of digital innovation.

Digital artefacts or digital objects are a theoretical category under which fundamental properties of non-material entities have been discussed. Digital artefacts are typically defined by examples that include things like profiles on social networks, computer bugs (Ekbia, 2009) or video files (Kallinikos and Mariátegui, 2011). Their traditionally physical component matters as a bearer for the data (Runde and Faulkner, 2019) or as a device through which a user can interact with the functionality (Yoo, Henfridsson and Lyytinen, 2010). However, it is the “intangible, or nonmaterial, that raises questions about how the nonmaterial and the tangible or material combine, and about how the same nonmaterial thing can exist in many different forms” (Runde and Faulkner, 2019). Hui defines digital artefacts as objects that “take shape on a screen or hide in the back end of a computer program, composed of data and metadata regulated by structures or schemas” (Hui, 2016) which is a definition we largely adopt.

While the notion of digital artefacts provides the most fundamental theoretical reflection, data objects are a concept proposed to describe more stable entities which are composed to and inherit properties of digital artefacts (Alaimo and Kallinikos, 2021). The notion of data objects

is useful because it shows how the identity of digital artefacts is intentionally produced (Aaltonen, Alaimo and Kallinikos, 2021) or becomes stabilized by becoming wowed into organizational practices (Østerlie and Monteiro, 2020).

Finally, digital products are results of product development that involves recombination of digital artefacts (Yoo *et al.*, 2012). They are assembled by drawing on, or channelling, different digital resources including data objects but also different sets of algorithmic logics (Henfridsson *et al.*, 2018). They inherit the properties discussed in the literature on digital artefacts such as their interactivity and distributability (Kallinikos, Aaltonen and Marton, 2013).

### **3 Data and Methods**

#### **3.1 Case selection**

This paper approaches the topic by employing a multiple case study (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). Multiple case study allows to “confirm emergent relationships and enhance confidence in the validity of the relationships” (Eisenhardt, 1989, p. 542). The previous efforts in researching this topic were conducted using an in-depth single-case design which surfaced some of these emergent relationships. The present work aims to move our understanding from the logic of discovery towards the logic of confirmation (Swedberg, 2012) and generalizable theory (Eisenhardt, 1989) by proposing a general model of the process.

We were interested in the topic of co-evolution of digital artefacts and organizational arrangements in digital strategy from our knowledge of the existing literature which highlights organizational implications of digital artefacts as salient (Henfridsson, Mathiassen and Svahn, 2014). With a point of departure in a knowledge of the literature, we were able to draw on theoretical concepts in addition to grounded theorizing.

#### **3.2 Research setting / cases**

Eisenhardt (1989) argues that a central component of building theories from multiple cases is “theoretical sampling” or choosing cases that represent some phenomenon purposefully. In this study, each of the five case companies in the sample was chosen because those companies experienced an episode during which a new, radically different, digital product was developed.

Our cases were also similar in three respects. First, the businesses are all natively digital. This means that each of the companies offers a digital product or a service. This makes our cases suitable to study the theoretical puzzle of co-evolution of artefacts and organization in executing of digital strategies. Second, all the companies are small to medium sized enterprises. They are all consisting of fewer than sixty employees. This makes the strategic moves manageable to observe and. Third, all of them are established business with more than ten years of history. Therefore, the companies included in our sample are not start-ups. Quite the contrary, they are companies with products that have matured and the episodes we studied follow their attempts to catch a second breath and reinvigorate their growth with a new or enhanced product.

While our case companies undergo the same type of episode, the five companies however also exhibit some key variances. The companies have handled digital artefacts differently in the process of executing their digital strategies; they have organised differently; and their motivations and aims were diverse. In terms of use of artefacts, some of the case companies extended existing artefacts while others developed new ones. In terms of organising, some of the companies developed innovations within existing structures while others established separate organisational units. In terms of their motivations and aims, some of the organisations were proactive while others were reactive. Moreover, some of the organisations developed innovations to deepen relationships with existing groups of customers while others branched out into new market segments with their innovations. As a consequence of investigating different interplays between organizing and digital artefacts our ability to develop a more robust and generalizable theory is enhanced.

**Table 1: Overview of interviews**

<b>No</b>	<b>Interviewee</b>	<b>Length</b>	<b>Company</b>
1,2	Head of product	1:26 and 1:13	RentCorp
3	Product designer	1:01	
4	CTO	1:08	
5	CEO	1:12	WebCorp
6	CTO	1:06	
7	Senior tester	58min	VoiceCorp
8	Head of Marketing	1:12	
9	CTO	1:04	
10	Product Designer	1:05	

11	Product Manager	1:00	HealthCorp
12	CEO	45min	
13	User researcher	1:12	
14	Developer	1:10	FinCorp
15	Marketing manager	1:05	
16	Lead Developer	1:04	
17	UX designer	1:10	

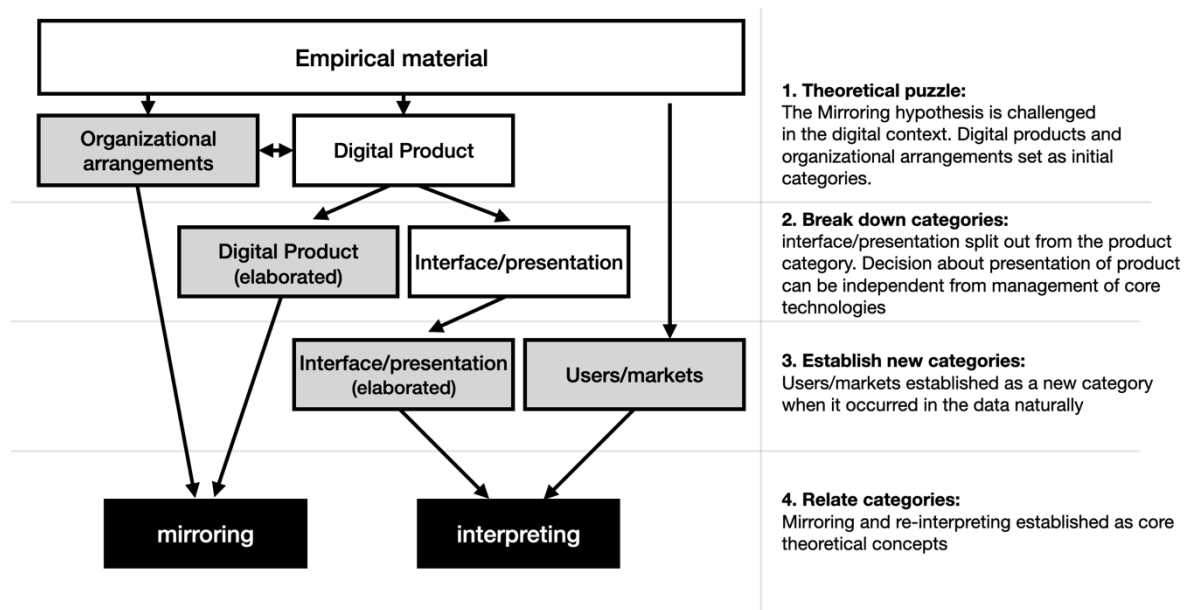
Within those five companies, we conducted interviews with informants that experienced the transition from the initial steps towards the new product. In each company, a minimum of three interviews were conducted. The informants were chosen to capture understanding of both the technical aspect of the experience (Chief Technical Officers, Software Developers) and the business aspect of the experience (Head of Marketing, User Researcher). Majority of the respondents held positions in middle-to-top management and could therefore speak to the strategic intent behind the actions. However, at least one of the interviews in each company was with a person who could provide a more direct insight into the experience of living through these changes (developer, senior tester). Those respondents also sometimes provided the most candid view of the organizational change, which provided a balance to the possibly rationalized retrospectives of management. Table 1 provides an overview of the conducted interviews.

The interviews themselves were semi-structured and always covered three main areas: organizational choices, handling of the product in terms of extension or new development, and choices around the presentation of the new product. A fourth topic emerged around the understanding of users and markets. Attached appendix provides the interview guide we used.

### 3.3 Data Analysis

Our analysis proceeded partly in parallel to data collection. We have moved iteratively between case data and theory. This “constant comparative logic” (Eisenhardt, 1993) allowed us to develop richly saturated constructs and synthesise them into a theoretical model. Because we took a point of departure in a literature, we abductively iterated between theory and data in a way that allowed for theory elaboration (Fisher and Aguinis, 2017). Our analysis consisted of five main stages, which are summarized in Figure 2.

Grodal et al. (2020) suggest that “when developing theory, it is practical to start with what is surprising and unexpected in how the data relate to existing theory”. In this research, recent literature on digital innovation pointed us to such a puzzle. Multiple papers document the challenges of organizing when digital artefacts are involved (Yoo, Henfridsson and Lyytinen, 2010). They highlight that it is particularly the digital nature of the digital artefacts, that introduces empirical novelty (Hylving and Schultze, 2020). Because we are seeking a revision of extant theories in light of the widespread diffusion of digital artefacts, we can draw from the existing repertoire of concepts in addition to grounded theorizing. We have begun by categorizing the data into broad constructs provided by the literature. Those constructs were the (digital) product architecture and the organizational structure, as taken from the literature on the Mirroring hypothesis. Those served as “tentative categories” (Grodal, Anteby and Holm, 2020).



**Figure 2: Key moves in data analysis**

As the second step, we have used the interview data to break down the main concepts: organizational structure and product architecture. This largely stabilised the tentative categories and provided them with thickness. Sample first-order codes are provided as a column in Table 2.

