Bus Inf Syst Eng
https://doi.org/10.1007/s12599-024-00884-5

RESEARCH PAPER

Building the Processes Behind the Product: How Digital Ventures Create Business Processes That Support Their Growth

Tobias Wuttke · Thomas Haskamp · Michael Perscheid · Falk Uebernickel

Received: 23 November 2023 / Accepted: 22 June 2024
© The Author(s) 2024

Abstract Business process management (BPM) is changing in the digital age. As a result, organizations are confronted with new logics that their business processes adhere to: processes are designed to allow for easy adaptability, infrastructure becomes progressively more flexible, and process participants make their own decisions in ambiguous situations. In this context, business process change becomes increasingly important. Digital ventures – key phenomena in the digital age – heavily rely on digital technology and, hence, have the potential to change quickly. Consequently, their business processes need to change at the same speed. While the literature on BPM proposes different types of business process change and acknowledges that digital technology can enable such developments, it remains to be explored which specific characteristics of digital technology facilitate business process change. The study investigates this by drawing on a multiple case study with seven digital ventures. It finds four patterns of business process changes in digital ventures, illustrating digital technology's impact on business processes. The study compares the patterns with existing types of business process change from the literature and discusses differences and similarities, trying to advance the understanding of business process dynamics in the digital age.

Accepted after two revisions by the editors of the Special Issue.

T. Wuttke (✉) · M. Perscheid · F. Uebernickel
Hasso Plattner Institute, University of Potsdam, Prof.-Dr.-Helmert-Str. 2-3, 14482 Potsdam, Germany
e-mail: tobias.wuttke@hpi.de

T. Haskamp
European Research Center for Information Systems, University of Münster, Leonardo Campus 3, 48149 Münster, Germany

Keywords Business process management · Digital entrepreneurship · Digital ventures

1 Introduction

Recent studies highlight that business process management (BPM) is changing in the digital age due to the integration of new digital technologies and management concepts (e.g., Mendling et al. 2020; Baiyere et al. 2020; Kerpedzhiev et al. 2021). As a consequence, organizations are confronted with new logics that their business processes adhere to: processes are designed to allow for easy adaptability, infrastructure becomes increasingly flexible, and process participants make their own decisions in ambiguous situations (Baiyere et al. 2020). In this dynamic context, business process change is an increasingly important instrument of BPM (Röglinger et al. 2022). BPM allows for intentional business process change, such as business process reengineering or continuous business process change, but also helps organizations to deal with unintentional business process changes, such as process drift or exogenous shocks (Röglinger et al. 2022). Existing literature acknowledges the role of digital technology in enabling business process change (e.g., Kallio et al. 1999; Davenport 1993; Pentland et al. 2020). However, the specific characteristics of digital technology that facilitate business process change remain largely unexplored.

One context that can teach us about business process change in the digital age is digital venturing. By leveraging digital technology, digital ventures demonstrate the potential to rapidly expand their user base (Huang et al. 2017; Tumbas et al. 2017a). In this regard, digital entrepreneurship literature highlights the role of digital technology's characteristics, such as specificity and

Published online: 07 August 2024

relationality, to explain digital ventures' growth (Lehmann et al. 2022; von Briel et al. 2017; Huang et al. 2017). Although inevitable for successful scaling, growth in sales, employees, and funding can also challenge a venture's success by necessitating the development of corresponding business processes. For this task, business process changes are essential to enable digital ventures to iteratively create business processes "that permit growing their user base, such as establishing sales and marketing departments, hiring new employees, and reallocating resources" (Lehmann and Recker 2022, p. 71).

Building on the BPM literature and different types of business process change, this study aims to investigate how digital technology's unique characteristics affect business process changes in the digital age. We select digital ventures as our focal context because these firms inherently integrate digital technology into their core offerings and continually adapt their business processes in pursuit of growth (Lehmann et al. 2022; Lehmann and Recker 2022; Tumbas et al. 2017b). Hence, we pose the following research question: *How do business processes change in digital ventures, and what is the role of digital technology?*

Based on a multiple case study of seven digital ventures, we identify four patterns of business process change: (1) *creating minimum viable processes*, (2) *creating encapsulated business processes*, (3) *creating centralized control flow integrations*, and (4) *creating centralized data flow integrations*.

Indeed, during their growth period, digital ventures face unique forms of business process changes, allowing us to unpack the relationship between generative digital technologies and business processes in the digital age. Our four patterns deviate from the literature's existing types of business process changes to a certain extent. We find that digital ventures seem to experience mixed forms of established business process change types. We take that as an opportunity to compare the four patterns from the cases with existing types of business process change, showcasing similarities and differences. By doing so, we seek to unpack some of the dynamics of business processes in the digital age by deepening our understanding of how digital technology influences digital ventures' business processes. Further, the study attempts to link the – with minor exceptions (Lehmann et al. 2022; Lehmann and Recker 2022; Tumbas et al. 2017b) – largely independent discourses on BPM and digital entrepreneurship.

The paper is structured as follows. We first review existing work on business process change and the role of digital technology in the activities of digital ventures. We then explain our multiple case study research design before presenting the four patterns of business process change in digital ventures. Finally, we compare our patterns to the literature on business process change and discuss similarities and differences before concluding with limitations and future research.

2 Related Work: Business Process Change in Digital Ventures

BPM is a holistic management discipline (Rosemann and Vom Brocke 2015) that oversees "how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities" (Dumas et al. 2013, p. 1). Initially understood "as a set of activities performed in coordination in an organizational and technical environment" (Weske 2019, p. 5), business processes form the backbone of ventures as they allow to "track work, enforce policies, and ensure compliance" (Beerepoot et al. 2023, p. 9). Van der Aalst et al. (2012) list several perspectives through which business processes unfold in organizations. These perspectives include the control flow, data flow, time, and organizational view (Van der Aalst et al. 2012). The control flow refers to the ordering of process activities in a business process (Van der Aalst et al. 2012). In contrast, the data flow perspective refers to the relationships of data elements alongside the control flow (Sun et al. 2006). The time perspective deals with the timing and frequency of events (Van der Aalst et al. 2012). The organizational perspective includes the resources involved, such as process participants or digital technologies. In this perspective, we focus specifically on the role of digital technologies, which is why we refer to this perspective as 'technology' from here on.

Challenging the assumption that business processes remain stable once implemented, recent BPM literature argues that processes need to be adapted to the ever-changing requirements of ventures' business environments (Baiyere et al. 2020; Kerpedzhiev et al. 2021; Mendling et al. 2020). Consequently, the three key BPM logics – the modeling of business process, the close alignment between process and the technical infrastructure, and the procedural role of the actors – change due to the generativity of digital technologies in organizations. Light touch processes, infrastructural flexibility, and mindful actors become the central paradigm for business process design (Baiyere et al. 2020).

Given the increasingly dynamic nature of business processes in the digital age, the literature has begun to study various types of business process change. Drawing on a review of the literature on business process changes (Online Appendix A and B; available online via http://link.springer.com), we delineate four main types of business process changes based on Röglinger et al. (2022) who distinguish the types based on intentionality and degree of change. Business process changes can be triggered by

problems or opportunities (Röglinger et al. 2022) and, depending on the change type, alter the characteristics of business processes, including increased or decreased business process flexibility (Shaw et al. 2007), maturity (Röglinger et al. 2012), or integration (Rai et al. 2015). The first type is business process reengineering, a radical but deliberate approach to changing business processes (Röglinger et al. 2022). From a time perspective, business process reengineering is described as an episodic and rapid change (Kallio et al. 1999; Hammer 2014). It is enabled by digital technologies (Kallio et al. 1999). Business process reengineering aims to create quantitatively measurable performance improvements but also increased customer satisfaction, increased flexibility, and better information and control about processes and customer behavior (Morrow and Hazell 1992; Ahire and Waller 1994; Bradley 1994). The second type is continuous business process improvement, which is seen as a deliberate but incremental business process change (Röglinger et al. 2022). From a time perspective, this change type unfolds continuously (Hammer 2014) rather than episodic. Instead of digital technology, the primary enabler of continuous business process improvement is "statistical control" (Davenport 1993, p. 11). Continuous business process improvement intends to iteratively increase process efficiency or effectiveness (Röglinger et al. 2022; Davenport 1993). The third type is business process drift, an incremental and unintentional process change (Röglinger et al. 2022; Pentland et al. 2020). Business processes supported by digital technologies can gradually shift over time, which might lead to unexpected results (Pentland et al. 2020). Finally, exogenous shocks or process disruptions are characterized by radical and unintentional changes in business processes (Röglinger et al. 2022). Exogenous shocks disrupt business processes in five stages (pre-shock, pre-shock-in-shock transition, in-shock, in-shock-post-shock transition, and post-shock phase) (Röglinger et al. 2022) and, therefore, are episodic. While they are externally triggered, flexible digital technologies can help to buffer their effects (Röglinger et al. 2022). Examples of this phenomenon are business process changes experienced in ventures worldwide due to the COVID-19 pandemic (Röglinger et al. 2022). In Table 4 in Online Appendix A, we list the four business process change types and provide an overview of their characteristics in the various business process perspectives.

In addition to the existing literature on business process change, the literature on digital entrepreneurship offers knowledge on the role of digital technology in digital ventures' operations. It has argued that digital technologies are shaped by the characteristics of reprogrammability, homogenization of data, and their self-referential nature (Yoo et al. 2010), which affects the venture creation process (Nambisan 2017). Specifically, the term specificity has emerged to describe the degree of the digital technology's malleability (von Briel et al. 2017). Additionally, the term relationality describes which relationships digital technology can leverage to facilitate its functionality (von Briel et al. 2017). Further, the literature has identified six mechanisms that operate when technologies are used in digital ventures. Those mechanisms include compression, conversation, expansion, substitution, combination, and generation (von Briel et al. 2017). Compression reduces the time required for actions, while conversation decreases resource needs. Expansion broadens resource availability, substituting traditional resources with digital alternatives and combining allows for resource bundling to create new products and business models. Finally, generation facilitates the creation of innovative devices, functionalities, and business models by modifying existing ones. From the perspective of the digital venture's market offering, the literature has also identified three mechanisms that digital ventures apply to design their market offering: bounding the technology scope, transposing through digital objects, and probing the solution space (Lehmann et al. 2022).