In the third steps, we found it necessary to split some of the tentative categories. The category about digital product architecture was not entirely captured by the notion of product

architecture as understood by the architecture on the mirroring hypothesis. Substantial part of this category in our data concerned the ways the product was being presented. This included the decisions about presentation, which entails user interface and also branding. In parallel to that we established a category for markets and user needs. Table 2 provides an overview of the coding scheme with sample first-order codes.

**Table 2: Coding structure**

<b>Linking Process</b>	<b>Category</b>	<b>Sub-category</b>	<b>First-order codes</b>
<b>Mirroring</b>	Organizational arrangements	Separation	Prioritization, focus on new industry, different maturity levels
		Integration	Knowledge sharing, shared developers, shared backlog, shared management practices
	Digital product	Separation	New development, technical debt, exploring new technologies
		Integration	Leveraging databases, microservices architecture, reusing existing technologies,
<b>Interpreting</b>	Interface/ presentation	New identity	Leveraging customers, brand recognition, alienating old customers, risk of experimenting with the old brand
		Existing identity	Differentiation, new value proposition, confusion by interface integration, interface norms
	Markets/users	Users	User needs, customer research, personas, design research, product-market-fit
		External actors	Industry norms, legal context, regulation, investors, competition, data standards



The fourth step entailed merging—or at least relating—the established and stabilised categories. We merged the four constructs into two main dyads: organisation-product, as captured by the notion of mirroring, and a dyad connecting presentation with markets and user needs. Analogically to the process of mirroring, we named this dyad after the process that linked the two categories: interpretation.

Finally, we integrated the established categories into a model that theoretically integrated the empirically saturated constructs, theoretical concepts, merged in the previous step into dyads, and linked them with the two processes: mirroring and interpreting.

## **4 Mirroring and Interpretating across five case companies**

In this section, we present the data from the multiple case study according to the coding structure (Table 2) which resulted from the analytical process (Figure 2). The two high level theoretical categories provide sub-sections for each of the cases: Mirroring and interpreting.

### **4.1 RentCorp**

RentCorp provided an online marketplace for rental housing, which was connecting rental seekers and landlords. This marketplace grew to become a national leader in this space. When the company experienced a sudden period of negative growth after a long period of expansion; alarmed, they sought to diversify revenue streams. To do that, RentCorp pursued development of a new business that would provide tools for landlords to manage their properties. This service was supposed to be offered by a spin-off company that was to become an independent business unit. Over time however, the team behind the envisioned new business was merged with the old and the technology developed in the separate business-to-be was integrated into the old rental platform as new incremental features. RentCorp was investigated in-depth in a project that preceded the research presented here (Hron, Obwegeser and Müller, 2021). For this research, we conducted new interviews about two years after the initial data collection with newly joined staff and with new, more pointed, questions resulting from an evolved framing.

#### **4.1.1 Mirroring**

RentCorp established a separate organizational unit to develop a new product, specifically for landlords. This separate organizational unit developed a separate technological artefact.

However; over time, the two new technological artefacts grew more and more integrated with the legacy product. The organizations likewise grew more integrated. In the end, the two separate organizational units and the two products were merged:

*We had the landlord development in the incubator kind of setup... but now we have the landlord features running from the same platform handled by the same team as the seeker-side  
(Head of IT)*

One reason the manager gave for the integration had to do with efficiency and resource reuse:

*Seeing [the old product and the innovation] as two teams and two projects and two different ways of doing it and two code bases and so on and so on was not ideal. So now we just have one way of communicating. Structure it and it's just much easier for everyone, especially for the developers (Head of Product)*

The old way was worse:

*Before the integration, we had two teams. One looked at the new platform the other was working on the legacy code: two teams, two ways of doing things we had two code bases and so on. Now we migrate it all into one which makes our life simpler (Head of Product)*

But besides the reasons that had to do with difficulty to organise a company with two artefacts, there was also a matter of deciding on what the product under development even was. Was the new team developing a spin-off company or was it an incubator for new features to the old product:

*The idea initially was to build their own company around the new product. Well maybe we should have... We should have prepared so we can divest them. We should give them their own legal personhood... and seen from a customer perspective.... But what do they need? All what the landlords and seekers use is totally integrated in this one system (Designer)*

#### **4.1.2 Interpreting**

The new product was envisioned as having a completely new identity: new interface, new name—all completely severed from the main company. During development, this new identity was gradually abandoned as the new products became submerged under the identity of the old product. A key reason to leverage the old identity had to do with the user groups for which the

digital product was valuable. The platform of RentCorp was already connecting landlords and rent-seekers. The new product effectively ended up deepening the tools to manage the landlord-seeker relationship. It was counter-productive to focus on landlords and users with different development teams:

*Our developers need to understand each other because many functions are about when seekers and landlords meet on the platform. So, if you just have one team focusing on the landlords in the spin-off, they need to figure out what about the seekers and that's another team, another codebase, another prioritization, another design (Product Designer)*

A large part of what RentCorp offered had to do with connecting landlords and seekers and they perceived integration of the product and team as more natural:

*For example, it should take the messages: Messages is for the landlord and for the seeker. So, if you have one team only focusing on the landlord, he maybe forgot how the seekers should experience the inbox and what kind of communication they should have after he moved in. (Head of Product)*

In RentCorp, a new identity of the digital artefact was not found. One of the reasons why the old identity stuck was that they were developing digital products for users they already had and they did not learn to see the users or their needs in a profoundly new way.

*Seen from a company perspective, it's much, much easier to communicate one brand, one product, one team... Honestly, it is quite difficult to switch your brain from creating something for landlords who use it for eight hours a day as a work tool, to something that seekers use one hour a day for three months, when they look for a new place. (Product Designer)*

## **4.2 VoiceCorp**

The product that established VoiceCorp was a solution that facilitated management of meetings. The product allowed to prepare an agenda and take minutes. This product found remarkable success particularly in the public sector, where many meetings require heavy documentation like agendas and minutes. As this first product found success, it reached a potential limit in the national market.

To find new sources of growth, the leadership in VoiceCorp started considering ways to build on top this success. They saw an opportunity from technology and from new markets. Technologically, the options enabled by voice transcription and natural voice processing were

seen as exciting ways to extend the existing product. It would not only help to prepare the meeting with agendas and provide interface for minute taking. The product could take the minutes by itself. In terms of new markets, VoiceCorp leadership looked at the private sector as the natural next step, after becoming a household name in the public sector.

To explore these options, VoiceCorp established a separate team to explore particularly options enabled by natural language processing. This team aimed to develop new features for later integration in the first product, extending its scope and reach. This however proved technically difficult. The new digital resources were built with new foundations that made merging hard. Moreover, VoiceCorp found out that the needs of the private sector were quite different and after a series of pivots, the separate team became a separate company focused on software that analyzes recorded calls from service hotlines, which was seen a better application for the voice-related technology. This new product has become completely separate in terms of organization, product architecture. It was also presented under a new brand.

#### **4.2.1 Mirroring**

VoiceCorp established a separate, exploratory, group to develop a possibility around natural language processing such as voice transcription. The exploratory group developed their products independent from the old product and as much as it was difficult to integrate their product with the old digital product, there were issues with combining the new team with the old team. The exploratory group was eventually separated as its own company. The digital artefacts they developed were similarly kept separate. The CTO described the origin of the separate group as follows:

*We had the vision about having an experimental track alongside the main development track.... So we have this stable product. For the main persona, we knew all about it and then just to ensure that we as a company develop, we started having a beta to do some experimentations (CTO)*

Those experimental features were aimed to be eventually integrated:

*The intent in the beginning was to do the voice features as an add on to this old product for meetings. But it was never really developed in that platform. It was always developed as a separate app, Designer*

For the separate features, new team was established:

*The voice technology development has always been on their own... we hired a guy who was an expert in voice... And then we have started experimenting... if it makes sense. Later, we actually hired a product manager to drive the beta track (CTO)*

But the output of the beta track was never integrated to the main product. The products stayed separate and the team also stayed separate. In the end, the separate team was divested to be a company of its own.

#### **4.2.2 Interpretation**

VoiceCorp thought they are developing extension to their core product but, over time, discovered that the voice features do not fit well with the existing product and are better suited as a foundation of an entirely new product and a completely new, spin-off company.

The development of the voice features in the beta track was proceeding well but the match with the old product was difficult to establish. The company attempted to establish integration between the way the voice features and the old product are presented:

*For example, the public sector customers would go in the first product, and if they needed to dive deeper into a conversation or a meeting, they could click on that meeting and they would see a different view in the new product. They would actually jump to the other product. But without knowing it completely, it would be the main goal was to not change the user experience (Head of Marketing)*

This light connection between the two products was also confusing to the users. The company experimented with different types of integration for a long time but they did not find a way to make the new and old products align seamlessly:

*We tested out a lot of different things and eventually we decided that the two products are so different it doesn't make sense to have them in one company anymore. We have this steady old product that didn't see a lot of growth and then we have this kind of startup product that is experiencing exponential growth and has yet to conquer the market in the first place (Head of Marketing)*

It was not the technological incompatibility, which led to the decision to separate. It was the different market segments:

*We had great technology and well working technology, but it did not meet the customer requirements or our customer didn't have a big enough problem. We had to find a better product-market fit (CTO)*

After a series of pivots, the voice features served as a basis for a product for analysis of recorded calls in call centers. This product for call centers is developed by a separate company. The core staff of this new company still remembers the origins as a “beta track” in the company that develops products for digital agendas.

### **4.3 WebCorp**

WebCorp started as a blogging platform but, as blogging was becoming eclipsed by social networking, the management saw they needed a new focus for the company to continue thriving. WebCorp found this new focus when it transformed into a company for programmatic advertising. The new focus of the company was enabled with a critical sub-component of the blog business. To monetise the original blogging service, WebCorp developed a set of technologies to improve serving of advertisements on the network of blogs. This technology to better service advertisements was so valuable, that it could be offered as a standalone service to other content-based businesses like publishers.

A separate team formed in WebCorp, that focused on the advertising technology. This separate team ended up growing by including developers from the old company and new hires. In the entire company reoriented towards development of the programmatic advertising service. The blogging platform ended up being just maintained by one or two developers. The blogging network and the advertising product were connected: If WebCorp could optimise advertisements on its own network of blogs, it could do so for external clients too.

#### **4.3.1 Mirroring**

As much as the product transformed in meaning and composition, so did the team. Sub-components of the old blog network were transferred into the new product and subset of the old team similarly changed their focus to become responsible for the new product. The CTO provided a succinct synopsis:

*Put simply, during about four years, the entire team refocused to the new business with the exception of one person who is maintaining the old business, (WebCorp CTO)*

The reorientation involved starting development around a key sub-component and cultivation of a new team with a basis in the old team:

*The core was a microservice for serving the advertisements. It was a small part of the old product and we kept it as separate as possible so we could develop it without threatening the rest of the product (CTO)*

As much as the sub-component became a foundation of new focus, the team responsible for development of the new product on this foundation was initially staffed with developers familiar with the sub-component:

*The team started around the two guys who were working on the micro service. We hired a few more but the old business was not requiring that much focus so others joined us when we needed them (CEO)*

But the Microservice continued to provide an indispensable component of the blog network:

*With development of the new business, they were basically starting from a fork of the code from the old business. There was this technology there for the ads, which was essentially copied into the new business. Then they took it and expanded it further alone but there was also some integration there in the sense that what they developed could be contributed back to the mother organization (WebCorp CEO)*

#### **4.3.2 Interpretation**

In the studied period, the company re-interpreted itself and its products. WebCorp as a company went from focusing on a selling to customers to selling to other businesses. The advertising algorithms were reinterpreted from a sub-component of an old product to a component of a new product. A major difference between the two products was who were they addressed for. It was the customers and their needs that drove the development on top of the foundational, re-used, sub-component:

*So, the initial part was developed a long time ago.... Nevertheless, when we started getting publishers as clients, we felt a need to get some statistics and eventually a user interface. That was developed as a greenfield product completely independent from the old blog network (CTO)*

A senior tester described how this transformation process unfolded gradually:

*“The people, the place... Everything was the same, it's just topic of what we do has changed... it was like this natural drift towards the new stuff. We just needed to focus on something new.  
(Senior tester)*

The initial blog network provided the new entity with a proof of concept that helped with convincing future customers of the value the new company can provide.

#### **4.4 FinCorp**

FinCorp started with a mobile app for tracking personal finances which grew to be popular on the national market. A critical component of the personal finance app was a piece of software that allowed to download data from personal bank accounts of large banks. This piece of software was needed to populate the personal finance app with data about personal spending the app would provide analysis of. What this software did was in demand by other companies that also need to extract the same kind of spending data as a part of their products or services. To satisfy this demand, FinCorp spun off a new company focused exclusively on providing this data extraction service to other companies. This new company became its own business, that still provides the parent company with the critical sub-component but otherwise operates independently, with its own team and brand.

##### **4.4.1 Mirroring**

In FinCorp, the original app—and the original team—included the sub-systems responsible for extracting data from internet banking. These data-extraction sub-systems, and corresponding sub-teams, became a major focus for their potential to be offered as a service to other companies. To fully focus on this result of strategic decision, the sub-systems were made independent of the main product and the part of the organization responsible for them also grew independent until it became their own company. A lead developer stated the intention concisely:

*The CEO through, OK, but we have this unique technology, why don't we try to sell this to other companies so they can build on top of this so they can actually innovate on top of our APIs (Lead Developer)*

The new product was initially developed inside of the company but it was split-off eventually:



*There was like a side project that grew into exactly taking up 80 percent of the time. In the beginning it was just a small project, maybe 10, 20 percent of our time and it just grew bigger and bigger until it became 80 percent and then we split the marketing department up and then the whole company. (Marketing Manager)*

Even if the core technology was reused, the effort required a lot of new development:

*Essentially, they have to build everything from the ground up, it was only this connection with the banks that they could take from the old company and then develop the API on it were so that other clients could like use the technology to retrieve data on their own (Lead Developer)*

A new development, correspondingly, required a new team:

*They mostly hired new people for the new product. I think it was mostly because different people like different contexts. That was the challenge for me: going into new context every time for new products. So that was just like me seeing this as new, like kind of in context, I have to like, figure out trying to design for you (Designer)*

In FinCorp, a component of the old product grew into becoming a foundation of a spin-off business. It was initially developed within the old organizational and technical structures but it progressively gained independence. The independence was solidified by the focus on a completely different market segment: rather than a personal app, the spin-off was aimed at business clients.

#### **4.4.2 Interpretation**

The identity of the spin-off represented a profound shift. Offering technologies for manipulation of financial data to other businesses is a very different business than offering a personal finance app mainly for young adults. Even though the core of the product shared the same technological assets, the identity of the two products and their organizations was profoundly different. The main similarity between the two entities was that the personal finance app as well as the spin-off were in the broad finance space. This allowed the spin-off to draw on the legitimacy by showcasing the personal finance product as a demonstration of what can be built on top of the algorithms the spin-off was offering.

*We build an app and showed people what we could actually do with this technology. And then after validating that, we started selling the technology to other companies (Marketing Manager)*

A User Experience designer highlighted that this benefit however lost its strength as the new product gained its independence from the parent company:

*At the very beginning the established brand helped, but it always needed to have different branding if it was to be a successful B2B company. Eventually, we've reached a point where you know the clients that are using the new product don't necessarily know the original product anymore, and the new company has it's own recognition and all that. (UX Designer)*

The focus on a different group of customers (B2B as opposed to personal customers) changed the interpretation of what the company is and led to some people leaving:

*Some people that have been leaving their jobs because the company doesn't fit them anymore because they have been invested in the old company. And I only think it's natural. They didn't come to develop a B2B product. (Marketing Manager)*

## **4.5 HealthCorp**

HealthCorp began with an ambition to serve the healthcare domain with advanced technology like artificial intelligence. It was however hard to break into healthcare because of issues like privacy. Therefore, HealthCorp started with a less challenging domain and developed products that helped accountants by automatically handling invoices. The technology and know-how from invoice automation then helped to enter healthcare. Those technologies and capabilities from finance however also constrained development of the healthcare products.

When the invoice technology was mature enough, the technology for automating the processing of incoming invoices was repurposed to processing of incoming patients in hospitals. Incoming patients are a bit like incoming invoices, the reasoning went. This analogy proved at the same time effective and restrictive, especially when it came to convincing medical professionals about buying the technology. All of this happened in one organization with teams, that were fluidly borrowing members and sharing expertise. The teams however grew more independent as the two distinct products matured. Each of the products (invoices and healthcare) were branded independently however a personalised consultancy approach reduced importance of brands in favour of personal connection between representatives of the client organizations and representatives of the company

HealthCorp continued to offer two products and develop them in one company where the teams were fluid. This arrangement allowed them to share knowledge and even repurpose some digital artefacts. It however presented an increasing demand on coordination. To an outside observer, it could come as a surprise that the two distinctly branded products were coming from the same organization.

#### **4.5.1 Mirroring**

In HealthCorp, the two products were fluidly borrowing digital artefacts from each other and the two teams responsible for them were characterised by similar fluidity. Even though the teams were separate, the boundary between them wasn't entirely fixed:

*We definitely share people... if somebody needs help from our development team, then he can just go and ask... we can usually allocate some resources within like that specific product because a lot of the technology is similar. (Designer)*

Much like the teams were blurring together, the products did too:

*Our products are technically separate, but they are also kind of built on the same platforms. So, we have frameworks we reuse across the products when it helps. (Developer)*

The fluidity of teams and products helped with learning:

*We kind of use different machine learning platforms as they roll out because, you know, within our domain of data analysis and machine learning, there's always going to be new kind of machine learning packages that are publicly available. (Project Manager)*

#### **4.5.2 Interpretation**

Even though the two products in HealthCorp shared technological architecture and relied on some shared components, they differed substantially. The analogies between the two products have proven to be a double-edged sword. The company started with automatic sorting of invoices and used the learning to enter healthcare:

*We said, let's pretend the invoices are patients and see if we can optimise them and route them through the bookkeeping departments in the public sector (CEO)*

Relying on this analogy too much was tricky:






*If we say to the clinicians, a patient reminds us a little bit about an invoice, they totally say: "hey, stop, you don't understand anything that we're doing!" (Designer)*

And it took quite some convincing to establish a trusted identity for the healthcare product:

*What we experienced that was that we had the engineering side of things developing this model that could predict these acute admissions. But then we kind of did not understand, like, OK, how is the healthcare, how is the healthcare landscape going to adapt this technology? (CEO)*