Different streams of literature have begun to unpack business process changes in the digital age. While the business process management literature has started to depart from the assumption of stable business processes and has proposed four types of business process changes, the digital entrepreneurship literature has suggested specificity and relationality as key attributes to describe the impact of digital technology on digital ventures' activities. We take those findings as a departure point for our study.

3 Research Design

To investigate business process changes in digital ventures and understand the role of digital technology in this process, we opted for a qualitative multiple case study design (Yin 2009). This choice was motivated by the novelty and dynamic nature of our phenomenon of interest: business process changes in digital ventures. Pursuing a qualitative approach was considered suitable as business processes in digital ventures evolve in a highly dynamic way. In such a context, qualitative research is deemed suitable as it helps to study a phenomenon in its real-world context, aiming to generate findings grounded in empirical evidence from multiple cases (Yin 2009). Accordingly, every digital venture is considered a case (Yin 2009). The instances of business process changes within each case are our units of analysis (Yin 2009). Specifically, we studied the business processes of lead-to-cash, hire-to-retire, and product management as they serve as direct proxies for investigating growth (lead-to-cash for a venture's number of customers,

hire-to-retire for a venture's number of employees, and product management for product feature extensiveness).

3.1 Data Collection

Regarding data collection, we followed existing guidelines (Wiesche et al. 2017; Urquhart et al. 2010) and opted for multiple data gathering and analysis rounds. Regarding a sampling strategy, we selected the *most similar* method to make findings within ventures comparable (Seawright and Gerring 2008). To implement this, we defined three criteria for participating ventures. To qualify for a digital venture in our study, digital ventures needed to have (1) digital technology at the core of their market offering, (2) venture capital funding as a proxy for fast-changing business environments and growth, and (3) a subscription-based business model. We recruited digital ventures from our personal network, leading to the cases presented in Table 1.

Our data gathering was guided by grounded theory principles (Wiesche et al. 2017; Urquhart et al. 2010). Following the principle of theoretical integration, we conducted four rounds of data collection and analysis. For example, in the initial venture recruitment, we checked whether interviewees could report instances of business process changes where we dropped uninformative cases, leading to two exclusions. We conducted semi-structured interviews with founders and managers from the ventures based on established guidelines (Myers and Newman 2007) with a questionnaire (can be found in Online Appendix C). Depending on the digital ventures' phase, founders sometimes directed us to other team members who were vital in operating the business process of interest, something referred to as snowball sampling in the literature (Myers and Newman 2007). Within each interview, we sought to identify stories of business process changes around the introduced processes.

In total, we conducted four rounds of data collection: the first in February and March 2023, the second in September and October 2023, the third in February 2024, and the fourth in May 2024. Utilizing multiple rounds allowed us to thoroughly analyze the data, supplement it with publicly available material, and ask follow-up questions in subsequent rounds to delve deeper into specific instances of process changes. In total, we interviewed 17 individuals in 26 sessions, amounting to 17 h and 35 min of recorded interviews, all transcribed for data analysis using ATLAS.ti.

Table 1 Data collection

Company code name	InvestApp	MonitorApp	DevTools	MusicApp	OrgApp	FinanceApp	LogisticsApp
Digital market offering	SaaS app for sustainable investments	SaaS and hardware solution for machine error monitoring	SaaS or self-hosted data-centric developer tools	SaaS solution to connect music producers and loop creators	SaaS solution to book workplaces in hybrid teams	SaaS solution that can be integrated into digital platforms to offer financing	Services and software for e-commerce operations
Founding year	2022	2020	2020	2019	2019	2020	2020
Founding country	France	Germany	Germany	Germany	Germany	Germany	Germany
Industry	B2B	B2B	B2B	B2B	B2B	B2B	B2B
Number of employees	3	10	17	8	34	55	320
Number of interviews	3	5	4	2	5	2	3
Interviewed roles	Co-founder (2x), co-founder (1x)	Technical co-founder (3x), business co-founder (2x), software engineer (1x)	Co-founder (2x), software developer (1x), founder's associate (1x)	Co-founder (2x)	Technical co-founder (2x), HR manager (1x), IT administrator (2x), sales representative (1x)	Chief of staff (1x), product manager (1x)	Managing director (2x), business development lead (1x)
Total interview time (hh:mm)	01:30	04:17	02:57	01:05	04:08	01:38	02:00

3.2 Data Analysis

Regarding data analysis, we followed existing grounded theory principles (Wiesche et al. 2017; Urquhart et al. 2010; Corbin and Strauss 2015). After transcribing interview transcripts, we reviewed each case for instances of business process change. In follow-up interviews, we explored the reasons and dynamics surrounding those identified business process changes, which we coded inductively for triggers of business process changes, practices pursued during the business process change, and the resulting outcome of the business process change (Corbin and Strauss 2015). We coded iteratively with open, axial, and selective codes to find emergent themes and higher-level concepts (Corbin and Strauss 2015).

After each round of data collection, we iterated our coding approach, leading to four rounds of coding where we constantly compared our coded data units with instances in the same categories, a practice referred to as constant comparison (Urquhart et al. 2010). While the first coding round of the interviews was purely inductive (Gioia et al. 2013) and focused only on the digital technologies that venture use to change their business process changes, in later coding rounds, we seek to identify underlying generative mechanisms (Williams and Wynn 2018) of business process change. We also explored different theoretical lenses (e.g., entrepreneurial bricolage) in the second and third rounds, but as the number of interviews increased, those became less prominent. In the fourth round, we fully focused on the BPM perspective on our phenomenon of interest. Thus, we analyzed our instances of business process changes more deeply by investigating the process changes' control flow, data flow, time, and digital technology perspectives (Van der Aalst et al. 2012). Once the initial patterns of business process change emerged in the data, we intensively discussed and compared our findings with the BPM literature (e.g., Röglinger et al. 2022; Hammer and Champy 2006; Pentland et al. 2020), something referred to as theoretical integration (Urquhart et al. 2010). For the digital technology perspective, we draw on von Briel et al. (2017) and distinguish between technologies with low and high specificity. For example, we understand Notion as a low-specificity digital technology since it is designed to support many use cases (Notion Labs, Inc 2024b). Hence, ventures use it for various business processes, ranging from software development to knowledge management (Notion Labs, Inc 2024a). On the other hand, we understand high-specific digital technologies as specialized enterprise systems tailored to a specific business process domain. An example is HubSpot, a customer relationship management (CRM) system to support marketing and sales business processes (HubSpot 2024). In the final analysis, we identified 15 instances of business process change, 177 open codes, 12 axial codes, and four themes. Figure 1 illustrates our coding approach.

This way, we ended up with the four patterns of business process change in digital ventures that we present in Sect. 4: (1) *creating minimum viable processes*, (2) *creating encapsulated business processes*, (3) *creating centralized control flow integrations*, and (4) *creating centralized data flow integrations*.

4 Business Process Change Patterns in Digital Ventures

In this section, we present four patterns of business process change in digital ventures: (1) *creating minimum viable processes*, (2) *creating encapsulated business processes*, (3) *creating centralized control flow integrations*, and (4) *creating centralized data flow integrations*. We provide one story per pattern, while Online Appendix D lists additional examples. Table 2 provides an overview of business process patterns, including in which cases they occur and how they influence business processes from different perspectives.

4.1 Pattern 1: Creating Minimum Viable Processes

The first pattern we identified is *creating minimum viable processes*. In the early stages of venturing, technological support for business processes is lacking. Actors do not follow predefined event sequences, and business processes unfold at runtime. Consequently, the control flow is initially organized in a manually orchestrated manner while no data is persisted. Creating minimum viable processes does not change the control flow and leaves it orchestrated by the process participants (*control flow perspective*). In *creating minimum viable processes* digital ventures introduce low-specificity digital technology, such as Notion, to their business processes (*technology perspective*) to create semi-structured data storage and access across the activities they perform as part of their business process (*data flow perspective*). This business process change pattern unfolds episodically in relatively short time spans since it only requires the introduction of simple digital tools (*time perspective*). The combination of a human-orchestrated control flow and a semi-structured data flow in minimum viable processes increases the reliability of business processes (as data is persisted for the first time) while maintaining a high degree of business process flexibility (*context*). Digital ventures execute this pattern to address process-related challenges, such as needing more process transparency.

Figure 2 illustrates how minimum viable processes are created. We identified this business process change pattern in the ventures InvestApp (all processes), MonitorApp