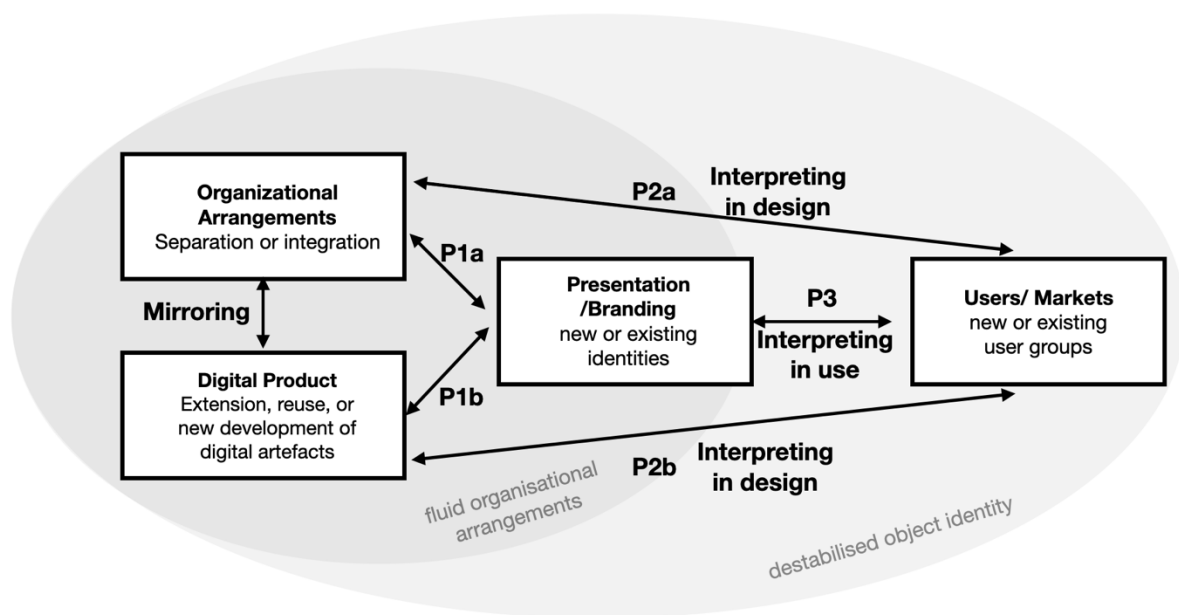
HealthCorp addressed two quite different types of needs in different markets. Even though the ambition to enter healthcare existed from the outset, HealthCorp started with a product for accounting. Despite the apparent distance of these two contexts, the developers and managers of HealthCorp saw intriguing similarities between the two contexts that were sometimes productive and sometimes restraining.

**Table 3: Overview of cases: Findings and synthesis**

		<b>RentCorp</b>	<b>HealthCorp</b>	<b>VoiceCorp</b>	<b>FinCorp</b>	<b>WebCorp</b>
<b>Mirroring</b>	Business areas	From online rental marketplace to tools for landlords	From AI accounting to AI in healthcare	From meeting assistant software to voice analysis	From personal finance app to finance data	From a blog network to algorithmic online advertising
	Case Presentation					
	Organisation	Two teams. One focused on the old business and the other focused on innovation. They are merged in the end.	The company develops two products in one organisation. Two teams with blurred boundaries, shared responsibilities and tasks	Development of the innovation in separate team which becomes a separate company	A part of the organization becomes its own organization	The entire company gradually shifts focus to development of the new product
	Product Architecture	Separate innovation merged into legacy product	Two products from shared technological core	Separately developed technological innovation becomes its own product	An integral component of a legacy product becomes its own product	
<b>Interpreting</b>	Interfaces	New interface merged into existing product	Some similarities in interface layout conventions but they are different	Early attempt at unifying but eventually different		Completely independent interface
	Presentation	Single identity	Separate identities under one company brand	Two separate identities		The company adopts a new identity
	Users/markets	Existing user needs in familiar markets	Two sets of user needs	New user needs in unfamiliar market		

## 5 Theorizing organizing in born-digital organizations as mirroring and interpreting

This paper set out to explore the interplay of digital artefacts and organizational forms in fully digital companies. In exploring this topic, we jointly draw on the literature on organizing with technologies including the Mirroring hypothesis (Colfer and Baldwin, 2010; Baldwin, 2015; Sorkun and Furlan, 2017). We supplement this literature with the perspectives on digital artefacts, which are characterised by unstable identity and connected to organizational fluidity (section 2.2). Our findings in brief are that that digitally native organisations mirror the fluidity of digital artefacts at their center.



**Figure 2: Process model of co-evolution of digital artefacts and organizations as mirroring and interpreting**

Digital artefacts are more malleable than physical artefacts (Kallinikos and Mariátegui, 2011) and the organizational arrangements reflect that. A key element of the malleability of digital artefacts is that their meaning depends on by the socially constructed understanding of the boundaries of the artefact, which requires their interpretation. So, what is being mirrored is not simply given but negotiated by a process we call interpreting. When organizations engage in

the process of interpreting, a key input is knowledge and understanding about the users, customers or markets the digital products cater to. When an organization reaches a new understanding of the users of its products, the existing digital artefact can be re-interpreted. The new interpretation of the market gives new meaning to how the organization sees the digital artefacts that it owns. This image of customers and their needs, combined with the material constraints of the digital product itself, is what the organizational structure mirrors. ‘

In this discussion, we develop a model of co-evolution of digital artefacts and organizations and elaborate three propositions that extend the Mirroring hypothesis. The overall model is displayed as Figure 2. Table 4 summarises the propositions, processes and supporting evidence. We derived our theorizing of organizing as mirroring and interpreting through the above presented multiple-case study. In the studied cases, the co-evolution of digital artefacts and organizations occurred in particularly salient periods: when these born-digital businesses were seeking to establish a spin-off business or radically new products. In the results, we have discerned four particular components, whose interaction plays a role in the co-evolutionary dynamics. We have also linked the four elements into two dyads, each dyad recognizing a process. Mirroring links the dyad of organizational arrangements and digital products. Interpreting links the dyad of presentation with users. In this section we develop these observations into a generalizable proposition while highlighting how our theorizing challenges the extant literature.

## **5.1 Mirroring**

Born-digital organizations are built with and around digital artefacts (von Briel, Recker and Davidsson, 2018). The digital artefacts can however only have value “when they are combined with organizational resources to create IT enabled resources” (Nevo and Wade, Michael, 2010). This correspondence of the technical asset (digital artefact) and an organization is governed by the process of mirroring, which we take from the literature on the Mirroring hypothesis. In line with the qualitative approach taken here, we are however conceptualizing mirroring as a process rather than an effect (Colfer and Baldwin, 2010; Baldwin, 2015; Sorkun and Furlan, 2017).

In the studied born-digital organizations, organizational structures eventually came to mirror the product architectures. Therefore, mirroring would seemingly be supported. However, two

amendments need to be made to account for specifics of digital artefacts. First, digital products have more freedom in the way they are presented and assembled into interfaces. For example, VoiceCorp can incorporate new voice features into an old product or into a new one with freedom that manufacturers of physical products simply cannot attain. The way digital artefacts are presented in digital products interacts with architectures of digital products and with organizational arrangements. The second amendment of the Mirroring hypothesis is that, digital products inherit properties of digital artefacts that allow for specific ways of arranging them like duplicating them to a new organization.

A development of new product for voice analysis in VoiceCorp was carried out in a separate team and as much as the teams gained more independence, so did the products drift apart. When it was found that the new products developed in RentCorp were better merged into the old product, the new product was likewise merged into the old product. While an evidence from a meta-analysis points towards inapplicability of the mirroring hypothesis to digital contexts (Colfer and Baldwin, 2016), we find mirroring to be a useful starting point for thinking about co-evolution of organizing of digital products and corresponding social structures.

Mirroring of in born-digital organizations however reflects the materiality of digital artefacts, which can be packaged and recombined more freely than non-digital products (Henfridsson *et al.*, 2018). Both organizational arrangements and the digital product architecture are influenced by the decisions about how the product is presented to its users. The way a digital product is presented includes considerations about its interface, conventions within the interface, or elements of branding like naming of the product, logos, and colour pallets. FinCorp and WebCorp were two companies in our study that developed new products aimed at a different segment (B2B rather than B2C in both cases). Both FinCorp and WebCorp needed to establish new brands and interfaces to distinguish the new products and to communicate in line with the expectations for the new segment. (Tumbas and Berente, 2017). Interestingly, WebCorp sought a radical break in identity from the start whereas FinCorp tried to leverage some of its brand elements (e.g. colour) to help establishing a new identity. Either way, establishing a new brand was better accomplished in a new unit; so, even if the core digital artefacts were shared between the old and new teams, the way it they were presented influenced organizing:

*1a: The way in which the digital product is presented will mirror the organizational architecture*



Analogically, when a digital product is presented under a new identity, the independence of its presentation will be mirrored in independence of its development. VoiceCorp provides a nice illustration of this process. Even if the aim in VoiceCorp was to integrate new voice functionalities into the old product, the company found that the voice features are better suited for different needs and should therefore be packaged in a new interface. A new interface was better developed separately. HealthCorp provides an alternative illustration. In HealthCorp, they shared elements of presentation across their two digital products. Correspondingly, the development teams also shared expertise. To formalise those observations, we can formulate proposition 1b, extending our discussion of the influence of presentation of digital products on its architecture:

*1b: The architecture of the digital product will mirror the way it is presented*

Besides the importance of presentation, the properties of digital materiality also amend the way mirroring unfolds. Digital artefacts provide a range of properties that are not present in the same way with non-digital products (Kallinikos, Aaltonen and Marton, 2013; Hui, 2016). Those new properties allow to manipulate the artefacts differently and new ways of changing organizational arrangements are correspondingly available. For instance, forking (Karhu, Gustafsson and Lyytinen, 2018; Andersen and Ingram Bogusz, 2019) is a way to duplicate a digital artefact when development objectives shift. A new customer group can be formed as a result of a fork or a new group can instigate a fork. More generally, digital artefacts are distributable (Kallinikos, Aaltonen and Marton, 2013) Because multiple groups can access the same digital artefact at once (Kallinikos and Mariátegui, 2011), it is not necessarily true that each module of the digital product has a corresponding organization.

## **5.2 Interpreting**

The key observation derived from our research is the identification of a second process, that occurs alongside mirroring; interpretation. Because the identity of digital artefacts is open-ended and unstable, it needs to be stabilised through a socio-cognitive process (Nambisan *et al.*, 2017). Whether a FinCorp is dealing with a sub-component of an old business or with a foundational element of a new spin-off business is not given but rather negotiated. Through interpretation, both the structure of the product and the structure of the organization are arrived at because organization and the technical artefact are connected by the mirroring process. Interpreting and the stabilization of meaning of digital artefacts is linked to the organization's understanding of users, their needs, and the markets that the digital product is (to be) serving.

Because interpreting is a cognitive process, we can distinguish between two kinds of interpreting, depending on whose cognition is involved. The first concerns the interaction between the digital product, as accessed through its interface, and the user. We call this interpreting-in-use. The second kind of interpreting concerns the interaction between the product and the organization, which learns about the needs of its users and arrives at some way of structuring of the market. We call this (interpreting) in design.

### **5.2.1 Interpreting in design**

The Mirroring hypothesis holds that the architecture of a product and the architecture of organizational arrangements is going to look alike. Each module of a technical product, for instance, is likely going to have a corresponding organizational unit. But what are the boundaries of modules of digital products? When products are generative and can be infinitely re-combined (Henfridsson *et al.*, 2018), the identification of boundaries of products and their modules is less clear-cut. Especially since digital artefacts are context agnostic (Alaimo and Kallinikos, 2021, p. 7).

Through our empirical work, we found that what influences the number, boundaries and identities of modules is the understanding of users and their needs together with markets that the digital product caters to. That is to say, depending on how the organization understands and categorises its users plays a role in decisions to draw a boundary around a module. When VoiceCorp started developing new features around voice analysis, they expected that they will be incorporated in the old product. However, they recognised that the new voice features are better fit with a new market segment. This motivated formation of a new team. The story of VoiceCorp illustrates the role of interpretation for organization:

*P2a: A set of user needs recognised as new, is likely to eventually correspond to a separate organization*

Interpretation also influences the way the digital artefacts themselves are arranged. When RentCorp recognised the separately developed functionalities are a better fit with their existing customers rather than new ones, they merged the developed digital products together. Conversely, FinCorp saw it as necessary to support independent development of their advertising technology partly because it was aimed at a different market. The interpretation of the digital artefacts is grounded in the value they perform for their users and identification of a

new user group typically comes to correspond to a new set of digital artefacts. We can formulate the second part of proposition 2 as follows:

*P2b: A separate digital artefact is likely to correspond to framing a new market or user group*

Interpreting-in-design is the process by which members of a born-digital organization come to an understanding of an identity of the digital artefacts at the core of their organization. The identity of digital artefacts is stabilised with reference to the value provided to a particular user group. Once an interpretation is reached, it can have effects on the organizational structures (proposition 1a) and digital products (proposition 1b).

### **5.2.2 Interpreting in-use**

The meaning of a digital artefact can be left ambiguous until the point of use because digital artefacts are interactive (Kallinikos, Aaltonen and Marton, 2013; Henfridsson *et al.*, 2018; Lehrer *et al.*, 2018) and is contingent on local contexts (Ciborra and Willcocks, 2006; Nevo, Nevo and Pinsonneault, 2016). However, digital artefacts are not neutral as they carry “predilections that are linked to “beliefs, organizational aims, or physical beliefs, organizational aims, or physical constraints” (Alaimo and Kallinikos, 2021, p. 7). Users, who interact with digital products, thus draw on the existing repertoire of technological frames (Orlikowski and Gash, 1994) or institutional norms which born-digital organizations may need to adopt to achieve legitimacy (Tumbas and Berente, 2017).

Even if our data does not provide us with an extensive empirical account of users and their encounters with products-in-use (Hron, 2021), we learned about the importance of the interpreting process of users in RentCorp, where the managers learned that even though they were developing a new product, their customers saw it as an extension of the initial product. Conversely, VoiceCorp understood that voice features were not a fit with the needs of old users and thus presented them separately. Relating those observations with the literature, we formulate proposition 3:

*P3: The identity of the product is interpreted in-situ by users interacting with the interface of the digital product.*

Prop.	Formulation	Illustrative evidence summarised	Theorised process
<i>1a</i>	The way in which the digital product is presented will mirror the organizational architecture	<i>FinCorp</i> and <i>WebCorp</i> developed spin-offs for B2B segments rather than their original B2C products. New interfaces and brand identities were needed and new groups were correspondingly established.	<i>Mirroring</i>  Digital products generally mirror organizational arrangements. However, digital materiality affords freedom in how different features can be presented. Organizations make decisions in how to present developed features to users. The decisions about presentation can influence organization and product architecture.
<i>1b</i>	The architecture of the digital product will mirror the way it is presented	<i>VoiceCorp</i> decided to develop voice technologies separately and ended up with separate interface. <i>HealthCorp</i> borrowed conventions in presentation across their two digital products. The development teams also shared expertise.	
<i>2a</i>	A set of user needs recognised as new, is likely to eventually correspond to a separate organization	<i>VoiceCorp</i> discovered that voice features are better suited for a new set of users. New team was setup to cater to them.	<i>Interpreting in design</i>  Organizations need to negotiate the identity of products under development. Sets of user needs (new or familiar) contribute to stabilization of identity of digital products. Recognition of new user need tends to correspond to new organization of artefact.
<i>2b</i>	A separate digital artefact is likely to correspond to framing a new market or user group	<i>HelathCorp</i> learned that they need to frame their healthcare products differently from accounting products	
<i>3</i>	The identity of the product is interpreted in-situ by users interacting with the interface of the digital product.	<i>RentCorp</i> learned that even though they were developing a new product, their customers saw it as an extension of the initial product. Conversely, <i>VoiceCorp</i> understood that voice features were not a fit with the needs of old users and thus presented them separately.	<i>Interpreting in use</i>  Identity of digital products depends on the fit with the needs of users. Even though digital artefacts can be combined freely. Users' interpretative frames play a role.

**Table 4: Propositions, evidence, and process**

## **6 Linking the model to the properties of digital artefacts**

The two processes that we theorise are particularly accentuated for the context of digital innovation. Namely, the two challenges of organizing (with) digital artefacts, that were developed in section 2.2, are related to specific parts of the model, which is depicted in Figure 2. In this sub-section, we explicitly connect the challenges of digital artefacts with our model.

### **6.1 Organizational fluidity in the model**

The first challenge of managing digital artefacts had to do with the fact that digital artefacts are linked to organizational fluidity. They can freely distribute across organizational boundaries (Kallinikos, Aaltonen and Marton, 2010), possibly causing organizational convergence (Yoo *et al.*, 2012; Hron, Obwegeser and Müller, 2021). Ekbia's theoretical development, which links identity of digital artefacts to the processes that mediate their production (Ekbia, 2009) is perhaps the strongest articulation of this idea.

Within our model, organizational fluidity concerns the core mirroring process, which links the organizational arrangements and architectural arrangements of the digital product. However, on top of this apparent rediscovery of the Mirroring hypothesis, we find it necessary to distinguish the decisions about presentation of the product (e.g., should a new functionality be presented within existing interface or packaged as a new product) from the core of the product (i.e., central algorithms, data etc.). The decisions about how are the functionalities presented are related but independent of what constitutes the core of the product. When VoiceCorp developed new voice features, it could be integrated into the old product for agendas or serve as a basis of a new product. Both options were available. Given properties like distributability of digital artefacts, (Kallinikos, Aaltonen and Marton, 2013) or the fact that they can be used by multiple groups (Faulkner and Runde, 2009), they can be recombined seemingly endlessly (Henfridsson *et al.*, 2018). The properties of digital artefacts contribute to increased organizational fluidity which affects the organizational designs, products designs, and decisions about presentation of any digital capabilities.

### **6.2 Unstable identity in the model**

The second challenge of managing digital artefacts had to do with the fact that digital artefacts are characterised by unstable identity. They can be freely extended (Garud, Kumaraswamy and

Sambamurthy, 2006) because they are intentionally incomplete (Garud, Jain and Tuertscher, 2008) and thus “ever in the making” (Lehmann and Recker, 2021). Even if they are temporarily stabilised, they can be freely reused and recombined to become something else (Henfridsson *et al.*, 2018). Notably, the process of recombination, by which a digital artefact becomes something else, can take place within the company itself or it can also happen when a digital artefact is used by a person (Yoo, Henfridsson and Lyytinen, 2010). The importance of local context for interpretation reflects notions like individual cognitive frames (Orlikowski and Gash, 1994) or norms in a field (Tumbas and Berente, 2017).

Within our model, the organizational challenge of managing artefacts with unstable identity is one that transcends but encompasses the born-digital organization itself. From our empirical material, we theorise that the identity of a digital artefact is tightly linked to its role in use. What a product is depends on how it fits with needs of users of different market segments. The understanding of those then moderates decisions about how to organise the architecture of the product and the organizations (remember, those mirror each other).

Our theorizing is particularly fitting to the contexts of organizing with digital artefacts. Digital artefacts are linked with certain challenges (organizational fluidity, unstable identity). Within the organization, properties like distributability (Kallinikos and Mariátegui, 2011), non-rivalry in use, and open ended capacity for generative recombination lend itself to ability of the digital artefact to travel across the organization and be actively interpreted

## **7. Contributions and implications**

Our research contributes to three academic discussions in particular. We firstly contribute to the debate on digital innovation. We derive our findings by examining born-digital organizations, which have become a subject of their own stream of literature. The literature on born-digital organizations is the second area this paper contributes to. Relatedly, we provide contributions to the literature on digital artefacts, which form the core of born-digital organizations. Lastly, we derive our contributions by revisiting a seminal perspective—the Mirroring hypothesis—within the broad literature on management of technology and innovation.