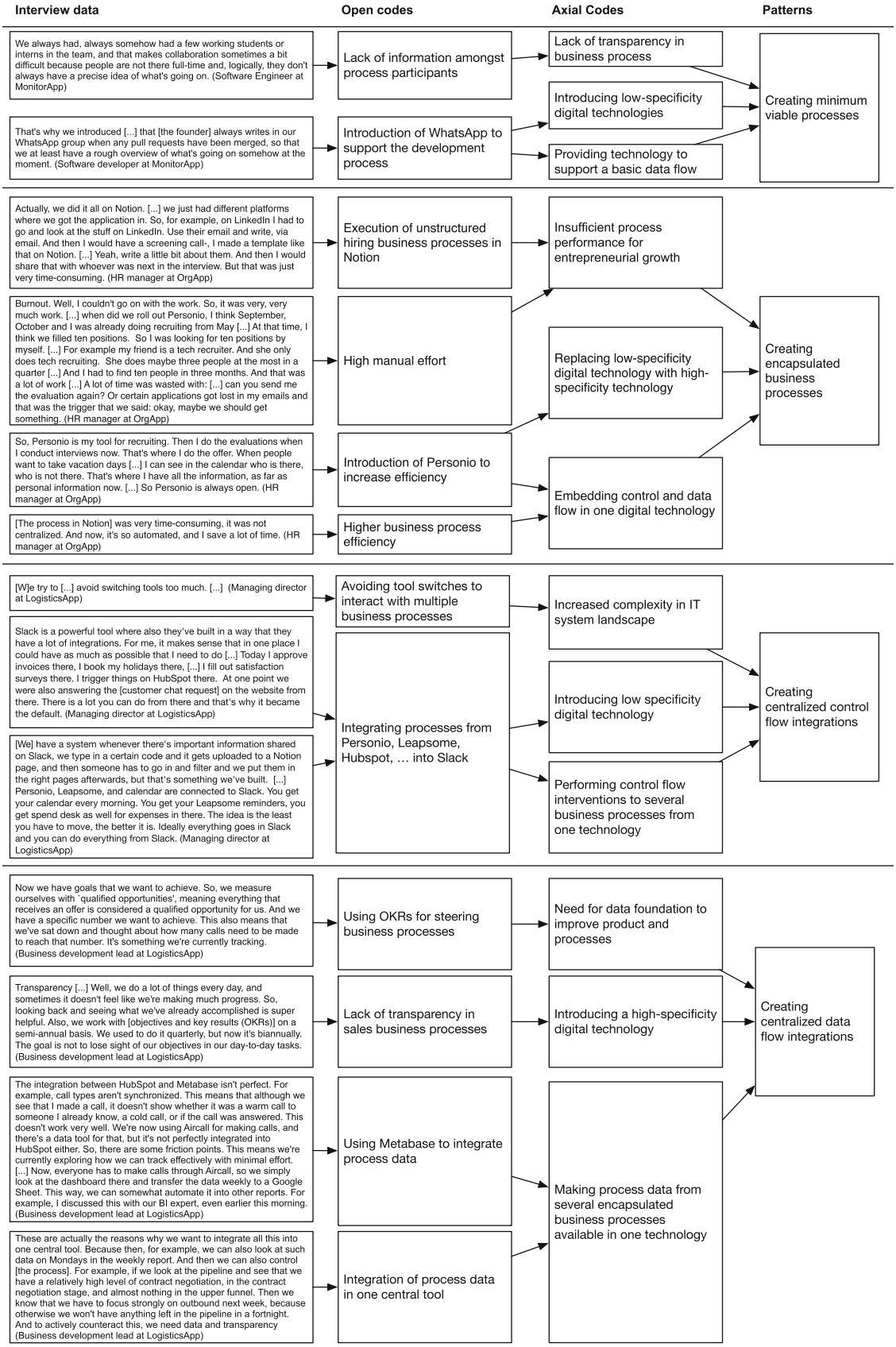

Fig. 1 Illustration of our coding with quotes from our interviews

(product management), DevTools (hire-to-retire), and LogisticsApp (hire-to-retire).

For example, in the case of DevTools, the small team of the three founders was confronted with the task of hiring their first employees. As the co-founder responsible for the venture's operations explains:

> When starting a startup, there is often not a large capital available, which can directly pay full-time personnel. [...] In our case, it was more of a student team [...] Therefore, based on experience, you often prefer to bring in people from your closer circle if you have the opportunity, rather than going through a formal hiring process. You simply say, 'Okay, now I want to hire this person.' And then you wonder, 'What can I do to make this person a real part of the company?' In our case, the need for a tax advisor emerged as a unit responsible for the process because they said, 'For the tax registration, please submit the employment contract. You need to fill out the personnel questionnaire. These individuals are students, so we also need the proof of enrollment.' The employment contract is, I believe, familiar to everyone. When you hire people for the first time, you've likely had an employment contract in your previous jobs. But it was in the process of filling out this personnel questionnaire that we really learned along the way. (Co-founder of DevTools)

As the DevTools example shows, digital ventures face resource scarcity when hiring employees. The fact that the co-founder of DevTools relied on his personal network to recruit new employees makes this visible. Furthermore, the process was human-orchestrated. This becomes evident from the external tax advisor providing structure by delivering the mandatory documents such as personnel questionnaires or employment contracts. This approach changed when DevTools was able to raise venture capital and was about to hire the first full-time employee who was no longer a student:

> Where it started to change was when you grew a bit bigger and maybe received more venture capital. At that point, you started to look externally [...] so when someone who was a bit further along in life, like, someone who had a child, was brought into the team, they brought a different level of responsibility [...] Then you would pause and think about how to onboard the person most effectively. (Co-founder of DevTools)

Hence, the venture felt the need to professionalize in order to meet the needs of its new recruits. In response to this trigger, DevTools initiated the creation of a document on the note-taking tool Notion to collect the necessary steps they want to perform regarding HR processes. The co-founder explains:

> At some point, we started filling in a Notion document. You have a basic process. What needs to be covered in onboarding? Eventually, it also involved processes. What happens when someone is sick? In a team of three or four people, of course, you notice it, just like with vacations. But when you are a larger team, it can happen that one person tells another person, who isn't you, 'I'll be on vacation next week.' Then the other person forgets to inform the rest, and that's when the confusion arises. (Co-founder of DevTools)

By introducing Notion as a low-specificity digital technology, DevTools allowed users to store process data from their onboarding process. While the control flow was still human-orchestrated, Notion introduced a basic structure to the data flow. This led to a data foundation across process activities supporting the enactment.

In summary, the change of the business process around hiring new employees at DevTools provides evidence for *creating minimum viable processes* since the venture draws on low-specifity digital technology to address growth opportunities while simultaneously dealing with the problem of lack of business process transparency. This pattern was also visible in other cases in our study, such as InvestApp, MonitorApp, DevTools, and LogisticsApp. MusicApp, for instance, uses the communication platform Slack to structure discussions about product features in its development process.

4.2 Pattern 2: Creating Encapsulated Business Processes

The second pattern is *creating encapsulated business processes*. In this pattern, digital ventures operating with minimum viable processes adjust their business processes, prompted by insufficient business process performance for their entrepreneurial growth. In striving for greater efficiency (*context*), they transition individual processes from low-specificity digital technologies to more tailored solutions, notably enterprise systems (*technology perspective*). Leveraging specialized enterprise systems is advantageous, as they typically come equipped with established best practices for business process implementation and an integrated data model to facilitate process execution. As a result, the control flow is changed to match a reference process that comes with the implemented system (*control flow*). The data flow is aligned with the control flow because the business process and the data model used were designed for each other (*data flow perspective*). We conceptualize the result of this business process change pattern

Table 2 Business process change patterns in digital ventures

Pattern	Description Explanation	Example	Appears in case	Perspectives Control flow	Data flow	Time	Technology	Context
(1) Creating minimum viable processes	Creation of a first technology-enabled business processes necessary for operation using simple digital tools	DevTools: Using Notion to support the onboarding process MusicApp: Using Slack to structure discussions about features in the product development process	InvestApp MonitorApp DevTools MusicApp	*No change* – Control flow remains human-orchestrated with no predefined sequence of events before process runtime	*Incremental* – Change of data flow towards storing process data for the first time in a mostly unstructured way	*Episodic* – Short time span of change (only needs access to low-specificity digital technologies)	*Technology-enabled* – Introduction of low-specificity digital technologies to store process data, human actors orchestrate the process execution	*Intentional* – Digital ventures aiming to increase the reliability of their business processes while maintaining business process flexibility
(2) Creating encapsulated business processes	Adopting specialized enterprise systems that enforce a predefined control and data flow	OrgApp: Switching of hiring process from Notion to Personio MonitorApp: Switching of product development process from communication via WhatsApp to Shortcut	MonitorApp DevTools MusicApp OrgApp FinanceApp LogisticsApp	*Radical* – Change of control flow to match reference process that comes with specialised enterprise systems	*Radical* – Change of data flow to align with control flow as implemented in the introduced enterprise systems	*Episodic* – Medium time span of change (takes an implementation project)	*Technology-enabled* – Introduction of high-specificity digital technology that takes over process orchestration, reduced effort of human actors in process execution	*Intentional* – Digital ventures aim to increase their efficiency by automating business processes based on digital technology
(3) Creating centralized control flow interventions	Utilizing digital technologies to interact with the control flow of multiple encapsulated business processes to streamline business process execution	LogisticsApp: Integrating different encapsulated business processes (including invoice (HubSpot) or vacation approvals (Personio)) into Slack FinanceApp: Integrating the encapsulated sales process in HubSpot into Slack	FinanceApp LogisticsApp	*Incremental* – Change of control flow to enable more flexibility due to the implementation of options to intervene with the control flow of encapsulated business processes	*No change* – Data flow remains orchestrated by enterprise systems	*Episodic* – Short time span of change (e.g., integrations in Slack can be built in minutes)	*Technology-enabled* – Introduction of low-specificity digital technology that acts as a proxy for users to interact with different enterprise systems and the processes they support, reduced human effort, since switches between systems become less frequent	*Intentional* – Digital ventures integrate different business processes into central tools to reduce media breaks and the increasing complexity of their enterprise systems landscape. By doing so, they can flexibly trigger and interact with these business processes
(4) Creating centralized data flow interventions	Centralizing data from various encapsulated processes into a unified repository for better decision making	OrgApp (planned): Integrating process data from several enterprise systems into a central repository to improve decision making LogisticsApp: Integrating process data from HubSpot, Aircall, and the product backend to Metabase	OrgApp (planned) FinanceApp LogisticsApp	*No change* – Control flow remains orchestrated by enterprise systems	*Incremental* – Change of data flow by using process data of several encapsulated business processes for decision-making at process runtime	*Episodic* – Medium time span of change (digital technology has to be implemented and process data needs to be integrated)	*Technology-enabled* – Introduction of high-specificity digital technology that acts as a central proxy to consume process data, reduces human effort to make informed decisions	*Intentional* – Digital ventures integrate process data from several business processes into one central digital technology to support their decision making