The principal contribution is to the debate on digital strategy and innovation. Organizing for digital innovation is a key practical concern (Obwegeser *et al.*, 2020) and an identified focus for theoretical development (Yoo, Henfridsson and Lyytinen, 2010). An influential explanation of the relationship

between organizations and technological products has been provided by the Mirroring hypothesis (Colfer and Baldwin, 2010; Sorkun and Furlan, 2017). Recent research however argues that Mirroring may not be applicable to digital domain (Lee and Berente, 2012; Hylving and Schultze, 2020). To this dominantly positivist literature, we contribute with a perspective derived by qualitative research. Multiple case study allows us to treat mirroring as a process rather than a deterministic (hypothesised) effect. Within such position, we can elaborate (Fisher and Aguinis, 2017) the Mirroring hypothesis to show that within digital innovation, mirroring is accompanied by a second process of interpretation. Interpretation is the process by which the architecture and identity of a digital product is established. This process aids in accounting for the apparent inapplicability of the hypothesis. What gets mirrored cannot be simply assumed because identities of digital products are negotiated.

A modest stream of scholarship has examined born-digital organizations (von Briel, Recker and Davidsson, 2018). Within this literature, we find papers that document how born-digital firms harness generativity of digital technologies (Garud, Jain and Tuertscher, 2008) and have to manage fluid ongoing evolution of digital products (Lehmann and Recker, 2021). As digital products are extended, they may need to be legitimised as they enter new fields (Tumbas and Berente, 2017). The existing digital artefacts can provide a generic template for future extension (Huang, Henfridsson and Liu, 2021). While we confirm much of those findings, from our analysis, we find that extensions of digital products do not have to rely on generic solutions (*ibid.*). In the studied cases, we find that digital artefacts behind quite specific solutions were routinely repurposed to address a completely new need without a generic template. The context-agnostic (Alaimo and Kallinikos, 2021) nature of digital artefacts was sufficient to enable their recombination (Henfridsson *et al.*, 2018). What stood in a way of the process to develop new products was mostly a failure of imagination, which the companies overcame by separating the development effort either organizationally or architecturally.

For the debate on digital artefacts (Hui, 2012; Kallinikos, Aaltonen and Marton, 2013), we extend the theorizing firstly by demonstrating the role of digital artefacts in organizing. The literature on digital materiality provides us with a valuable source of concepts to explain the novelty of digital innovation. However, we use this literature not only as a source; we also contribute to it. Ekbja (2009) anchors the identity of digital artefacts to the processes that are involved in their creation. We add to that perspective and claim that the identity of digital artefacts can also be tied the patters of their consumption or use. When a company achieves some understanding of a pattern of use, this

understanding can inform the assumed identity of the digital product or digital artefact under development.

This work also provides value to the debate on the Mirroring hypothesis within the broader management literature. The work here joins to the stream of research examining mirroring as a dynamic phenomenon (Consoli, 2005; MacDuffie, 2013). By casting mirroring as a process, we examine how it unfolds in born-digital organizations, which have been identified as a potentially anomalous context for mirroring. The qualitative method allows us to cast mirroring as a process and deepen such view by inclusion of the co-occurring process of interpretation, which is especially salient for digital artefacts with unstable identity. The notion of interpretation also provides a key element to a solution for the “mirroring trap”. If a company wants to pursue an architectural innovation and “break the mirror”, re-interpretation of their technical (digital) resources can aid in the effort.

## **7.1 Managerial implications**

The subject of this research also holds important practical implications. Is it better to pursue digital innovation within existing organization or in an organizationally separated setup? This research suggests that the organizational setup can depend on the type of market addressed. New markets or radically new user needs may be better served within an organizationally separated setup and with a correspondingly separated development of the digital artefact (minimal reuse). Another important area for practice concerns the interpretative process. The negotiation of the boundaries between what constitutes a new product and what constitutes an extension of the old product is key to succeeding with development of digital ventures.

Previous research showed that the consideration of organizational arrangements should be accompanied by consideration of digital artefacts (reuse or new development) (Hron, Obwegeser and Müller, 2021). This research extends those considerations by highlighting the role of external environment, like different user groups, as a key variable which should enter managerial decision making during digital innovation.

## **8. Conclusion**

Execution of digital strategy requires both technical (digital) and organizational resources (Piccoli, Gabriele and Ives, 2005), which come to mirror one another (Colfer and Baldwin, 2016). Perfect



mirroring, while efficient, can hinder exploration when it manifests as a “mirroring trap”. Born-digital organizations need to overcome the mirroring trap if they want to succeed with development of radical or architectural innovation.

Born-digital organizations are built around digital artefacts. Digital artefacts can be extended and interpreted (Nevo, Nevo and Pinsonneault, 2016; Karhu, Gustafsson and Lyytinen, 2018). Their meaning can be changed in production or in consumption (Henfridsson *et al.*, 2018; Lehrer *et al.*, 2018). Those novel properties complicate the process of mirroring. Given the properties of digital artefacts, which can be edited, copied or re-used, the modules that they form (and which the organization ends up mirroring) are a result of a social process of negotiating the boundaries of the artefacts. In other words, there is a second process—interpretation—that happens in parallel but not independent of mirroring.

The interpretation process is an important ingredient to the challenge of how to overcome the “mirroring trap”. By re-interpreting the identity of the mirrored digital artefacts, born-digital companies are more likely to succeed in “breaking the mirror” and escape the efficient state of full mirroring. Our theorizing of digital strategy as mirroring and interpreting adds to the debate on digital strategy, innovation, and also extends the debate on the processual view of the Mirroring hypothesis.

## 8.1 Limitations

One limitation of the present work is that it relied on retrospective data collection. We did so because we selected the case companies precisely because they went through the experience of executing a strategy that diversified or redefined what the company is. Following companies in real time and hoping such strategy would naturally occur would be ideal but prohibitively demanding and practically unfeasible.

As a second limitation, our sample consisted of digitally-native firms undergoing a particular decision: whether to establish a separate organisation or whether to develop a new product within existing structures. We used these cases to exemplify how the Mirroring Hypothesis applies to the

digital context. It can be alleged that the Mirroring Hypothesis is posited to apply to a broader range of more fine-grained organizational decisions than whether to setup a separate company or not. Having acknowledged that, we can only add to the voices which advice to continue research on organizing logic of digital innovation and revising the mirroring hypothesis for the digital context (Constantinides, Henfridsson and Parker, 2018).

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## Appendix: The Interview Guide

Theme	Questions
<i>Intro</i>	<ul style="list-style-type: none"> <li>• My interests: Digital Innovation and organization</li> <li>• Can you introduce yourself? What is your role in the company?</li> <li>• How would you describe the company?</li> </ul>
<i>Organization and process</i>	<ul style="list-style-type: none"> <li>• How big is the (developer) organization? How is it organized?</li> <li>• Did this change over the time you were with the company?</li> <li>• What is the work process? In terms of methodologies etc.?</li> <li>• How do you gather requirements / develop concepts? Collaboration with support or user focus groups?</li> <li>• How do you prioritize between the different concepts?</li> <li>• How do you split work between the different tasks?</li> <li>• What tools are you using? Are they shared among the groups?</li> </ul>
<i>Product</i>	<ul style="list-style-type: none"> <li>• What are your products and how are they related?</li> <li>• How what is the story of how you ended up with the current portfolio?</li> <li>• Who are the product features for?</li> <li>• How are the products technologically enabled? Shared database? Shared GitHub? Or separate codebases?</li> </ul>
<i>Presentation</i>	<ul style="list-style-type: none"> <li>• If you develop new features, how do you think about how are they going to be presented? Old brand / new brand? Old interface / new interface? Color choice?</li> <li>• What do you see as an advantage of the chosen path?</li> <li>• How are you communicating with the different audiences?</li> <li>• How are the products to-be-integrated? Both in terms of UI but also visual identity?</li> </ul>
<i>Customers and competitors</i> <i>(Added in later stage of data collection)</i>	<ul style="list-style-type: none"> <li>• Who are you competitors?</li> <li>• Who are you customers?</li> <li>• How do you learn about the customer needs? How does that inform your roadmap or what you focus in development now and what is on the roadmap?</li> <li>• How do you aim to differentiate against competition?</li> </ul>
<i>Outro</i>	<ul style="list-style-type: none"> <li>• Thank you for your time!</li> </ul>



Part 3

# **Discussion and conclusion**

## Theoretical Contributions

This dissertation primarily aims to contribute to the literature on digital innovation. It elaborates the organisational mechanisms and management challenges associated with the systematic involvement of digital artefacts in organising for innovation. Innovation drift, or the proclivity of radical innovation ambitions to gradually drift towards more incremental realisations, is one of those mechanisms that Paper II illustrates in particular depth. By examining the role of digital artefacts, the research presented herein approaches the core of what makes digital innovation novel, as it is the widespread diffusion of digital artefacts that gives rise to new organisational logics.

The opening chapter of this dissertation has explained how this dissertation engages with three related streams of literature (digital innovation, digital artefacts, and management of technology and innovation). In this closing chapter, the dissertation revisits these three streams of literature and explicates how the individual papers leverage them and contribute to them. The overview of the individual papers and their engagement with the three streams is given in Table 1 below.

### **Paper I: Quest for New Theoretical Logics of digital innovation**

The opening paper contributes to the literature on digital innovation in three ways. First, it critically evaluates the existing research on digital innovation for its degree of focus on the distinguishing properties of digital artefacts (Kallinikos et al., 2013). Secondly, the paper explains how organisational level conceptualisations of digital artefacts are suitable to revealing their different properties by a means of a meta-theory (Bostrom et al., 2009). Lastly, the paper proposes an agenda for future research, which would closely attend to the digitality of digital innovation.