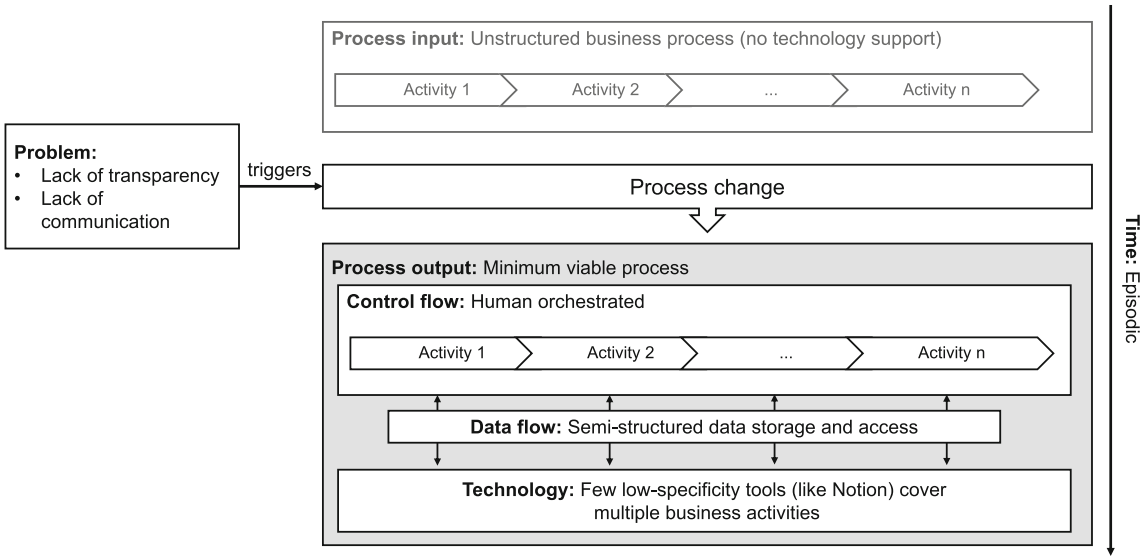

Fig. 2 Process change pattern (1) *creating minimum viable processes*

as encapsulated business processes, wherein the modified processes operate within the confines of the chosen high-specificity technology, which also serves as the repository for all process-related data. The business process change that this pattern represents unfolds over more extended periods (compared to pattern 1) since digital ventures initiate a system selection and implementation project to introduce enterprise systems, such as HubSpot or Personio (*time perspective*). Figure 3 illustrates this pattern of process change. This pattern was visible in the ventures MonitorApp (lead-to-cash and product management), DevTools (lead-to-cash and product management), MusicApp (lead-to-cash), OrgApp (lead-to-cash and hire-to-retire), FinanceApp (lead-to-cash, hire-to-retire, and product management), and LogisticsApp (lead-to-cash, hire-to-retire, and product management).

For example, OrgApp applied this pattern to their hiring process. The venture was building its original hiring

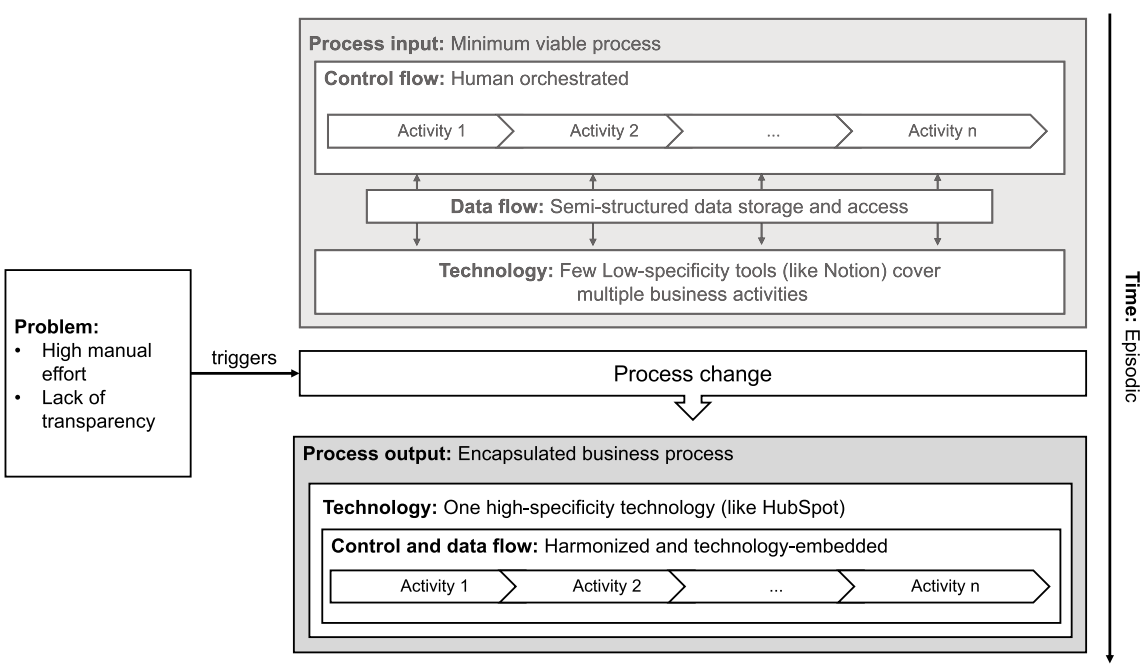

Fig. 3 Process change pattern (2) *creating encapsulated business processes*

process on Notion (as an outcome of the first change pattern). The responsible HR manager explains:

> Actually, we did it all on Notion. [...] we just had different platforms where we got the application in. So, for example, on LinkedIn I had to go and look at the stuff on LinkedIn. Use their email and write, via email. And then I would have a screening call-, I made a template like that on Notion. [...] Yeah, write a little bit about them. And then, I would share that with whoever was next in the interview. But that was just very time-consuming. (HR manager at OrgApp)

However, after raising a new funding round, the venture set out to hire more employees due to its ambitious growth goals. Unfortunately, this minimum viable process led to high manual effort that was hard for the only hiring HR manager to deal with:

> Burnout. Well, I couldn't go on with the work. So, it was very, very much work. [...] when did we roll out Personio, I think September, October and I was already doing recruiting from May [...] At that time, I think we filled ten positions. So I was looking for ten positions by myself. [...] For example my friend is a tech recruiter. And she only does tech recruiting. She does maybe three people at the most in a quarter [...] And I had to find ten people in 3 months. And that was a lot of work [...] A lot of time was wasted with: [...] can you send me the evaluation again? Or certain applications got lost in my emails and that was the trigger that we said: okay, maybe we should get something. (HR manager at OrgApp)

To address this issue, the HR manager introduced the HR enterprise system Personio to automate the hiring process. She explains:

> So, Personio is my tool for recruiting. Then I do the evaluations when I conduct interviews now. That's where I do the offer. When people want to take vacation days [...] I can see in the calendar who is there, who is not there. That's where I have all the information, as far as personal information now. [...] So Personio is always open. (HR manager at OrgApp)

Having a business process automated using Personio was a significant performance boost for the venture:

> [The process in Notion] was very time-consuming, it was not centralized. And now, it's so automated, and I save a lot of time. (HR manager at OrgApp)

When questioned about the degree to which Personio was tailored to OrgApp's specific requirements, the HR manager indicated that they primarily leaned on the reference process provided by Personio:

> Hardly, maybe around ten percent or so. But really not much, because the process sets the standard, but the standard is just that-a standard for a reason. And you can only do so much. I've only changed a few things. So, for example, what now means is that we naturally wrote the email templates ourselves. So, this, 'Hi, thanks for applying at [OrgApp].' Then, I've tweaked the pipeline a bit, but not very much. Actually, there wasn't much to do. (HR manager at OrgApp)

In summary, the execution of the hiring process at OrgApp illustrates the creation of *creating encapsulated business processes*, as the venture migrates its business processes from low-specificity technologies like Notion to high-specificity technologies such as Personio, aiming to enhance the efficiency of their operations. This business process change pattern is also evident in several other cases, including MonitorApp, DevTools, MusicApp, OrgApp, FinanceApp, and LogisticsApp. MonitorApp, for instance, previously relied on WhatsApp to communicate updates on the product development process but then introduced Shortcut as a specialized system to support product development.

4.3 Pattern 3: Creating Centralized Control Flow Integrations

We call the third pattern that we identified *creating centralized control flow integrations*. In this pattern, digital ventures build on encapsulated business processes by using low-specificity digital technologies, such as Slack (*technology perspective*), to engage with the control flow of multiple encapsulated business processes without directly interacting with the encapsulating enterprise systems (*control flow perspective*). This integration is prompted by various process-related issues, including excessive media breaks and an increasingly complex enterprise systems landscape. Creating centralized control flow integrations does not directly impact the business processes' data flow (*data flow perspective*). The creation of integrations is episodic and can be implemented quickly, as Slack integrations, for example, can be built in minutes (*time perspective*). Interacting with multiple business processes from a central digital technology, such as Slack, allows users to flexibly interact with business processes encapsulated in enterprise systems (*context*). The implemented control flow interventions can trigger the commencement of follow-up business process activities or can be utilized to automate tasks within the business process outside the constraints of the encapsulating enterprise systems. Figure 4 illustrates this pattern. We observed it in the ventures LogisticsApp and FinanceApp.

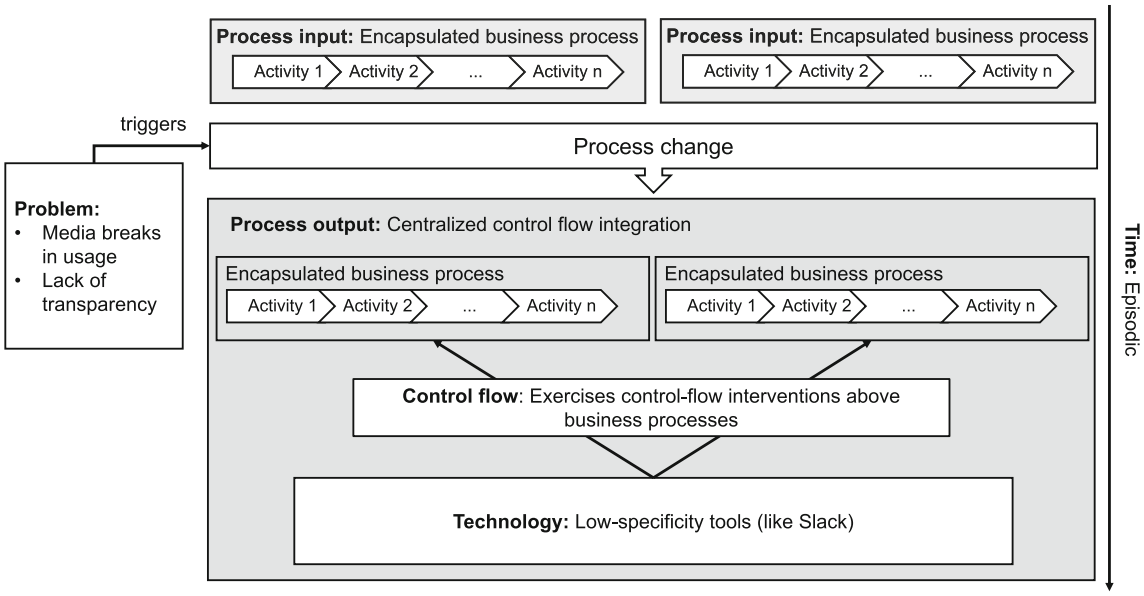

Fig. 4 Process change pattern (3) *creating centralized control flow integrations*

For instance, at LogisticsApp, where many business processes are executed encapsulated in high-specificity tools, working with the different processes becomes tedious and requires many tool switches (or media breaks). The managing director at LogisticsApp explains: "[W]e try to [...] avoid switching tools too much. [...] The idea is that the less you have to move, the better it is. Ideally, everything goes in Slack, and you can do everything from Slack." To address the pain point of having too many media breaks, which could potentially make it hard for employees to complete their tasks seamlessly, LogisticsApp introduced several Slack integrations. The managing director elaborates:

> Slack is a powerful tool where also they've built in a way that they have a lot of integrations. For me, it makes sense that in one place I could have as much as possible that I need to do [...] Today I approve invoices there, I book my holidays there, [...] I fill out satisfaction surveys there. I trigger things on HubSpot there. At one point we were also answering the [customer chat requests] on the website from there. There is a lot you can do from there and that's why it became the default. (Managing director at LogisticsApp)

This quote illustrates that Slack can trigger subsequent business process activities without interacting directly with the enterprise systems encapsulating them. LogisticsApp's managing director also lists several other enterprise systems (and their respective business processes) that users can interact with via Slack:

> "[We] have a system whenever there's important information shared on Slack, we type in a certain code and it gets uploaded to a Notion page, and then someone has to go in and filter and we put them in the right pages afterwards, but that's something we've built. [...] Personio, Leapsome, and calendar are connected to Slack. You get your calendar every morning. You get your Leapsome reminders, you get spend desk as well for expenses in there. The idea is the least you have to move, the better it is. Ideally everything goes in Slack and you can do everything from Slack." (Managing director at LogisticsApp)

In these cases, Slack is used to trigger automated business process activities. In summary, having Slack – a low-specificity digital technology – in place to perform control flow interventions enables LogisticsApp to make its business processes more accessible to users who interact with several business processes by enhancing the user experience. This pattern was also present in the case of FinanceApp, a provider of loans on digital platforms that integrates sales business processes into Slack.

4.4 Pattern 4: Creating Centralized Data Flow Integrations

The fourth and final pattern identified is *creating centralized data flow integrations*. In this pattern, digital ventures integrate data from different encapsulated business processes into one central digital technology to establish a data set for improved decision-making to exploit opportunities such as further entrepreneurial growth. By *creating centralized data flow integrations*, digital ventures create the

foundation to enable data-driven decision-making in their business processes (*context*). They introduce digital technologies with high specificity, such as the business intelligence system Metabase (*technology perspective*), to aggregate data from several encapsulated business processes. Consequently, process data from multiple processes is extracted and processed for decision-making at process runtime (*data flow perspective*). This pattern does not directly impact the control flow of the business processes as it only improves the data foundation (*control flow perspective*). Compared to patterns 1 and 3, *creating centralized data flow integrations* involves an episodic software selection and implementation project, leading to a more extended change period (*time perspective*). Figure 5 illustrates the creation of centralized data flow integrations. This pattern is evident in the cases of OrgApp (data integration for financial planning), FinanceApp (data integration for product management and financial planning), and LogisticsApp (data integration for lead-to-cash, product management, and financial planning).

LogisticsApp, for instance, tracks the performance of their sales process with so-called "qualified opportunities." The number of qualified opportunities produced by the sales process indicates how many potential sales prospects have been evaluated and determined to be likely to buy the venture service. These prospects receive an offer from the venture. The venture is successful in its industry and expands its sales to several European countries, leading to increased sales process volumes. However, after applying pattern 2 (*creating encapsulated business processes*) several times, it faces data opacity issues since the data to steer the sales process properly is distributed across several high-specificity technologies in the venture's system landscape. The business development lead explains:

> Now we have goals that we want to achieve. So, we measure ourselves with 'qualified opportunities,' meaning everything that receives an offer is considered a qualified opportunity for us. And we have a specific number we want to achieve. This also means that we've sat down and thought about how many calls need to be made to reach that number. It's something we're currently tracking. We're also building relevant dashboards to improve data transparency. Unfortunately, it's not all super straightforward. Our system landscape is a bit fragmented. So we use HubSpot as our CRM and Metabase for general data [...] Metabase handles everything related to data for us. We have the fulfillment data of all our customers, where we can see how much revenue we've generated, and so on [...] We now use Aircall for making phone calls. (Business development lead at LogisticsApp)

Using HubSpot as a CRM, Aircall as a cloud-based phone system, and Metabase as general data storage with information from other teams, the venture has several digital technologies in place that each holds data relevant for monitoring the venture's sales process. The venture decided to increase process transparency to keep track of the process data from these systems. LogisticsApp implemented a central business intelligence (BI) tool for their sales process to integrate the process data into a central data repository. Metabase is already used for this purpose in other teams at LogisticsApp, and therefore, the ventures

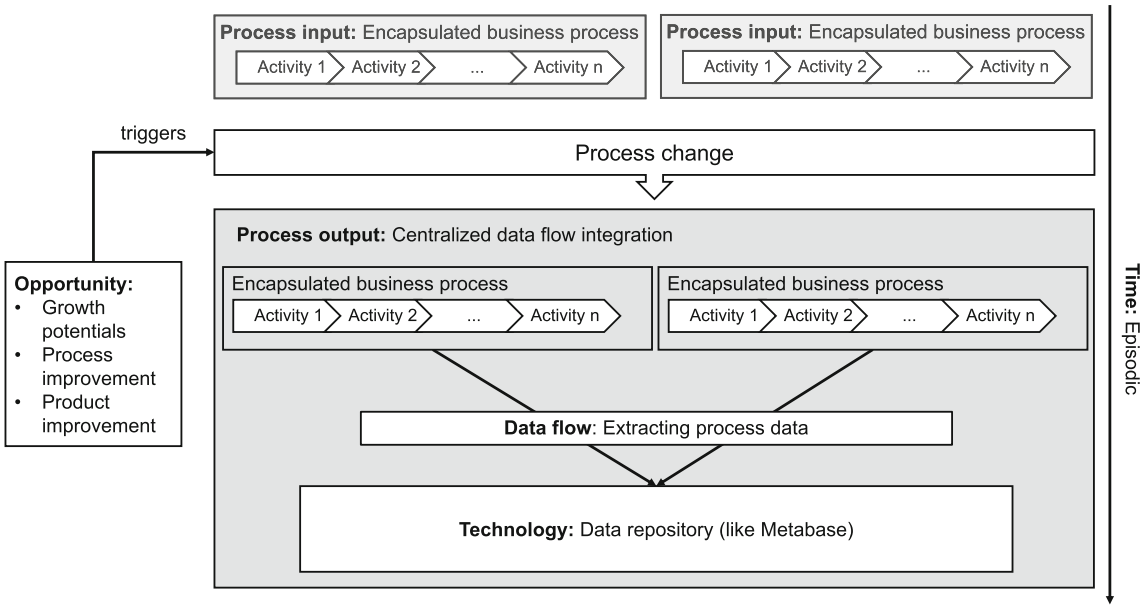

Fig. 5 Process change pattern (4) *creating centralized data flow integrations*

want to extend its usage for their sales process. The business development lead elaborates on what triggers them to change how they support their sales process using data:

> Transparency [...] Well, we do a lot of things every day, and sometimes it doesn't feel like we're making much progress. So, looking back and seeing what we've already accomplished is super helpful. Also, we work with [objectives and key results (OKRs)] on a semi-annual basis. We used to do it quarterly, but now it's bi-annually. The goal is not to lose sight of our objectives in our day-to-day tasks. (Business development lead at LogisticsApp)

Metabase serves as a central BI software to create central data flow integrations, as explained by the business development lead:

> Metabase handles everything related to data for us. We have the fulfillment data of all our customers, where we can see how much revenue we've generated, and so on. Metabase is essentially our BI tool. That's where we consolidate data from various sources, including BigQuery. We also incorporate marketing data in it and use SQL to join the databases. (Business development lead at LogisticsApp)

Creating centralized data flow integrations enables the digital venture to manage its sales process more transparently. This example illustrates that pattern 4 facilitates the analysis of generated business process data, which becomes integral to data-driven decision-making within business processes. Dashboards are utilized for decision-making at business process runtime. With better visibility into the stage of their sales funnel, LogisticsApp can make better process decisions to facilitate further business growth:

> These are actually the reasons why we want to integrate all this into one central tool. Because then, for example, we can also look at such data on Mondays in the weekly report. And then we can also control [the process]. For example, if we look at the pipeline and see that we have a relatively high level of contract negotiation, in the contract negotiation stage, and almost nothing in the upper funnel. Then we know that we have to focus strongly on outbound next week, because otherwise we won't have anything left in the pipeline in a fortnight. And to actively counteract this, we need data and transparency. (Business development lead at LogisticsApp)

In summary, LogisticsApp created data flow integrations to analyze data from various processes encapsulated within distinct high-specific digital technologies. The objective is to derive insights in order to implement further process enhancements and ultimately achieve continued entrepreneurial growth. This pattern was also visible in the OrgApp and FinanceApp cases. OrgApp, for instance, plans to integrate process data from sales, marketing, and HR into a BI system to inform future decisions.

5 Discussion

This study attempted to investigate business process changes in digital ventures and the role of digital technology. From a multiple case study, we derive four business process change patterns that we will now discuss regarding the existing business process change types in the BPM literature, specifically unpacking the role of technology in business process changes.