Paper I contributes to the literature on digital artefacts by linking the properties of digital artefacts (Kallinikos et al., 2013) with the conceptualisations that are used to envisage them in organisations (Runde & Faulkner, 2019). For organisational level analysis, digital artefacts can be conceived in different ways. For instance, digital artefacts can be seen as resources or as a medium for service delivery. The analysis reveals that each conceptualisation on the organisational level is conducive to illuminating different properties. Following with the previous example, when digital artefacts are seen as resources, the property of distributability is highlighted. Similarly, when researchers approach digital artefacts as a medium for service delivery, interactivity of digital artefacts likely becomes the focus. The paper contributes to the literature on digital artefacts by developing a meta-theory linking properties of digital artefacts to their organisational level conceptualisations.

Paper I draws on existing literature within management of technology by duplicating and extending the seminal study by Orlikowski and Iacono (2001) which called for specific consideration and theorisation of the IT artefact in research. This paper, however, does not simply join other papers which replicated the original study (Akhlaghpour et al., 2013; Grover & Lyytinen, 2015) because it extends and adapts it to the context of digital innovation. Orlikowski and Iacono (2001) emphasised the advantages of adopting the ensemble view of IT wherein technology is envisaged not as a tool or a static variable but “an ensemble or ‘web’ of equipment, techniques, applications, and people that define a social context” (p. 122). While Orlikowski and Iacono (2001) concluded with identification of the ensemble view, Paper I of this dissertation takes the papers that adopt the ensemble view as a starting point of the analysis, seeking ways that such depiction can be attained specifically for digital artefacts, as depicted in the literature that theorises them (Kallinikos et al., 2013; Runde & Faulkner, 2019).

### **Paper II: Innovation Drift:**

#### **The influence of digital artefacts on organising for innovation**

Paper II contributes to the discourse on digital innovation by explaining the process by which reuse of digital artefacts can undermine development of radical innovations. By reusing digital artefacts, ambitions for radical innovations can drift towards more incremental realisations. Paper II formalises this process under the concept of innovation drift, where organisational separation can drift towards organisational integration; new identity can drift towards presentation under existing identities; and a radical vision can drift towards incremental realisation. All these tendencies can be explained with reference to properties like distributability and openness of digital artefacts. The paper moreover challenges the academic discourse on digital innovation, which is often motivated by examples of radical, even paradigm-changing innovations. By presenting a case of—eventual—incremental innovation, the study proposes to open a discussion surrounding consideration of incremental digital innovations.

Paper II elaborates the role of digital artefacts for organising for innovation. The notion of innovation drift is explained with reference to the distinguishing properties of digital artefacts as they manifest in practice. Because digital artefacts are open and distributable, they can be easily reused and serve as a foundation or a building block for development. While individual decisions to rely on existing building blocks may appear rational, such decisions can yield innovation drift as described above.

Our observations also add to the depiction of digital artefacts as generative or facilitators of innovation and showcases that they can be both enabling and restricting (W. J. Orlikowski, 2000).

Paper II revisits the established findings on the effectiveness of organisational separation and integration as strategies for innovation. An assumption that needs not be questioned in non-digital innovation is the boundedness of the product. However, digital products are unbounded as a result of their potential for extension and their ability to freely cross the organisational fabric (Eck et al., 2015; Zittrain, 2008). As a consequence, organisational separation cannot be considered alone for the context of digital innovation; as digital artefacts travel across organisational boundaries, they can undermine effectiveness of organisational separation as a vehicle for development of innovative concepts. Therefore, the decision of how to manage digital artefacts (reuse or new development) is an added dimension accompanying decisions regarding organisational arrangements (integration or separation).

### **Paper III: Mirroring and Interpreting: Co-evolution of Digital Artefacts and Organisations**

Paper III contributes to the discourse on digital innovation by proposing a process model of co-evolution of organizational structures and digital artefacts. The model is composed of two processes: mirroring and interpreting. For the discourse on digital innovation, this paper leverages the seminal Mirroring hypothesis to understand the process of digital strategy execution. In born-digital environments, we find the Mirroring hypothesis to be a source of reliable explanations of how digital strategy unfolds as combination of digital artefacts and organizational resources. To account for the specifics of digital, we also elaborate interpretation as a co-occurring process by which the identity of the digital artefact-to-be-mirrored is stabilized. The identification of the interpretation process attests to the importance of “socio-cognitive sensemaking” for digital innovation (Nambisan *et al.*, 2017).

Paper III elaborates on the effects of digital artefacts on organisational forms. By reviewing the literature theorising digital artefacts, it establishes two important challenges: (1) digital artefacts are tied to organisational fluidity, and (2) digital artefacts are characterised by unstable identity. The first challenge links the organisational structures and architectural choices (also identified in Paper II). The second challenge relates to the identity of digital artefacts. Ekbria (2009) articulates a view of digital artefacts wherein their identity is tied to the processes that mediate their production. Paper III

adds a complementary view wherein we link the identity of a digital artefact to the processes that mediate their use or consumption. Navigating the process of interpretation is in line with the importance of socio-cognitive sensemaking for digital innovation, as highlighted by Nambisan et al. (2017) in their widely cited editorial.

Paper III leverages the seminal “mirroring hypothesis” (Colfer & Baldwin, 2016) and proposes its extension for the context of digital innovation. Adopting a qualitative method allows us to treat mirroring as a process rather than an effect. The data provides evidence in favor of the mirroring hypothesis. Newly developed digital products correspond to new and separated organisational units and vice versa. Because digital artefacts are open, generative, and characterised by unstable identity, what is being mirrored is not simply given but is determined by a process of social construction we term “interpreting.” The identity of a digital artefact (including the consideration of whether or not it is a separate artefact) largely depends on the way the organisation understands its customers and their needs. The established research on the mirroring hypothesis largely assumes a structure of a product under development is given, an assumption that is helpful to relax when developing digital artefacts with unstable identities.

	Paper I	Paper II	Paper III	Overall contribution	
<b>Literature stream</b>	<b>Digital Innovation</b>	Literature on digital innovation pays limited attention to properties of digital artefacts. Research agenda that would rectify this is proposed.	In digital innovation, both organisational integration and separation and available. Treatment of digital artefacts needs to be considered too to avoid drift of innovation from radical to incremental.	When organising for digital innovation, digital products and organisations mirror each other but the structure of the digital artefact is not given but negotiated. It highlights importance of socio-cognitive sensemaking	The current literature on digital innovation pays limited attention to digital artefacts. Digital innovation is tightly linked with organising. It is a social phenomenon because identity of digital artefacts is socially constructed.
	<b>Digital artefacts</b>	Assessment of degree of attention literature on digital innovation gives to digital artefacts. Different conceptualisations highlight different properties.	Digital artefacts are not only generative but can likewise be constraining to innovation efforts. Digital artefacts can influence effectiveness of organising arrangements for innovation	Digital artefacts are linked with organisational fluidity and can be reinterpreted. Their identity is influenced by their role in consumption.	Different properties are surfaced by different conceptualisations of digital artefacts. They are generative but also restrictive. Their identity is tied to consumption in addition to production.
	<b>Management of technology and innovation</b>	The seminal work from Orlikowski and Iacono (2001) is not only replicated but extended to account for specifics of digital artefacts	Organisational separation, as a vehicle for development of radical innovation, can be undermined by reuse of digital artefacts, which are easily recombined and travel across organisational boundaries.	The Mirroring hypothesis is extended by adding a co-occurring process of interpretation to account for unstable meaning of digital artefacts which are associated with increased organisational fluidity.	Established literature can serve as a basis for theorising digital innovation but it needs to be problematised or elaborated. Outdated root metaphor is often a cause of deficiency in the old theories.

**Table 1 Contribution per stream**

## **Overall Contribution per stream**

### **Digital Innovation**

For the literature on digital innovation, the work contained here contributes by articulating an approach and documenting specific phenomena within this approach. The approach advanced here reinstates the approach articulated within the IS discipline to specifically consider and theorise the technological artefact (W. Orlikowski & Iacono, 2001). The technological artefact relevant to digital innovation is the digital artefact, which has been theorised independently of the IT artefact (Kallinikos et al., 2013; Runde & Faulkner, 2019). Much like the overall information systems literature has paid limited attention to IT artefacts (Akhlaghpour et al., 2013; Grover & Lyytinen, 2015), the research here finds that the literature on digital innovation has paid insufficient attention to its central object. Paper I proceeds to develop a research agenda that would rectify this shortcoming.

The two empirical papers then document how digital artefacts in practice have the potential to interface with organisational arrangements. They can facilitate convergence (Seo, 2018; Yoo et al., 2010) or blending of organisational units together, but they also allow for new development by virtue of being generative (Eck et al., 2015; Garud et al., 2008; Yoo et al., 2010). Their potential to be easily recombined fuels the potential of digital innovation (Henfridsson et al., 2018). However, as the research here demonstrates, without conscious management of what is recombined when, the outputs of a digital innovation process can miss their aims. They can drift from radical to incremental. Decisions regarding what to reuse and where to start new development are moderated by an understanding of where boundaries between old and new products are drawn. Due to the open-endedness and unstable identity of digital artefacts, the boundary between old and new products is not clear cut. It is in fact a subject of social construction or sense making (Nambisan et al., 2017) that occurs as a part of the innovation process.

### **Digital Artefacts**

The literature that theorises digital artefacts has provided this research with a source of concepts that aid in explaining the observed phenomena of digital innovation (Ekbia, 2009; Hui, 2012; Kallinikos et al., 2013; Runde & Faulkner, 2019). If it wasn't for digital artefacts, digital innovation would not exist, and the organising logic of innovation would not be changed. The literature debating specifics of digital artefacts articulates a range of properties (e.g., distributability). It also discusses how digital artefacts can be conceptualised on the organisational level. Paper I of this dissertation constructs a

meta-theory relating properties to organisational-level conceptualisations, unearthing how different organisational conceptualisations (e.g., digital artefacts as options) are suitable to revealing different properties of digital artefacts (e.g., openness).