5.1 Using Digital Technologies To Facilitate Business Process Change

By relying on low-specificity technology, digital ventures apply pattern 1 (*creating minimum viable processes*), drawing on the new logics of BPM described by Baiyere et al. (2020). However, they do not apply this pattern derived from structured business processes. Instead, it is based on loosely coupled processes without technological support. Consequently, business process changes in digital ventures adhere to similar BPM logics seen in industrial companies undergoing digital transformations, aiming to leverage the characteristics of low-specificity digital technology to establish flexible business processes. However, there is a distinction in the initial state before business process changes: digital ventures typically start from unstructured business processes, whereas industrial companies often begin with structured business processes usually supported by enterprise systems. Nevertheless, the results of the change described by Baiyere et al. (2020) and *creating minimum viable processes* are similar: Digital ventures utilize unstructured business processes that could be described as light touch processes (Baiyere et al. 2020). They rely on low-specificity technologies that offer infrastructural flexibility (Baiyere et al. 2020) and the process is orchestrated by human actors, who might be described as mindful actors (Baiyere et al. 2020). This is consistent with the finding of Tumbas et al. (2017b), indicating that digital ventures might start their processes with tools such as Excel "to find out if they really need a project management tool or resource planning system" (Tumbas et al. 2017b, p. 11). In this regard, we argue that *creating minimum viable processes* is an instrument for digital ventures that leads to increased business process

flexibility (Shaw et al. 2007). Kerpedzhiev et al. (2021) coin the term "minimum viable processes" to describe processes that allow for continuous change and fast trial-and-error approaches for process design and improvement, but do not go into detail what these processes might look like. With pattern 1, we aim to contribute to our detailed understanding of how minimum viable processes emerge in digital ventures. However, since both digital ventures and incumbents seem to use this pattern of process change, one could investigate under which circumstances and in which business processes it occurs exactly. This knowledge can help anticipate process changes and provide best practices for managing them.

Compared to the existing business process change types from the literature, pattern 1 appears as a hybrid between continuous business process improvement and business process reengineering. The pattern showcases similarities with continuous business process improvement, as it resembles an incremental and intentional change (Röglinger et al. 2022) of the data flow. However, the key role of digital technology (Kallio et al. 1999) and its episodic nature (Hammer 2014) are characteristics of business process reengineering. Furthermore, business process reengineering aims to increase the flexibility of business processes (Kallio et al. 1999), which is in line with the high business process flexibility (Shaw et al. 2007) that is the outcome of pattern 1.

In pattern 2 (*creating encapsulated business processes*), high-specificity digital technologies replace low-specificity digital technologies, thereby changing the control flow agency from human-orchestrated processes to technology-orchestrated ones. Transferring control and data flow to high-specific digital technologies creates more structure in business processes. This change could be seen as transitioning from the new logics of BPM "back" to the traditional ones described by Baiyere et al. (2020). Hence, this stage is more closely aligned with the prescriptive assumptions of traditional BPM (Weske 2019; Recker et al. 2009). Paradoxically, both parties do so to increase the speed at which they execute their business processes, given their different contexts. Nevertheless, digital ventures apply it to increase the potential of compression and conservation mechanisms, confirming the proposition of von Briel et al. (2017) that "[a]s the specificity of digital technologies increases, their potential for enabling compression and conservation mechanisms increases" (von Briel et al. 2017, p. 52). Therefore, we argue that pattern 2 leads to increased business process maturity (Röglinger et al. 2012). The increased structure that high-specificity digital technologies, such as Personio, impose might reduce the flexibility of digital ventures since they steer the control flow of the business processes they support. This is in contrast with the finding by Tumbas et al. (2017b) that digital ventures try to maintain "flexibility [...] outside of the system" (Tumbas et al. 2017b, p. 14). While the authors argue that classical enterprise systems may limit flexibility and might not be beneficial for digital venturing (Tumbas et al. 2017b), we have observed that digital ventures explicitly look to delegate the business process agency to increase process efficiency. To unravel this tension, one could examine the conditions under which the transfer of process agency to technology takes place and when digital ventures strive to preserve a more flexible approach to business processes.

In congruence with the literature on business process change, we argue that pattern 2 represents an instance of business process reengineering in digital ventures, as it is an intentional and radical change of business processes (Röglinger et al. 2022) that involves both the control and the data flow in an episodic manner (Hammer 2014). Digital technology facilitates the business process change (Kallio et al. 1999). In the context of digital ventures, pattern 2 is applied to transfer the orchestration of business processes to enterprise systems, leading to an alignment of control and data flow. This step contributes to increased efficiency and increased business process maturity (Röglinger et al. 2012).

In pattern 3 (*creating centralized control flow integrations*), low-specificity digital technology is used as a proxy for the control flow of business processes encapsulated in high-specificity digital technologies, enabling digital ventures to make the business processes and their (intermediate) products more accessible. Using Slack, a low-specificity technology, as a proxy for control flow interventions increases the potential for expansion and substitution mechanisms regarding the controlled encapsulated business processes. The high relationality of such software makes the interaction with business processes more accessible. This confirms the proposition by von Briel et al. (2017): "As the relationality of digital technologies increases, their potential for enabling expansion and substitution mechanisms increases" (von Briel et al. 2017, p. 54). Therefore, we argue that *creating centralized control flow integrations* increases the intrafirm business process integration (Rai et al. 2015). Furthermore, from a business process participant perspective, *creating centralized control flow integrations* reduces the complexity of the IT systems landscape. Using a proxy technology to perform control flow interventions might be another form of light touch process (Baiyere et al. 2020), allowing process participants to work with encapsulated processes more flexibly. Hence, it might be a way to maintain "flexibility [...] outside of the system" (Tumbas et al. 2017b, p. 14), increasing the business process flexibility (Shaw et al. 2007). In this regard, it would be interesting to investigate the effects of such proxy technologies on the control flow

execution of the encapsulated business processes in their respective enterprise systems.

Regarding the literature on business process change, pattern 3 showcases comparable characteristics, which leads us to classify it as a hybrid between continuous business process improvement and business process reengineering. Just as continuous business process improvement, it is an intentional and incremental change (Röglinger et al. 2022) as it affects only the control flow of business processes in digital ventures. However, as stated before, digital technology also enables this change pattern with the intention of increasing the business process flexibility (Shaw et al. 2007) for process participants, which is characteristic of business process reengineering (Kallio et al. 1999). Furthermore, the creation of the integrations is episodic (Hammer 2014). Additionally, the business process data integration that comes with pattern 4 generates a data foundation for decision support, aligned with potential goals of business process reengineering (Kallio et al. 1999).

In *creating centralized data flow integrations* (pattern 4), a high-specificity technology is used as a proxy for the process data of different encapsulated business processes, ultimately improving the foundation for data-driven decision-making. In this pattern, digital ventures use digital technologies with high specificity to increase the relationality of process data of encapsulated business processes, resulting in increased data availability. While we argue that digital technologies, such as data lakes or data warehouses, have a relatively high specificity, they are used in this pattern to combine different technologies to provide ventures with a new level of data transparency (von Briel et al. 2017), which is needed to further drive entrepreneurial growth and address data opacity. Incorporating this type of digital technology enhances the relationality of business process data, moving it away from being encapsulated within individual business processes (von Briel et al. 2017). The potential for combination and generation mechanisms for the digital technologies that provide the process data increases (von Briel et al. 2017). Additionally, specificity moderates the ability of digital technologies to enable expansion and/or substitution mechanisms (von Briel et al. 2017). While we would argue that digital technologies for intra-organizational business processes have a relatively low relationality because only members of the organization use them, we suggest that making process data more available increases the potential for expansion and substitution mechanisms for the digital technologies in the business processes (von Briel et al. 2017). Managers can then access the data more efficiently to inform their decisions. Hence, we argue that *creating centralized data flow integrations* increases the intrafirm business process integration (Rai et al. 2015).

Regarding the literature on business process change, we argue that pattern 4 is a hybrid of continuous business process improvement and business process reengineering. The pattern shows similarities with continuous business process improvement, as it is an intentional and incremental business process change (Röglinger et al. 2022) that affects only the data flow. However, in terms of the role of digital technology and its episodic nature, it resembles the characteristics of business process reengineering (Hammer 2014).

Digital ventures generally seem to implement business process changes in response to issues with their current process designs. Our findings suggest that they typically start with pattern 1 as their initial business process structure. As these processes struggle to keep up with the organization's rapid growth, they might eventually shift to pattern 2. This shift often results from the inefficiencies inherent in pattern 1's human-managed processes, leading to a need for greater efficiency and triggering the transition to pattern 2. However, while pattern 2 can enhance efficiency, it may also result in data silos and a more complex business process landscape, presenting new challenges for digital ventures. Consequently, patterns 3 and 4 may emerge as responses to the limitations of pattern 2. Of these patterns, pattern 4 represents a move towards opportunity-driven process changes, enabling digital ventures to configure their processes to collect and analyze data for informed decision-making regarding future improvements in processes or products.

All of the patterns we identified suggest that digital technology plays a vital role in changing business processes for digital ventures. In the existing literature that deals with the role of digital technologies for digital ventures, for instance, Lehmann et al. (2022) find that digital ventures use digital technology to realize their vision of a digital market offering within the constraints of their current environment. In our cases, we could also observe this behavior when creating the business process architecture of digital ventures. By identifying problems in their way of working and opportunities for their organization, digital ventures define use cases for new technologies to improve their business processes. Therefore, we propose that bounding the technology scope (Lehmann et al. 2022) applies to creating digital market offerings and changing business processes in digital ventures. Future work could build on this proposition and investigate in more detail how the process of bounding the technology scope unfolds in business processes and where it differs from a market offering focused form.

To demonstrate the similarities and differences between the identified business process change patterns and the business process change types outlined in the literature, we conducted a comparative analysis presented in Table 3.

Table 3 Business process change types in digital ventures

	Context	Control flow	Data flow	Time	Technology	
Intentional business process change types:						
Business process reengineering	Intentional	Radical	Radical	Episodic	Technology-enabled	
Continuous business process change	Intentional	Incremental	Incremental	Continuous	Not technology-enabled	
Business process change patterns in digital ventures:						**Findings:**
(1) Creating minimum viable processes	Intentional	(None)	Incremental	Episodic	Technology-enabled	Finding 1: Creating minimum viable processes is a hybrid of continuous business process improvement and business process reengineering
(2) Creating encapsulated business processes	Intentional	Radical	Radical	Episodic	Technology-enabled	Finding 2: Creating encapsulated business processes is an instance of business process reengineering
(3) Creating centralized control flow integrations	Intentional	Incremental	(None)	Episodic	Technology-enabled	Finding 3: Creating centralized control flow integrations is a hybrid of continuous business process improvement and business process reengineering
(4) Creating centralized data flow integrations	Intentional	(None)	Incremental	Episodic	Technology-enabled	Finding 4: Creating centralized data flow integrations is a hybrid of continuous business process improvement and business process reengineering

Colors: Characteristics of business process reengineering , characteristics of continuous business process improvement

As we could only observe intentional business process changes in our cases, we focused specifically on business process reengineering and continuous business process improvement. While the existing business process change types can explain the identified patterns to some extent (finding 2 in Table 3), we see that patterns 1, 3, and 4 represent combinations of business process change types (findings 1, 3, and 4 in Table 3), providing a more nuanced understanding of how business processes change in digital ventures and respectively in the digital age. Our findings from business process change in digital venturing confirm that the influx of digital technologies is challenging existing views on BPM (Mendling et al. 2020; Kerpedzhiev et al. 2021; Baiyere et al. 2020). The patterns illustrate that the highly dynamic context of digital ventures and the key role of digital technology in the digital age are changing how organizations adapt their business processes. While the existing business process types are valuable instruments for investigating how business process change unfolds in organizations, our insights from studying digital ventures reveal that revisiting them is worthwhile in the digital age. As we observed hybrid instances of continuous business process improvement and business process reengineering in digital ventures, we argue that the pervasiveness of digital technologies emerging in the digital age seems to blur the boundaries between these business process change types.

5.2 Limitations and Future Work

Regarding limitations, we consider our patterns to be a beginning and a first attempt to understand the business process dynamics in digital ventures. As we only draw on seven digital ventures, future research might extend our study to a larger sample size. Further, while our findings indicate first insights into relationships between the patterns, more empirical data – in the best case, longitudinal data – would be necessary to unpack relationships between business process changes in digital ventures over time (Gehman et al. 2018). Further, our findings need more international validation since all of our digital ventures were located in Europe. Also, we only look at three business processes in digital ventures, which limits our findings. Future research might investigate whether the business process type influences emerging change patterns.

Finally, our patterns primarily describe and only to a certain extent begin to explain *how* processes change in digital ventures (Pentland et al. 2021). However, understanding the *why* – the driving forces or "motors" behind process dynamics (Pentland et al. 2021) – presents a

compelling avenue for future research. Future work could draw, for example, on digital trace data and engage in computationally intensive theory development (Berente et al. 2019) to analyze how digital ventures change their business processes supported by digital technologies.

6 Conclusion

Our study aimed to investigate business process changes in digital ventures and unpack digital technology's role in this process. Conducting a multiple case study with seven digital ventures, we found four patterns of business process change that illustrate business process dynamics in the digital age. We explain and discuss these patterns in detail with regard to the current BPM literature and the characteristics of digital technology, hoping to contribute to better understanding the dynamics of business processes in the digital age.

For practice, our findings imply that enterprise system providers should develop modular and composable solutions that can scale with the growth of the venture. For example, providers of enterprise systems with reference models for a wide range of business processes for different-sized ventures might use our findings to design applications that address the shift from human-orchestrated flexibility to pre-designed structured business processes (and back, as discussed by Baiyere et al. (2020)) without migrating from one application to another. By adopting this approach, they can potentially save digital ventures from the complexities and costs associated with introducing entirely new enterprise systems to their business, which are often notorious for their high costs and susceptibility to project failure (Newman and Westrup 2005). Given that various processes may draw from common master data, an extendable data model that integrates data at runtime might be at the technical core of such endeavors. This strategy would mitigate process opacity issues when digital ventures grow and mature.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12599-024-00884-5.

Acknowledgements We thank the editors of the special issue and the three anonymous reviewers for their insightful and valuable feedback. Our gratitude also goes to Sandro Franzoi for his constructive comments. Additionally, we thank the seven digital ventures for their participation and SAP SE for their funding, which made this research possible.

Funding Open Access funding enabled and organized by Projekt DEAL.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Ahire SL, Waller MA (1994) Incremental and breakthrough process improvement: an integrative framework. Int J Logist Manag 5(1):19–32. https://doi.org/10.1108/09574099410805054

Baiyere A, Salmela H, Tapanainen T (2020) Digital transformation and the new logics of business process management. Europ J Inf Syst 29(3):238–259. https://doi.org/10.1080/0960085X.2020.1718007

Barley SR (1986) Technology as an occasion for structuring: evidence from observations of CT scanners and the social order of radiology departments. Admin Sci Q 31(1):78–108. https://doi.org/10.2307/2392767

Battleson DA, West BC, Kim J, Ramesh B, Robinson PS (2016) Achieving dynamic capabilities with cloud computing: an empirical investigation. Europ J Inf Syst 25(3):209–230. https://doi.org/10.1057/ejis.2015.12

Beerepoot I, Di Ciccio C, Reijers HA, Rinderle-Ma S, Bandara W, Burattin A, Calvanese D, Chen T, Cohen I, Depaire B, Di Federico G, Dumas M, van Dun C, Fehrer T, Fischer DA, Gal A, Indulska M, Isahagian V, Klinkmüller C, Kratsch W, Leopold H, Van Looy A, Lopez H, Lukumbuzya S, Mendling J, Meyers L, Moder L, Montali M, Muthusamy V, Reichert M, Rizk Y, Rosemann M, Röglinger M, Sadiq S, Seiger R, Slaats T, Simkus M, Someh IA, Weber B, Weber I, Weske M, Zerbato F (2023) The biggest business process management problems to solve before we die. Comput Ind 146(103):837. https://doi.org/10.1016/j.compind.2022.103837

Berente N, Seidel S, Safadi H (2019) Research commentary - data-driven computationally intensive theory development. Inf Syst Res 30(1):50–64. https://doi.org/10.1287/isre.2018.0774

Beverungen D (2014) Exploring the interplay of the design and emergence of business processes as organizational routines. Bus Inf Syst Eng 6(4):191–202. https://doi.org/10.1007/s12599-014-0335-3

Bhattacherjee A, Davis CJ, Connolly AJ, Hikmet N (2018) User response to mandatory IT use: a coping theory perspective. Europ J Inf Syst 27(4):395–414. https://doi.org/10.1057/s41303-017-0047-0

Bradley S (1994) Creating and adhering to a BPR methodology. Gartner Group Report, pp 1–30

Cheung W, Babin G (2006) A metadatabase-enabled executive information system (part B): methods for dynamic multidimensional data analysis. Decis Support Syst 42(3):1599–1612. https://doi.org/10.1016/j.dss.2006.01.008

Constantiou ID, Lehrer C, Hess T (2014) Changing information retrieval behaviours: an empirical investigation of users' cognitive processes in the choice of location-based services. Europ J Inf Syst 23(5):513–528. https://doi.org/10.1057/ejis.2014.12

Corbin JM, Strauss AL (2015) Basics of qualitative research: techniques and procedures for developing grounded theory, 4th edn. SAGE, Los Angeles

Davenport TH (1993) Process innovation: reengineering work through information technology. Harvard Business Press, Boston

Dennis AR, Carte TA, Kelly GG (2003) Breaking the rules: success and failure in groupware-supported business process reengineering. Decis Support Syst 36(1):31–47. https://doi.org/10.1016/S0167-9236(02)00132-X

Doomun R, Vunka Jungum N (2008) Business process modelling, simulation and reengineering: call centres. Bus Process Manag J 14(6):838–848. https://doi.org/10.1108/14637150810916017

Dumas M, La Rosa M, Mendling J, Reijers HA (2013) Fundamentals of business process management. Springer, Heidelberg. https://doi.org/10.1007/978-3-642-33143-5

Edmondson AC, Bohmer RM, Pisano GP (2001) Disrupted routines: team learning and new technology implementation in hospitals. Admin Sci Q 46(4):685–716. https://doi.org/10.2307/3094828

Feldman MS, Pentland BT (2003) Reconceptualizing organizational routines as a source of flexibility and change. Admin Sci Q 48(1):94–118

Foster J (1997) The analytical foundations of evolutionary economics: from biological analogy to economic self-organization. Struct Change Econ Dyn 8(4):427–451. https://doi.org/10.1016/S0954-349X(97)00002-7

Fulkerson B (1997) A response to dynamic change in the market place. Decis Support Syst 21(3):199–214. https://doi.org/10.1016/S0167-9236(97)00029-8

Gehman J, Glaser VL, Eisenhardt KM, Gioia D, Langley A, Corley KG (2018) Finding theory-method fit: a comparison of three qualitative approaches to theory building. J Manag Inq 27(3):284–300. https://doi.org/10.1177/1056492617706029

Gioia DA, Corley KG, Hamilton AL (2013) Seeking qualitative rigor in inductive research: notes on the Gioia methodology. Organ Res Method 16(1):15–31

Goel K, Bandara W, Gable G (2021) A typology of business process standardization strategies. Bus Inf Syst Eng 63(6):621–635. https://doi.org/10.1007/s12599-021-00693-0

Goh JM, Gao GG, Agarwal R (2011) Evolving work routines: adaptive routinization of information technology in healthcare. Inf Syst Res 22(3):565–585. https://doi.org/10.1287/isre.1110.0365

Grisold T, Gross S, Röglinger M, Stelzl K, Vom Brocke J (2019) Exploring explorative BPM - setting the ground for future research. In: Hildebrandt T, Van Dongen BF, Röglinger M, Mendling J (eds) Business process management. Springer International, Cham, pp 23–31

Hammer M (2014) What is business process management? Handbook on business process management 1. Springer, Heidelberg, pp 3–16

Hammer M, Champy J (2006) Reengineering the corporation: a manifesto for business revolution, 1st edn. Collins Business Essentials, New York