More than just a source of concepts, however, the research here articulates some important consequences of digital artefacts on organising. The literature on digital artefacts highlights their generative potential or their capacity to enable action (Eck et al., 2015; Zittrain, 2008). In line with the observation that technologies are enabling and restricting of practice (W. J. Orlikowski, 2000), we offer a parallel observation regarding digital artefacts. While they certainly exhibit generative potential through their ability to be recombined (Henfridsson et al., 2018), they can likewise anchor practice, cause rigidity (Leonard-Barton, 1992), or contribute to a form of inertia (Hannan & Freeman, 1984). In other words, digital artefacts can restrict action as much as enable it. Even though digital artefacts are non-human things, their non-materiality and ability to freely distribute across the organisational fabric paradoxically make their management tightly linked to cognition or processes within which they exist. Ekbia (2009) uses the notion of quasi-object to articulate such a view. Unlike Ekbia, who highlights the role of production processes in determining the identity of digital artefacts, this dissertation adds the process of consumption as what can define the identity of digital artefacts.

### **Management of technology and innovation**

The papers in this dissertation jointly demonstrate that the extant corpus of academic research on management of technology and innovation can provide concepts that serve as input for development of theories of digital innovation. While some academics call for reinvention of theories (Nambisan et al., 2017) or development of entirely new logics and frameworks (Yoo et al., 2010), this dissertation paves an approach that seeks to develop understanding of new phenomena of digital innovation by the means of careful re-examination of the extant theory. The approaches that allow such theory development include theory elaboration (Fisher & Aguinis, 2017), or what Gkeredakis and Constantinides (2019) term “phenomenon-driven problematization” (p.2), which “helps us identify and scrutinize the limits of a particularly dominant theoretical metaphor”.

Paper I leverages elaboration in accepting the approach from a precious seminal study (W. Orlikowski & Iacono, 2001) and elaborates the findings in breaking down the established concepts. When it comes to problematisation, the recurrent strategy is to question assumptions tied to the metaphor of industrial production (Avital et al., 2019, p. 12) which served as backdrop to much of the established literature. In the case of digital innovation, the metaphorical image of a factory producing widgets in



an era of industrial production is unsuitable. This metaphor evokes an image of a rational division of labor with clearly delineated products. In digital innovation, organising is often much more fluid, and products lack clear identities over time. New frameworks with software development as a root metaphor are called for (Berente, 2020; Yoo et al., 2010). Paper II showcases how organising for innovation cannot be thought of independent of factors surrounding treatment of digital artefacts, as digital artefacts cannot be considered bounded, an assumption which holds for pre-digital contexts. Similarly, Paper III argues how the evolving and in part socially-constructed architecture of digital artefacts is mirrored in the evolving and fluid form organisational structures adopt. In the pre-digital context, it was more permissible to assume the architecture of product under development as static or given rather than fluid and socially constructed.

### **Conclusion, future research, and managerial implications**

The established research on management of innovation and technology has been largely developed on the backdrop of industrial production (Lyytinen, 2021), which provided a “root metaphor” to this corpus of scholarship (Avital et al., 2019). Widespread diffusion of digital artefacts in practice, however, give rise to a new organising logic, or the “managerial rationale for designing and evolving specific organizational arrangements” (Sambamurthy & Zmud, 2000, p. 107). We engage with the corpus of literature on management of innovation and technology to “identify and scrutinize the limits of a particularly dominant theoretical metaphor” (Gkeredakis & Constantinides, 2019, p. 2) to revise the established theories for the context of digital innovation.

The logic of digital innovation challenges assumptions embedded into much of the extant literature from both cognitive and materialist perspectives. Cognitively, much of the established research on innovation management assumes “the concept of a distinct, discrete product circulating in the market system” (Lyytinen, 2021). In contrast, digital innovation concerns fluidly evolving products rather than discrete products (Garud et al., 2008; Lehmann & Recker, 2021). Understanding innovation as the creation of new product categories is insufficient for the era of convergence (Seo, 2018; Yoffie, 1997) in which digital products are “ever in the making” (Lehmann & Recker, 2021) and challenging categories and identities of products is not uncommon (Faulkner & Runde, 2009). Understanding existing categories provides limited guidance in a world where innovation actively challenges product identity. The role of active framing and interpreting becomes particularly heightened (Ivarsson, 2022; Wang, 2021) when digital technologies can alter identities of entire organisations (Wessel et al., 2020).

The outdated assumptions of established literature on innovation are not limited to the cognitive domain which would be within reach of interpretative ontologies. This dissertation takes an especially realist stance by grounding the novelty of the organising logic of digital innovation in the properties of digital artefacts, thereby representing a special class of materiality. For instance, extant literature assumes a clear boundary between process and outcomes in the innovation process (Nambisan et al., 2017) as is exemplified with the distinction between product and process innovation (Abernathy & James, 1978). What blurs the boundary between digital innovation process and outcome is the fact that digital products (made of digital artefacts) are tightly linked to the process that mediates their creation (Ekbia, 2009). As paper II demonstrates, the arrangement of the innovation process is accompanied by arrangement of the digital artefacts. Digital innovation derives its novelty from digital materiality, and therefore, incorporating digital artefacts into our theorising can be useful to explain and theorise the novelty of the logic of digital innovation.

We answered the call for research to develop new theoretical understanding of digital innovation (Nambisan et al., 2017; Yoo et al., 2010). Rather than seeking to build entirely new theories, the research here joins a less voluminous stream of research on digital innovation, which seeks to reach a theoretical understanding of digital innovation through revision of established perspectives (Baiyere et al., 2020; Gkeredakis & Constantinides, 2019; Hinings et al., 2018). We discovered that the interplay of digital artefacts and organisational structures produce new phenomena, such as innovation drift, that challenge assumptions such as the distinction between product and process. We arrived at our conclusions by focusing on born-digital organisations where the organising logic of digital innovation should be fully realised, rather than in traditional organisations only learning to reap the benefits of digital innovation.

### **6.3 Future research**

The research here contributes to the burgeoning agenda on digital innovation and can be extended in ways that would address its limitations. Firstly, Paper I poses a range of research questions in the research agenda it offers. The dissertation only addressed some of these questions, leaving much of the agenda open. Regardless of the research questions, the approach paved here can be applied to much of the other digital innovation phenomena. By this approach, I understand two specific choices made in this research. They are (1) to focus on revisiting established perspectives and (2) to elaborate the role of the digital artefact as a source of novelty. Two particular directions for extension are available for future research: towards generalisability and towards greater granularity.

To extend the findings in the direction of generalisability, statistical methods could aid in testing some of the predictions implied in Paper III. Namely, the research in the multiple case study implies that organisational separation is more suitable when a goal of a radical digital innovation is aimed at a new market. In other words, organisational capabilities and digital artefacts (as resources) should not be reused for development of innovations aimed at a new market. Such a proposition could be tested with a large sample of companies.

To extend the findings towards greater granularity, a closer involvement within the field would be beneficial. An ethnographic approach including observations of how digital innovation unfolds could offer insight into the specific practices by which coordination of work or exchange of knowledge is accomplished. Such a close look would facilitate the unpacking of the notions of organisational separation and integration into more specific links between actors such as different practices.

### **6.4 Managerial Implications**

Digital innovation is a timely topic with great relevance to practice. The research here is motivated by a practical problem faced by RentCorp: Is it better to develop radical innovations in a new organisation or within the existing organisational structure? RentCorp had experienced issues pursuing innovations within an existing organisation. Interestingly, the management of RentCorp was informed by popularised accounts of management research, much of which advocates organisational separation for radical innovations. For RentCorp, however, organisational separation did not yield the expected results. Not only did they not manage to deliver on the radical ambition, the new organisation was also difficult to keep separate. The failure of an organisationally separated arrangement to deliver radical innovation aligns with the research that argues for a need to revisit

established perspectives on management of innovation. Paper II shows that in addition to selecting an organisational configuration, it is also important to consider whether development will reuse existing digital artefacts and how.

While the case study of RentCorp (Paper II) provides us with a problem, the multiple case study (Paper III) points towards a solution. Organisationally separated setups may be more appropriate when the innovation aims to develop a market offering aimed at a new segment of the market, catering to a previously unserved user need. To succeed with such an ambition, reframing or re-interpreting what the product (its identity) is critical. Separation of the development and the organisation is likely helpful in the process of establishing a new framing for the product.

Managing digital innovation requires management of digital artefacts. Digital artefacts are tightly linked with organising, and decisions about which organisational groups work on which digital artefacts are critical. However, identity of digital artefacts is also linked to their purpose, and therefore, the role of customer groups is an important factor in determining how to organise for digital innovation.

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Co-author statement



**Declaration of co-authorship\***

Full name of the PhD student: Michal Hron

This declaration concerns the following article/manuscript:

Title:	<b>Innovation Drift: The influence of digital artefacts on organizing for innovation</b>
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Has the article/manuscript previously been used in other PhD or doctoral dissertations?

No  Yes  If yes, give details: \_\_\_\_\_

The PhD student has contributed to the elements of this article/manuscript as follows:

- A. Has essentially done all the work
- B. Major contribution
- C. Equal contribution
- D. Minor contribution
- E. Not relevant

Element	Extent (A-E)
1. Formulation/identification of the scientific problem	C
2. Planning of the experiments/methodology design and development	C
3. Involvement in the experimental work/clinical studies/data collection	A
4. Interpretation of the results	A
5. Writing of the first draft of the manuscript	A
6. Finalization of the manuscript and submission	C

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\*As per policy the co-author statement will be published with the dissertation.