Hompes BFA, Buijs JCAM, Van der Aalst WMP, Dixit PM, Buurman J (2017) Detecting changes in process behavior using comparative case clustering. In: Ceravolo P, Rinderle-Ma S (eds) Data-driven process discovery and analysis, vol 244, Springer International, pp 54–75, https://doi.org/10.1007/978-3-319-53435-0_3 Accessed 16 May 2024

Huang J, Henfridsson O, Liu MJ, Newell S (2017) Growing on steroids: rapidly scaling the user base of digital ventures through digital innovaton. MIS Q 41(1):301–314

HubSpot I (2024) Why choose hubspot? https://www.hubspot.com/why-choose-hubspot, Accessed 10 Mar 2024

Jonsson K, Holmström J, Lyytinen K (2009) Turn to the material: remote diagnostics systems and new forms of boundary-spanning. Inf Organ 19(4):233–252. https://doi.org/10.1016/j.infoandorg.2009.07.001

Kallio J, Saarinen T, Salo S, Tinnilä M, Vepsäläinen A (1999) Drivers and tracers of business process changes. J Strateg Inf Syst 8(2):125–142. https://doi.org/10.1016/S0963-8687(99)00018-9

Kerpedzhiev GD, König UM, Röglinger M, Rosemann M (2021) An exploration into future business process management capabilities in view of digitalization: results from a delphi study. Bus Inf Syst Eng 63(2):83–96. https://doi.org/10.1007/s12599-020-00637-0

König UM, Linhart A, Röglinger M (2019) Why do business processes deviate? Results from a delphi study. Bus Res 12(2):425–453. https://doi.org/10.1007/s40685-018-0076-0

Lehmann J, Recker J (2022) Offerings that are "ever-in-the-making'': how digital ventures continuously develop their products after launch. Bus Inf Syst Eng 64(1):69–89. https://doi.org/10.1007/s12599-021-00730-y

Lehmann J, Recker J, Yoo Y, Rosenkranz C (2022) Designing digital market offerings: how digital ventures navigate the tension between generative digital technology and the current environment. Manag Inf Syst Q 46(3):1453–1482

Malaurent J, Avison D (2016) Reconciling global and local needs: a canonical action research project to deal with workarounds. Inf Syst J 26(3):227–257. https://doi.org/10.1111/isj.12074

Martinsons MG, Cheung C (2001) The impact of emerging practices on IS specialists: perceptions, attitudes and role changes in Hong Kong. Inf Manag 38(3):167–183. https://doi.org/10.1016/S0378-7206(00)00063-X

Mendling J, Pentland BT, Recker J (2020) Building a complementary agenda for business process management and digital innovation. Europ J Inf Syst 29(3):208–219. https://doi.org/10.1080/0960085x.2020.1755207

Morrow M, Hazell M (1992) Activity mapping for business process redesign. Manag Account 70(2):36–38

Münstermann B, Eckhardt A, Weitzel T (2010) The performance impact of business process standardization: an empirical evaluation of the recruitment process. Bus Process Manag J 16(1):29–56. https://doi.org/10.1108/14637151011017930

Myers MD, Newman M (2007) The qualitative interview in IS research: examining the craft. Inf Organ 17(1):2–26. https://doi.org/10.1016/j.infoandorg.2006.11.001

Nambisan S (2017) Digital entrepreneurship: toward a digital technology perspective of entrepreneurship. Entrep Theor Pract 41(6):1029–1055. https://doi.org/10.1111/etap.12254

Nelson KM, Ghods M (1998) Measuring technology flexibility. Europ J Inf Syst 7(4):232–240. https://doi.org/10.1057/palgrave.ejis.3000310

Newman M, Westrup C (2005) Making ERPs work: accountants and the introduction of ERP systems. Europ J Inf Syst 14(3):258–272. https://doi.org/10.1057/palgrave.ejis.3000539

Notion Labs, Inc (2024a) Notion customer stories. https://www.notion.so/customers, Accessed 10 Mar 2024

Notion Labs, Inc (2024b) Notion help center. https://www.notion.so/help/start-here, Accessed 10 Mar 2024

OMG (2008) Business process maturity model (BPMM). Object Management Group, Needham

Pentland B, Vaast E, Wolf JR (2021) Theorizing process dynamics with directed graphs: a diachronic analysis of digital trace data. MIS Q 45(2):967–984. https://doi.org/10.25300/MISQ/2021/15360

Pentland BT, Liu P, Kremser W, Haerem T (2020) The dynamics of drift in digitized processes. MIS Q 44(1):19–47. https://doi.org/10.25300/MISQ/2020/14458

R'bigui H, Cho C (2017) The state-of-the-art of business process mining challenges. Int J Bus Process Integr Manag 8(4):285. https://doi.org/10.1504/IJBPIM.2017.088819

Rai A, Arikan I, Pye J, Tiwana A (2015) Fit and misfit of plural sourcing strategies and IT-enabled process integration capabilities: consequences of firm performance in the U.S. electric utility industry. MIS Q 39(4):865–885. https://doi.org/10.25300/MISQ/2015/39.4.6

Recker J, Rosemann M, Indulska M, Green P (2009) Business process modeling - a comparative analysis. J Assoc Inf Syst 10(4):1. https://doi.org/10.17705/1jais.00193

Robey D, Boudreau MC (1999) Accounting for the contradictory organizational consequences of information technology: theoretical directions and methodological implications. Inf Syst Res 10(2):167–185. https://doi.org/10.1287/isre.10.2.167

Röglinger M, Pöppelbuß J, Becker J (2012) Maturity models in business process management. Bus Process Manag J 18(2):328–346

Röglinger M, Plattfaut R, Borghoff V, Kerpedzhiev G, Becker J, Beverungen D, vom Brocke J, Van Looy A, del-Río-Ortega A, Rinderle-Ma S, Rosemann M, Santoro FM, Trkman P (2022) Exogenous shocks and business process management: a scholars' perspective on challenges and opportunities. Bus Inf Syst Eng 64(5):669–687

Rosemann M, Vom Brocke J (2015) The six core elements of business process management. In: Vom Brocke J, Rosemann M (eds) Handbook on business process management 1. Springer, Heidelberg, pp 105–122

Seawright J, Gerring J (2008) Case selection techniques in case study research: a menu of qualitative and quantitative options. Polit Res Q 61(2):294–308. https://doi.org/10.1177/1065912907313077

Shaw DR, Holland CP, Kawalek P, Snowdon B, Warboys B (2007) Elements of a business process management system: theory and practice. Bus Process Manag J 13(1):91–107. https://doi.org/10.1108/14637150710721140

Sun SX, Zhao JL, Nunamaker JF, Sheng ORL (2006) Formulating the data-flow perspective for business process management. Inf Syst Res 17(4):374–391. https://doi.org/10.1287/isre.1060.0105

Sundarraj R (2004) A web-based AHP approach to standardize the process of managing service-contracts. Decis Support Syst 37(3):343–365. https://doi.org/10.1016/S0167-9236(03)00033-2

Tumbas S, Berente N, vom Brocke J (2017a) Born digital: growth trajectories of entrepreneurial organizations spanning institutional fields. In: ICIS 2017 Proceedings

Tumbas S, Berente N, vom Brocke J (2017b) Digital capabilities for buffering tensions of structure, space, and time during entrepreneurial growth. In: ICIS 2017 Proceedings

Urquhart C, Lehmann H, Myers MD (2010) Putting the 'theory' back into grounded theory: guidelines for grounded theory studies in information systems. Inf Syst J 20(4):357–381. https://doi.org/10.1111/j.1365-2575.2009.00328.x

Weske M (2019) Business process management: concepts, languages, architectures, 3rd edn. Springer, Heidelberg. https://doi.org/10.1007/978-3-662-59432-2

Van der Aalst W, Adriansyah A, De Medeiros AKA, Arcieri F, Baier T, Blickle T, Bose JC, Van Den Brand P, Brandtjen R, Buijs J, Burattin A, Carmona J, Castellanos M, Claes J, Cook J, Costantini N, Curbera F, Damiani E, De Leoni M, Delias P, Van Dongen BF, Dumas M, Dustdar S, Fahland D, Ferreira DR, Gaaloul W, Van Geffen F, Goel S, Günther C, Guzzo A, Harmon P, Ter Hofstede A, Hoogland J, Ingvaldsen JE, Kato K, Kuhn R, Kumar A, La Rosa M, Maggi F, Malerba D, Mans RS, Manuel A, McCreesh M, Mello P, Mendling J, Montali M, Motahari-Nezhad HR, Zur Muehlen M, Munoz-Gama J, Pontieri L, Ribeiro J, Rozinat A, Seguel Pérez H, Seguel Pérez R, Sepúlveda M, Sinur J, Soffer P, Song M, Sperduti A, Stilo G, Stoel C, Swenson K, Talamo M, Tan W, Turner C, Vanthienen J, Varvaressos G, Verbeek E, Verdonk M, Vigo R, Wang J, Weber B, Weidlich M, Weijters T, Wen L, Westergaard M, Wynn M (2012) Process mining manifesto. In: Daniel F, Barkaoui K, Dustdar S (eds) Business process management workshops. Springer, Heidelberg, pp 169–194

von Briel F, Davidsson P, Recker J (2017) Digital technologies as external enablers of new venture creation in the IT hardware sector. Entrepr Theor Practic 42(1):47–69. https://doi.org/10.1177/1042258717732779

Wiesche M, Jurisch MC, Yetton PW, Krcmar H (2017) Grounded theory methodology in information systems research. MIS Q 41(3):685–702

Williams CK, Wynn DE (2018) A critical realist script for creative theorising in information systems. Europ J Inf Syst 27(3):315–325. https://doi.org/10.1080/0960085X.2018.1435231

Wuellenweber K, Koenig W, Beimborn D, Weitzel T (2009) The impact of process standardization on business process outsourcing success. In: Hirschheim R, Heinzl A, Dibbern J (eds) Information systems outsourcing. Springer, Heidelberg, pp 527–548

Yin R (2009) Case study research: Design and methods, vol 5. SAGE, Thousand Oaks

Yoo Y, Henfridsson O, Lyytinen K (2010) Research commentary - the new organizing logic of digital innovation: an agenda for information systems research. Inf Syst Res 21(4):724–735. https://doi.org/10.1287/isre.1100.0322